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PROJECT COMPLETION REPORT

INDIA

**NARMADA RIVER DEVELOPMENT - GUJARAT
SARDAR SAROVAR DAM AND POWER PROJECT
(Credit 1552-IN/Loan 2497-IN)**

Annexes to Part I, and Part III

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Agricultural Operations Division
Country Department 2
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ENVIRONMENTAL IMPACTS AND MANAGEMENT

I. Project Background and Environmental Context

1. At the time the Sardar Sarovar Dam and Power Project was being prepared and appraised, the environmental regulatory regime in India and the Bank's operational guidance mechanisms with respect to environment were still being formulated, or were in the early stages of implementation. For example, the Bank's Operational Manual Statement 2.36 was not promulgated until May 1984. It described environmental concerns as "those pertaining to the natural and social conditions surrounding all organisms, particularly mankind and future generations. These concerns encompass human ecology and occupational health and safety." Recognizing that some environmental effects may not become identifiable for a long time, the 1984 manual stated that the environmental aspects of projects should be considered in a longer time-frame than may be appropriate for most other aspects of cost-benefit analysis. In particular, the Operational Manual specified that projects with unavoidable adverse effects on the environment should contain an outline of measures needed to avoid or mitigate these effects as well as a component to implement these measures. This statement was subsequently replaced by an Environmental Operational Directive in 1989, which was in turn strengthened and made more stringent (with respect to operational requirements) in September 1991.

2. In India meanwhile, a similar evolutionary process was underway with respect to environmental management. Several national committees had analyzed aspects of India's deteriorating ecology, particularly adverse impacts on forest cover and made recommendations for mitigation measures. These culminated, among other things, in the establishment of a Department of Environment and Forests (MOEF) in the Central Government and the issuing of the Forest Conservation Act in 1980. It was not until 1985, however, that the growing public environmental awareness and concern resulted in forceful action at the center - in January of that year, a new Ministry of Environment and Forests (MOEF) was established and the Prime Minister himself assumed the portfolio. Among other responsibilities, the new ministry was charged with environmental clearance of selected development projects. A year later, in 1986, the Government of India passed the Environmental (Protection) Act, 1986, empowering the Central Government to take necessary measures for protecting the quality of the environment.

3. During the period leading to the project approval by the Bank in 1985, a number of environmental studies were prepared by the Borrower to obtain the environmental clearance. These studies were undertaken by the State Governments (Gujarat and Madhya Pradesh particularly) and related primarily to impacts on fisheries, flora and fauna. But the environmental clearance was not provided and more studies were to be prepared. In any event, the projects were approved by the Bank's Board in March 1985 and became effective on January 6, 1986 without a formal forest clearance from the MOEF. Finally, a conditional environmental clearance was given in MOEF's letter of June 24, 1987 subject to the completion of several environmental studies relating to: (i) rehabilitation master plan; (ii) phased area catchment treatment scheme; (iii) compensatory afforestation plan; (iv) command area environmental assessment; (v) survey of flora and fauna; (vi) carrying field capacity of surrounding areas; (vii) seismicity; and (viii) health aspects. The letter noted that existing surveys were incomplete and full details would have to be submitted by 1989 as per an

agreed schedule. It also indicated that the Narmada Control Authority (NCA) "will ensure that environmental safeguards measures are planned and implemented pari pasu with progress of work on projects". Finally, the letter made it clear that the release of forest lands for the project would be subject to the Forest Conservation Act of 1980 and to prior approval by MOEF.

4. Subsequently, on September 8, 1987 the MOEF gave the requisite clearance for the submergence of 13,385 ha of forested areas by the Sardar Sarovar Dam subject to the several conditions relating to: (i) submission of detailed compensatory afforestation plans by September 30, 1987; (ii) compensatory afforestation would be double the area affected; (iii) preparation of a catchment area treatment plan by November 30, 1987; and (iv) no forest lands would be utilized for the resettlement of oustees. This latter condition was in contradiction with the project Legal Agreements as will be seen in the next paragraph. Finally, in October 1988, the Government of India Planning Commission also gave its formal endorsement to the project, again subject to several conditions relating to environment as well as R&R.

5. It should be noted that the Bank's appraisal report and legal documents also dealt with environmental aspects in the following ways:

- a. the Staff Appraisal Report contained a summary discussion of the project's environmental impact focussing particularly on fish and fisheries, the reservoir, forests and wildlife, public health, water distribution and drainage network, training (ref. Annex 1, Supplementary Volume I, pages 52 to 55);
- b. the Staff Appraisal Report also required the preparation of an environmental work plan for environmental effects anticipated including training programs for responsible staff and a watershed management study. (SAR p.29 and Table 22 p.102);
- c. the Development Credit Agreement (Credit 1552-IN, May 10, 1985) called for the Borrower to provide forest land, if necessary, in carrying out the project (Section 3.02); and
- d. The Gujarat Project Agreement (Credit 1552-IN/Loan 2497-IN both of May 10, 1985) called for Gujarat in collaboration with Madhya Pradesh and Maharashtra to prepare and furnish the Association for approval:
 - i. by December 31, 1985 an environmental work plan to include suitable training programs for project staff in all the three States (including plans, schedules, costing, etc) [Section 2.11 (a)];
 - ii. by December 31, 1985, studies and implementation schedules for fish and fisheries, forests and wildlife and public health aspects [Section 2.11 (a)]; and
 - iii. suitable training programs and called for Gujarat to implement such approved programs in collaboration with Madhya Pradesh and Maharashtra [Section 2.11(b)].

6. The deadline for submission of these covenants was formally amended to December 31, 1989.

II. Project Implementation

7. The project was regularly supervised at six-monthly intervals by Bank missions from inception to Credit closure. In 1985 to 1987, the Bank put much pressure on GOI for releasing the environmental clearance so that construction works could start. The clearance came on June 24, 1987. The first Bank review of the environment component was made in October 1988 and, as the project was not performing well on several fronts, the Bank and the Borrower signed a Memorandum of Understanding in December 1988 which stated that (i) a comprehensive environmental framework and its subsequent institutionalization in the concerned states should be prepared; (ii) studies on fisheries, forest, wildlife and health should be initiated or completed; (iii) appoint an Environmental Director at the newly created SSNNL; (iv) an Environment Cell should be created in the MOEF to monitor the activities of SSP; and (v) the recruitment of an expatriate environmental consultant to assist the Environmental Cell in preparing the environmental framework stipulated in the legal documents. However, the meeting also agreed that in view of the creation of the Environmental Cell it would not be necessary to engage an environmental specialist in NCA.

8. During that period, the Bank commissioned in 1987 an overview of the environmental aspects of the project to be carried out by an environmental consultant. The publishing of the report was delayed for various reasons to 1989. It made a number of observations and recommendations in particular that the Bank should intensify its supervision and enter into supplemental agreements to strengthen the environmental aspects of the project.

9. On March 31, 1989 the Water Delivery and Drainage project Credit Closing Date was extended by three months and then by one year to July 1, 1990 subject to certain conditions relating to the release of land for R&R in Maharashtra, R&R policies to be in line with the NWDT award, and other conditions relating to RWS. An Environmental Review carried out in April 1989 indicated that the specified time-based environmental work plan was yet to start and its absence was hampering the monitoring of environmental studies. It insisted in an action letter to DEA and MOWR that a consultant should be recruited as per agreed TOR for preparing the environmental work plan. It also recommended that the plan should be completed before institutionalizing the environmental components within NCA, MOEF and the three states. The mission recognized that some progress had been made on the studies on fisheries, compensatory afforestation, and archeology but none on health.

10. An other environmental review mission took place in December 1989. It observed that the environmental work plan that was originally due in December 1985 was still not started and that the staffing of NCA and SSNNL environmental cells was still inadequate. It recommended the Borrower to approach USAID to assist in the preparation of the work plan and made several suggestions on the studies relating to: (i) compensatory afforestation which should include habitat and linkages with natural reserves, (ii) catchment area treatment, (iii) wildlife in the submergence area, (iv) up stream and down stream fisheries, and (v) archeological aspects. The action letter to MOWR of December 13, 1989 which stipulated the conditions for a second one year extension of the Water Delivery and Drainage Project beyond July 1, 1990 emphasized the R&R aspects that should be met such as the release of land in Maharashtra for R&R but made no reference to the pending preparation of the environmental work plan.

11. The May 1990 environmental report indicated that the preparation of the environmental work plan had made no progress. However, the Annex on Status of Compliance with Covenants indicated wrongly that the covenant relating to the work plan was in full compliance. The report also indicated that the position of Member Environment in NCA was still not filled. The supervision mission determined that the conditions relating to R&R had been met and particularly that 2,700 ha of forest at Taloda had been released for the resettlement of oustees in Maharashtra. The Water Delivery and Drainage Project was, therefore, extended for another year to July 1991.

12. The June 1991 the environmental supervision mission paid much attention to the progress made on compensatory afforestation, catchment area treatment, wildlife, fisheries, archeology, health, training and NCA. It indicated that environmental training was yet to start¹. It also said that the Environment Member of NCA had been posted recently but that this organization had no clear program and was not effective in coordinating and integrating environmental studies. The June 8, 1991 action letter emphasized the need to prepare and implement an environmental training program.

13. In July 1991, the Water Delivery and Drainage Project was extended for a third and last year on the basis of the progress made in the civil works component and also in the implementation of the R&R component of the Dam and Power Project. The January 1992 supervision mission, which included for the first time a malaria specialist, observed that there was no specific anti-malaria program for the project and that the incidence of malaria had increased in the villages surrounding the dam construction site. He also stressed that the Public Health Service was not geared to meet the special needs of the project and that a Health Cell should be established in SSNNL.

14. As a result of the commissioning of an Independent Review of the SSP project, the Bank recruited an environmental specialist to assist SSNNL in preparing an EIA for the command area in view of a possible Phase II of the Water Delivery and Drainage Project. The consultant then published an Environmental Information Volume² which listed and summarized the large number of existing or ongoing studies and proposed a work program for the preparation of the command area EIA. This effort and the presence of the Independent Review Team helped in focussing the Borrower's attention on the environmental aspects of the project.

15. The last supervision mission conducted in August 1992, determined that the environmental work plan had still not been formulated as well as the malaria control action plan requested by the previous mission.

III. Independent Review Report

16. The Independent Review Team initiated its field work in September 1991 and published and circulated its final report in June 1992. It contains seven chapters dealing with environment. The report comprises an analysis of the legal background and status of compliance. It observes that by the end of 1988, all required agreements had been reached between the GOI, the States, the implementing agencies of which NCA, and the Bank to ensure that an adequate assessment of the environmental impact of the Sardar Sarovar Projects would be made by 1989. However, it notes that by the time of the review, most of the Bank's 1985 legal requirements and most of the conditions attached to the MOEF environmental clearance had not been met and concludes that, by any standards, this ought to be unacceptable. The report also criticizes the "pari pasu" approach which subverts any acceptable notion of ecological planning and defeats the very purpose of preparing environmental assessments to anticipate and prevent impacts and incorporate remedial measures in the project design.

17. After giving some background information on the project design, the report analyzes in more detail the major environmental aspects of the project including the impacts on the Narmada River upstream and downstream of the dam, the reservoir and the catchment areas. It concludes by

¹ Report on R&R and Environmental Training by World Bank Consultant, May 1991.

² SSP Environmental Information Volume by World Bank Consultant, 1992

saying some good work has been done on specific topics in the first part of the command area, but it does not come together to meet the requirements of a good environmental assessment and in the end, this project is likely to perpetrate the deficiencies noted in past projects.

18. On health aspects, the report states that by the time of the project appraisal the dangers of water-borne diseases in irrigation projects were well known and documented particularly those related to malaria and schistosomiasis. The report quotes a status report on malaria and other health-related aspects prepared by the Bank's consultant in January 1992 which states that the project has been planned, designed and executed without incorporation of health safeguards and that the levels of malaria in villages near the dam site were nearly double that of the other villages served by the health center in that area. The report concludes that the Bank and the state governments had failed to address the issue of public health adequately.

IV. Management Response

19. The Bank issued a Management Response on June 23, 1992. This document agreed with the Independent Review report on the description of the delays which occurred in completing the mandated environmental studies, and on the need for a more effective central management or coordination function in the Narmada Basin on environmental impact studies and mitigation programs. The Management also agreed on the need to accelerate work on health matters in Gujarat. In particular, the Management noted that greater urgency was needed on the analysis of impacts on the estuary (particularly fisheries) and on the treatment of health issues. However, the Management did not share the conclusions of the Independent Review about the severe environmental consequences of the study delays. With regard to wildlife management, the Management believed that adequate work had been done or was in hand. On hydrology, and sedimentation the Management disagreed with the analysis and particularly the assumptions behind the upstream Narmada Sagar dam. However, the findings of the PCR and the Bank's consultants indicate that the Independent Review had made a good point with regard to sedimentation. The Management's Response appears to defend the Borrower's *pari-pasu* approach to environmental management and seems to believe that, with an adequate environmental monitoring system, most impacts would be identified and mitigated long before reaching any damaging dimensions. This PCR has not endorsed this position and believes it is always preferable to carry out preventive measures based on prior assessment than to implement corrective measures based on monitoring and evaluation.

20. In July 1992, the Bank mounted a major mission (14 persons) to review the status of implementation and compliance of the project with the Bank's Legal Agreements in the light of the findings of the Independent Review report. The mission reported that the Borrower had completed 22 studies prior to the MOEF environmental clearance in 1987, that 11 had been completed since then and that 15 were underway or proposed. The mission confirmed that there had been no severe environmental consequences to date due to study delays. Nevertheless, the mission recommended that a detailed Environmental Management Plan be produced as soon as possible. This plan would include a synopsis of all the studies completed to date, underway or planned, and details of future work needed in the estuary and on health issues.

21. On health aspects, the mission noted that the Government of Gujarat had accepted the findings of the January 1992 mission concerning the expansion in and around the dam construction site, the risk of cerebral malaria and the inadequacy of the primary health care services. The recommendations of the mission included the setting up of a Health Planning and Monitoring Cell in SSNNL, preparing an environmental health management plan, and setting up an anti-malaria Unit at the dam site (Kevadia) to be followed by others in the command area later.

22. Following the July mission, the Bank sent an action letter dated August 10, 1992 which requested the Borrower to submit a schedule for producing an Environmental Management Plan within the next six months and a plan to address the health issues. The letter contained a detailed draft action program on the R&R aspects of the project.

V. Borrower Response

23. Following the Bank's mission and letter, the Borrower, in their letter of September 1, 1992, assured the Bank that GOI would address with urgency the positive concerns raised by the Independent Review and Bank missions and that management and organizational weaknesses in the R&R program would be removed. The attachment to the letter indicates that a comprehensive environmental action plan comprising such activities as catchment area treatment, compensatory afforestation, command area development, health plan, fisheries, flora and fauna, archaeological studies, etc., on which action has already been initiated, has been prepared and is presently under review by NCA. Also attached to the letter is a bar chart showing a list of environmental studies completed, ongoing and proposed.

VI. Board Benchmarks

24. A formal report entitled "Review of Current Status and Next Steps" was then prepared and submitted to the Board on September 11, 1992. The report gives a detailed description of the R&R and environmental issues identified by the Independent Review and Bank missions and indicates the most recent steps taken by the Borrower to remedy the situation. The guiding principle of the Management's response has been to seek with the Borrower constructive solutions to the issues raised in view of its belief that, even after full allowance is made for the costs of the R&R and relevant environmental mitigating measures, the SSP projects remain economically sound and developmentally important. The Management's position also recognizes that the benefits of the SSP projects must not be achieved at the cost of reductions in the standard of living of affected persons. According to the report, environmental costs and risks - particularly those related to health, loss of fisheries and possibility of waterlogging and salinity in the command area - have to be handled through an appropriate combination of ex-ante studies and the creation of capacity within the project to take timely ameliorative action.

25. In the section on Next Steps, the Management proposed to the Board three options:

- a. a formal or informal suspension of disbursements pending completion (and where necessary enhancement) of steps identified in the Borrower's response;
- b. reappraisal of the R&R and environmental aspects of the SSP projects as a basis for follow up projects to support: (i) R&R of those displaced by the reservoir; (ii) sustainable command area development; and (iii) implementation of an agreed Basin-wide Environmental Management Plan; and
- c. continuation of the support for the project on the basis of responses received from the Borrower, and subject to the confirmation of continued improvements over the next six months, to be monitored against actions already agreed and benchmarks for assessing progress in implementation.

26. The Management stated its preference for the third option which builds upon the results achieved and maximizes the prospects for successful implementation of the steps noted in the Borrower's response which are scheduled to be completed in the next few months. The Management, nevertheless, recognized the risk of these steps not being taken in a timely or effective manner and proposed that, in that event, remedial action be taken through suspension of disbursements.

Should financial or skill gaps emerge which prevent timely action, IDA would be prepared to consider supplementary support.

27. The Board of Executive Directors met on October 23, 1992 to discuss the Review of Current Status and Next Steps prepared by the Bank staff. The Executive Directors agreed with the analysis of the Independent Review which had identified a number of deficiencies in the Bank's appraisal and the Borrower's implementation of the projects. Many Directors had concerns about obstacles which still had to be overcome. They emphasized the need for full consultation with the affected people, the importance of satisfactory R&R programs in all three states involved and the importance of a timely and comprehensive analysis of environmental aspects. The Board agreed to the Management's third option to continue support to the projects because they wished to give the benefit of the doubt to the new Government of India which had recently made considerable efforts to address the projects' problems and because it was the best available option.

28. The Board determined a number of benchmarks that the Borrower would have to meet by March 31, 1993. These included:

- a. Terms of Reference for the preparation of a Narmada Basin Environmental Management Plan;
- b. Completion of a prioritized environmental overview report for the Sardar Sarovar Projects, including: (i) a summation and qualitative analysis of the 22 studies already completed, as well as the 11 now underway, and covering upstream and downstream impacts on such areas as wildlife, flora and fauna, archeological and religious sites, catchment area treatment, reforestation; and (ii) an environmental work plan covering works remaining to be done in both the upstream and downstream areas; and
- c. Adequate implementation of Gujarat's malaria control program at the SSP project site in line with the specific recommendations of the July 1992 Bank mission.

29. The Board requested that a special review mission should visit India during April 1993 to assess progress in the implementation of the agreed action plan. Continuation of the Bank's support after April 1993 depended on meeting the agreed benchmarks for assessing progress. During the Board meeting, the UK Executive Director proposed that the Overseas Development Agency (ODA) could assist the Borrower in meeting the benchmarks. Subsequently, a Trust Fund of £1.0 million was opened and deposited with the Bank for that purpose.

VII. Borrower Actions and Present Status

30. Beginning November 1992, a Bank mission headed by the Director, India Department visited the heads of all agencies concerned in India to discuss the benchmarks and agree on a work program for meeting these by end March 1993. This mission was followed by action letters dated November 9, 1992 to MOWR, NCA, and the three states concerned which contained a detailed list of time-bound actions that each implementing agency was to carry out. In particular, they were to:

- a. The states were to submit to NCA updated information on environmental works relating to catchment area treatment, compensatory afforestation, fisheries, archeological sites and health;
- b. Gujarat was to submit to NCA a comprehensive overview report for SSP covering the upstream, downstream and command area impacts with particular emphasis on:

(i) expanding the estuary studies to take into account the latest estimates of probable water releases patterns from SSP dam; and (ii) providing a set of downstream scenarios which can be used to plan protective ameliorative measures;

- c. Gujarat was to submit a detailed report on implementation of malaria control program for SSP project site;
- d. NCA was to complete TORs for the preparation of comprehensive Narmada Basin Environmental Management Plan;
- c. NCA was to update the Environmental Work Plan covering upstream and downstream impacts including priorities for future work, budget and timetable for the Sardar Sarovar Project; and
- e. NCA was to complete its staffing arrangements as per earlier Bank reports.

31. The Borrower and the Bank, thereafter, prepared detailed TOR and recruited in December 1992 two well known consultant firms to assist the implementing agencies in meeting the benchmarks. Specifically, these consultants were contracted to:

- a. assist NCA and SSNNL in preparing (i) the Environmental Overview Prioritized Action Plan of the Sardar Sarovar Projects; and (ii) the TOR for the formulation of a Narmada River Basin Environmental Management Plan.
- b. assist NCA and SSNNL in preparing (i) Sardar Sarovar Projects Command Area Environmental Impact Assessment; (ii) Environmental Changes Downstream of Sardar Sarovar Dam; (iii) Sediment and Back Water Aspects of Sardar Sarovar Project; and (iv) notes on Sardar Sarovar Project Hydrology.

32. The two consultant firms worked in India from January to March 1993 in association with the Borrower's implementing agencies. Although not formally part of the benchmarks, it had been agreed that the consultants would also review the project hydrology and downstream impacts which had been criticized in the Independent Review Report. In spite of the magnitude of the task the two consultant firms managed to submit their contributions by mid-March 1993. However, for various reasons, the Borrower requested the Bank by letter of March 29, 1993 to cancel the remaining portion of the Loan for the Dam and Power Project, thus terminating to the Bank's financial assistance to the Sardar Sarovar Projects. However, the Borrower, in doing so, reiterated their commitment to sound R&R and environmental practices and indicated they would meet the benchmarks fixed by the Board.

33. The Borrower's compliance with the environmental benchmarks was submitted to the Bank in NCA's letter of August 5, 1993 to which was attached the following reports:

- a. Evolution of Institutional Arrangements for R&R, Environmental Safeguards and the World Bank Involvement;
- b. Environmental Overview and Prioritized Action Plan;
- c. Terms of Reference for the preparation of a Narmada Basin Environmental Management Plan;
- d. Environmental Changes Downstream of Sardar Sarovar; and

- e. Sardar Sarovar Project Command Area Environmental Impact Assessment, Interim Report in three volumes.

34. The findings of the Environmental Overview and the downstream impacts, prepared by the Bank consultants, are summarized in Section K of this annex.

VIII. Bank Performance

35. At appraisal the Bank's procedures for environmental clearance were not as rigorous as they are now. As a result, the project was approved without an Environmental Impact Assessment or an Environmental Management Plan to mitigate the impacts. There was also no formal environmental component to mitigate the adverse impacts. However, these aspects were not overlooked since the SAR and the Legal Documents required that an environmental work plan including an assessment of impacts on catchment area, fisheries and forests together with measures to minimize risk of malaria, filaria, schistosomiasis and other water-related diseases be prepared by December 1985.

36. The Bank let the deadline for the preparation of the Environment Work Plan lapse twice, once in December 1985 and again in December 1989. On two other occasions, when the Borrower requested the extension of the Water Delivery and Drainage Project, the Bank did not use its conditionalities for requiring the completion of the Environment Work Plan. In retrospect, the Bank proved to be weak on the environmental front. This point was the source of strong criticism in the Independent Review report. It is clear now that appropriate action was not taken on time. The engineers supervising the project, in agreement with the Borrower, were confident that environmental aspects had been taken into account through the preparation of a number of environmental studies. However, none of these were assembled in a comprehensive Environmental Work Plan as required in the Legal Documents. The argument later used by the Bank that the situation was not critical since no environmental damage had occurred as a result of the project appears weak because this is true of any project which is being constructed and is not an excuse for not preparing the required Environmental Management Plan. Throughout project preparation and implementation, the Bank supervision missions paid more attention to the engineering than to the environmental aspects of the project. After seven years of implementation the Bank took appropriate action by fixing environmental benchmarks to be met by March 31, 1993.

37. Similarly, the Bank supervision missions did not pay enough attention to the health aspects of the project and relied too heavily on the Borrower's assessment of the situation. It is only towards the end of the project when the Independent Review team was at work that the Bank recruited a malaria specialist to assess the situations. His findings were critical of the prevailing situation and help in redressing what had been a lacuna.

IX. Borrower Performance

38. The Borrower's conditional environmental clearance was somewhat ambiguous when GOI agreed to the preparation of environmental studies "pari pasu" with the implementation of the project. It is certain that a project of this magnitude does not require that all possible impacts be assessed in detail particularly for those areas which are to be implemented in two decades time. However, with modern computer modelling and remote sensing technologies, it is possible and necessary to study in some detail the most critical impacts so that the project design can incorporate the most likely impacts. The Borrower's performance on this point has been weak even though a number of environmental studies had been carried out. Throughout project implementation, the Borrower had difficulties in integrating the various studies into a comprehensive Environmental Work Plan. It claimed, on several occasions, that the impacts would be monitored closely as project is implemented and the remedial action would be taken as and when necessary. This

procedure is not compatible with sound planning and can only lead to expensive crisis management. For example, one should not wait for the salinity in the estuary to rise to unacceptable levels before taking the requisite mitigating measures. It is always preferable and less expensive to carry out preventive measures as part of the project design from the start of the project than to carry out corrective measures during implementation.

X. Lessons Learned

39. The first lesson is that the Bank should not approve a project, particularly one that involves a large dam, without a proper Environmental Impact Assessment and management plan. The second lesson is that no project should be approved until a formal environmental clearance is obtained from the Borrower. A third lesson is that, in the case of a project with a large environmental impact, a mitigating environmental component should be made an integral part of the project supported by strong legal covenants. A fourth lesson relates to the need for the Bank to use highly qualified environmental specialists to supervise the environmental component and, as needed, to provide guidance to the Borrower in the resolution of special environmental issues. A fifth lesson is that, nowadays, there is no excuse for not making ample use of remote sensing and computer modeling technologies for assessing environmental impacts of large projects such as SSP.

XI. Major Impacts and Mitigating Measures

INTRODUCTION

40. The following sections summarize the findings of the Environmental Overview and upstream and downstream environmental studies prepared by consultants.

41. The project will provide irrigation water and domestic and industrial water supplies for millions of people in a drought-prone area of Gujarat and generate a large quantity of renewable power and energy. In addition to these environmental benefits, the impoundment of the River Narmada and the diversion of water will also have other environmental impacts. The following key areas need to be addressed in order to assess these impacts and to plan the project's environmental management:

- a. Compensatory Afforestation — to replace forest lands submerged or diverted for resettlement;
- b. Catchment Area Treatment — to check erosion and assist soil and moisture conservation in the catchment area within the immediate vicinity of the reservoir;
- c. Terrestrial Ecology — to conserve terrestrial flora and fauna;
- d. Upstream Aquatic Environment — to conserve important natural fauna;
- e. Public Health — to provide health care facilities to displaced people and to construction workers and prevention of the spread of disease;
- f. Cultural Heritage — to identify and protect culturally valuable artifacts in the submergence area; and
- g. The Downstream River and Estuary — to mitigate the potential effects of changed freshwater discharge patterns on the environment downstream of the dam.

42. This Annex of the PCR reviews the above topics with reference to government regulations and conditions, studies and investigations, potential impacts, mitigation measures, and the current status of implementation. Sections of this Annex also deal with Hydrology and Sediment and Backwater Effects; this is in response to questions raised on these topics in the Report of the Independent Review (June 1992).

COMPENSATORY AFFORESTATION (CAF)

43. The Forest Conservation Act (1980) prohibits the transfer of land designated as forest for development without prior clearance from the Ministry of Environment and Forests (MOEF). Clearance will only be granted, if at all, subject to the condition that Compensatory Afforestation (CAF) be undertaken on an area of land equivalent to the area of forest submerged. The usual requirement is that for every hectare of designated forest taken, one hectare of non-forest land should be afforested and declared as forest or, if suitable non-forest land is not available within the entire state, two hectares of degraded forest should be reforested. Non-forest land anywhere within the boundaries of the state may be afforested in compensation. Approval for the clearance of forest land for the project was granted by the MOEF in 1987, but eleven conditions were attached relating to the planning and conduct of CAF and other measures to protect the existing forest. Principal amongst these were the following stipulations:

- a. for every hectare of forest land submerged or diverted for construction of the project, there should be Compensatory Afforestation on one hectare of non-forest land, plus reforestation on two hectares of degraded forest. This represents a two-fold increase of the usual requirement;
- b. for the 2,700 hectares of forest land in Maharashtra which is to be used for R&R³, an equal area of non-forest land or double the area of degraded forest should be planted; and
- c. the governments of the three states involved should prepare plans detailing their proposals for Compensatory Afforestation and submit these to the MOEF before work in the forest area is due to commence.

Area of Forest Affected

44. Forest land needed by the project totals 17,943 ha and includes:

- a. 13,386 ha submerged by the reservoir in the three states;
- b. out of a total submerged area of about 37,000 ha, 357 ha of designated forest in Gujarat required for the construction of the dam and the irrigation system; and
- c. 4,200 ha of the Taloda forest in Maharashtra⁴ to be used for the resettlement of people displaced by the project.

³ This area is to be increased by about 1500 ha.

⁴ Initially 2,700 ha, to which 1,500 ha were added subsequently.

Impact and Management

45. There have been a number of studies in the three states aimed at assessing the extent and significance of the loss of forest lands attributable to the project. These include:

Sardar Sarovar (Narmada) Project Development Plan, Volume II prepared by the Narmada Planning Group (NPG) in 1983 contained a chapter on the various environmental aspects of the project. Details of land use and forest cover derived from aerial photography are included.

Studies on Ecology and Environment by MS University of Baroda (MSU) in 1983, used satellite photography, statistical sampling techniques and an extensive program of fieldwork to determine the density, species composition and productivity of forests in the submergence area of Gujarat.

Sardar Sarovar Project: Preparation of Environmental Work Plan by the Forests Department of Maharashtra in 1988, was a survey listing all important flora in the submergence area of Maharashtra.

Eco-Environmental and Wildlife Management Studies on the Sardar Sarovar Submergence Area in Gujarat reported on work done between November 1989 and May 1992 by MSU. This provided more detailed reports on the status of the forests in the submergence area and environs of Gujarat.

Impact Assessment of Madhya Pradesh Land to be Submerged Under Sardar Sarovar Project and Adjoining Ecosystems is an ongoing study, which began in September 1990 and for which quarterly reports and two interim reports (1990-1991 and 1991-1992) are available. The study is being conducted by the State Forest Research Institute (SFRI) in Jabalpur and financed by the Narmada Valley Development Authority (NVDA); the final report will be available in mid-1993. A detailed analysis of the growing stock and species composition of forest to be submerged is almost complete and a preliminary assessment of the status of the forest is given in the first and second interim reports.

Status of Flora and Fauna in and Around Sardar Sarovar Project, Maharashtra is a preliminary report of an on-going study by the University of Pune which began in 1992 and is due to run for two years. Pune has used satellite imagery and GIS techniques coupled with an extensive program of field work to report on the density and species composition of forest areas in Maharashtra.

46. The MSU studies demonstrated that the forest areas in the submergence area of Gujarat are of low density and quality. Although they could be classified as dry, deciduous teak forest and must once have supported a rich fauna, pressure from human and animal activities and severe soil erosion has reduced these areas to low productivity, highly degraded forest.

47. Interim reports from Madhya Pradesh suggest that the situation is similar there. Fires, overgrazing and shifting cultivation have led to severe damage to the forest and caused acute erosion.

48. Detailed surveys are on-going in Maharashtra, but forest areas in the submergence zone are contiguous with those of Gujarat on the south side of the Narmada and are reportedly in the same poor condition. Preliminary reports by the University of Pune and field visits by NCA officials suggest that over-exploitation, encroachment by people for agriculture and consequent erosion has

reduced much of the area to a highly degraded state. The forests to be used for resettlement in Maharashtra are also heavily degraded so that, of the total designated forest area to be diverted in Maharashtra, less than 50% currently has a significant tree cover.

Proposed Management Measures

49. MOEF has specified that the project will compensate for forest lands taken by the projects as shown below. The project is also required to supply construction workers at the dam site with fuel wood.

	<u>Gujarat</u>	<u>Maharashtra</u>	<u>Madhya Pradesh</u>	<u>Total</u>
Forest area taken by the project	4,523 ha	9,188 ha	2,732 ha	16,443 ha
Degraded forest to be replanted	9,300 ha	12,980 ha	6,547 ha	28,827 ha
Non-forest land to be afforested	4,650 ha	9,190 ha	2,190 ha	16,030 ha
<u>Total area for CAF</u>	<u>13,950 ha</u>	<u>22,170 ha</u>	<u>8,737 ha</u>	<u>44,857 ha</u>

Action Plans

50. In compliance with the conditions set by the MOEF, each state has prepared an action plan for CAF within its boundaries. The relevant documents are:

Government of Gujarat Work Plan for Management of Environmental Effects, Section on Forests and Wildlife: The Compensatory Afforestation Plan for the Rann of Kutch. 1986

Project for Afforestation in Sardar Sarovar Project Impact Areas due to Diversion of Forest Lands for Sardar Sarovar Project (Gujarat).1989

Compensatory Afforestation Scheme in Lieu of Sardar Sarovar Project in Dhule District, Maharashtra State. 1991

Action Plan of Compensatory Afforestation for Sardar Sarovar multi-purpose river-valley project: Government of Madhya Pradesh Forest Department .1989

51. The three states have provided land, as far as possible, within the immediate vicinity of the project-affected areas. In Gujarat, however, there is not enough suitable non-forest land available owing to the large areas set aside for catchment treatment and other project-related work. For this reason, land away from the catchment of the Narmada was selected, including areas within the Rann of Kutch — an arid area to the north-west of the dam site. The feasibility of CAF in these areas was carefully studied before being approved by the Gujarat Forest Department.

Public Participation

52. None of the original CAF plans contained provision for the involvement of local people as envisaged in the National Forest Policy, 1988. The tight schedule of CAF implementation at first precluded the direct involvement of local communities, but to ensure the success of the planting program, the project authorities have now made arrangements with the local people to protect the new planting for three to seven years, depending on tree species. Also, provision has been made to reforest degraded forest areas rotationally to avoid the need to close off large areas of forest which may be used for grazing animals.

53. Efforts are now underway to enlist the support of the local population in a participatory management approach in accordance with National Policy. Madhya Pradesh, for example, has issued a Note on Participatory Management in Madhya Pradesh. This provides for the formation of Forest Protection Committees at the village level with full representation of the various groupings within the village community. The Committees will assist the Forest Department in the selection of tree species to be planted; policing and enforcing forest protection measures; and sharing of the intermediate and final yields of the forest. A similar approach is being adopted in Gujarat and Maharashtra.

Implementation

54. The total area afforested to date is over 29,000 ha out of the planned total of about 45,000 ha. Progress is good in all three states: Gujarat (62%), Maharashtra (69%), and Madhya Pradesh (55%). Under the Forest Conservation Act (1980) the Government is required to appoint an agency to monitor the implementation of the provisions of the Act. Five regional offices have been established for this purpose around India. The Office of the Regional Chief Conservator of Forests at Bhopal is responsible for monitoring CAF for the project on behalf of the MOEF, and each state forestry department has set up its own monitoring arrangements.

55. The areas treated under the CAF program are declared designated forest under the Forest Act of 1927 and will ultimately become the responsibility of the state forest departments. The CAF associated with the project is a small part of the total reforestation work being undertaken by these departments which are managing vast forest resources. They have, in the process of the work, acquired valuable experience which will be of advantage in ensuring the success of CAF for the project.

CATCHMENT AREA TREATMENT (CAT)

56. The MOEF environment clearance order stipulated that a phased catchment area treatment should be completed prior to reservoir filling. Subsequently, GOI decided that the project will bear the costs of treating critically-degraded watersheds draining directly into the reservoir. These watersheds were identified as those classified as either "very high" or "high" priority categories by the All India Soil and Land Use Survey (AISLUS). The project would also be responsible for the treatment of those areas of the catchment which are directly damaged by the project activities.

Sources of Erosion and Objectives of CAT

57. High rates of erosion prevail in the catchment where the soils have little vegetative cover; where steep slopes are farmed or felled without precautions to prevent erosion; and where there is overgrazing. CAT in the Narmada catchment will involve re-vegetation of barren areas and physical measures to protect unstable surfaces. These will give rise to a number of direct and indirect benefits, including a reduced rate of sediment runoff; an increased supply of fuel, fodder, minor forest products and small timber for the local population; and an increase in agricultural productivity through better moisture retention. The improved forest cover can also increase the carrying capacity for wildlife.

Management Plans

58. Surveys and studies have been undertaken to aid the development of a management plan for CAT in the catchment; these include the following.

Report of Inter-Departmental Committee on Soil Conservation and Afforestation, (the Dewan Committee Report), 1985 presented the findings and recommendations of an inter-

departmental committee set up by the Ministry of Agriculture to report on conditions in the catchment; suggest soil conservation and afforestation measures; and prepare a phased program of work and financial outlays. The committee reviewed proposals for CAT submitted by the three states and the soil survey work carried out by local forestry officers. It recommended further work to identify critically degraded sub-watersheds for priority treatment and gave advice on procedure and methodology for CAT in the Narmada Basin.

Report on Prioritization of Sub-watersheds in Sub-catchments of Narmada Catchment, 1991 presents the results of a three-year study conducted by AISLUS in accordance with the recommendations of the Dewan Committee. The catchment of Sardar Sarovar was divided into eight sub-catchments and each of these was further divided yielding a total of more than one thousand sub-watersheds. Each sub-watershed was then subject to detailed survey to establish the potential for erosion through consideration of such factors as slope, vegetative cover, soil characteristics, surface condition, physiography, etc. This information was used to derive a 'Silt Yield Index' (SYI) which was, in turn, used to prioritize the sub-watersheds for CAT. Almost 30% of the total catchment area falls into the 'very high' and 'high' categories, most susceptible to erosion.

Proposed Measures for CAT

59. The Ministry of Agriculture (MOA) has carried out catchment treatment work in many areas of India and has developed detailed guidelines for CAT in all kinds of terrain. The states of Gujarat, Maharashtra and Madhya Pradesh have selected treatment regimes for priority areas from these guidelines taking into consideration land use, soils, topography, vegetative cover, and agriculture.

60. There is considerable variation in the sub-catchment types in the catchment. A variety of measures were, therefore, selected for CAT in the three states. Mechanical measures include the construction of gully plugs, check dams, terraces, and contouring. Agronomic techniques include afforestation, rehabilitation of degraded forest, pasture development and protection of existing tree growth.

Action Plans

61. Gujarat accepted the recommendations of the Dewan Committee and, since the catchment area to be treated in Gujarat is relatively small, decided to treat the entire catchment area without waiting for the prioritization of the sub-watersheds by AISLUS. An action plan for CAT was included in their Work Plan for Environmental Effects. This plan was reviewed and updated by the Forest Department in the light of the results of a stock mapping survey and thematic mapping work. Thematic mapping was carried out under the guidance of the Indian Space Research Organization using satellite imagery provided by Indian satellite IRS-IA and corroborated by the French satellite imagery System Pour l'Observation de la Terre (SPOT). A revised program for CAT was developed by dividing the forest within the catchment area into three categories according to the density of tree cover: Category 1 (canopy cover <0.4), Category 2 (canopy cover 0.4-0.6) and Category 3 (canopy cover >0.6). In Category 3, only mechanical measures for soil conservation are deemed necessary. More degraded areas will, in addition, be subject to afforestation, the density of planting (400 to 2,000 plants/ha) being determined by the extent of degradation. CAT in Gujarat applies to 27,000 ha of forest — Category 1 (12,600 ha), Category 2 (11,900 ha) and Category 3 (2,600 ha). Also, there is in Gujarat 3,000 hectares of non-forest land, almost all of it agricultural and mainly privately owned, where proposals for treatment must be agreed with the individual owners. This work is being carried out by the Land Development Corporation of Gujarat.

62. Maharashtra. An action plan for CAT in forest and non-forest areas is based on survey reports which were submitted to MOEF in 1988. Implementation awaited the outcome of survey by AISLUS to prioritize the catchments. After publication of the AISLUS survey results in 1991, Maharashtra was able to submit revised action plans for the treatment of those 'very high' and 'high' priority sub-catchments draining directly to the reservoir. As in Gujarat, catchments were divided into three categories for treatment, although to take account of the specific conditions in Maharashtra, the slope was considered in addition to the percentage forest cover. Treatment is proposed for about 24,360 ha (20,000 ha forest area and 4,360 ha non-forest area) of which about 50% is in Categories 1 and 2. The extent of land to be treated under each category is currently being revised since additional directly draining priority sub-watersheds have recently been identified.

63. Madhya Pradesh. The Forest Department of MP has prepared a map of the degraded areas to be treated and classified forest areas into three groups. Areas with a low existing tree density will be brought under intensive planting. Areas where the density of existing forest is comparatively high (<0.4) will be treated under a program of rehabilitation of degraded forests. Forest and non-forest areas which are unfit for seedling planting will be developed for pasture. The total area to be treated is about 125,725 ha (51,930 ha forest area and 73,795 non forest area). However, a large part of the catchment (about 22,806 ha) in Madhya Pradesh is privately-owned agricultural land with flat to gently rolling topography. Mechanical measures to prevent erosion will, therefore, be used wherever considered necessary, including contouring and a variety of check dams. For the forest land, most of which is highly degraded, an action plan has been prepared to detail methods for planting and the species to be used; mechanical and vegetative barriers will be erected in these areas.

Implementation

64. The areas identified to be subject to CAT by AISLUS were given as gross areas of each sub-watershed. These areas include land uses where no treatment is necessary or possible including house, towns, villages, roads and water bodies. The gross area also includes high areas and steep slopes where topsoil has completely eroded away, leaving exposed rock. In Maharashtra, in particular, there are many such areas. Survey work conducted in areas currently being treated suggests that the net area on which CAT can actually be carried out is 50 to 60% of the gross area.

65. Gujarat has already treated 16,500 hectares. This is around 53% of the total area to be treated. The plan envisages completion of the program by the end of March 1995.

66. Maharashtra only finalized its action plan when the results of the AISLUS survey became available. Maharashtra prepared detailed action plans separately for agricultural and forest areas which were submitted in 1992. However, work could not start according to schedule due to agitation by anti-project residents. In Maharashtra, a substantial part of the CAT area is designated as forest but has, in fact, been encroached and used for agriculture by local people. These people are reluctant to allow local forestry officers on to the land until the matter of the legality of their tenure has been resolved. The Union and State Governments fear that, if the issue is resolved in favor of the encroachers, this will encourage further encroachment into forest areas and undermine the purpose of the Forest Conservation Act. Nevertheless, work has now commenced in the areas free from dispute and is scheduled to be completed by March 1996.

67. Madhya Pradesh submitted a detailed action plan in 1991 and CAT work commenced that year. The targets were not met, however, due to failure of the monsoon and a revised programme had to be prepared. To date, 17,000 hectares of land has been treated, and the entire program will be complete by March 1997.

68. The present schedules envisage completion of the CAT programme in all three states by the end of the 1996-97 financial year. Full impoundment of the reservoir is not due until 1998 so these schedules are in accordance with the condition of the MOEF that the entire program of CAT should be completed before reservoir filling

Public Participation

69. The long-term success of implementation of CAT measures depends on the cooperation and involvement of local residents and local interest groups. This is to be achieved through consultations between the implementing agency and District Land Improvement Committees. Before any CAT work can be undertaken, the implementing agency presents a proposal to the Committee giving such details as: area and location of the sub-watershed; physical and soil characteristics; likely benefits of CAT work; present land use details; and CAT treatment menus based on survey results. The Committee must approve these proposals before CAT work can commence. In addition, where the land is privately-owned, the owner must give consent. If the owner has objections, the Committee will consider them and negotiate on his behalf with the implementing agency. Where CAT is to take place on encroached forest land, however, there is no requirement for consultations with farmers (although work can obviously take place if participation and cooperation of local people is obtained).

Monitoring

70. Overall responsibility for the monitoring and quality control of CAT work belongs to the NCA. The arrangements for monitoring are similar to those for CAF. However, because of the large amount of agricultural land contained in CAT areas in Madhya Pradesh, the Chief Agricultural Officer of the state will also have a duty to oversee implementation. In each state, senior forestry officers are responsible for monitoring and the production of reports for the Chairman of the Environment Sub-Group of the NCA.

TERRESTRIAL ECOLOGY

71. The areas to be submerged by the dam were once part of a large forest ecosystem supporting a diverse range of plant and animal life. These included plants and fungi, invertebrate life, birds and reptiles, small mammals and larger animals such as tigers, bears, panthers, deer etc. Although much of the forest is now degraded, there may still be valuable plant and animal resources which are worth conserving and, where practicable, enhancing as part of the environmental management of the projects.

72. Wildlife is protected in India by the Wildlife Protection Act (1972) which contains schedules listing rare, endangered and threatened species requiring special protection. The guidelines of the MOEF require that when environmental clearance for large projects is sought, surveys of the terrestrial ecology are conducted so that the flora and fauna present can be assessed, listed species can be detected, if present, and appropriate conservation measures devised. On the basis of such studies, the MOEF was able to issue clearance for the project in 1987. A condition of this clearance, as far as it relates specifically to the terrestrial eco-system, was that further more detailed studies of flora and fauna would be carried out to confirm the absence of rare or endangered species. In addition, the World Bank Loan Agreement called for preparation of an environmental work plan covering forest wildlife.

Sources of Impact on Terrestrial Ecosystems

73. Several aspects of the dam have potential to cause adverse effects on the terrestrial ecology of areas upstream of the dam, principal amongst these being the submergence of forest land and the resettlement of people in new areas. The dam also has considerable potential to have beneficial effects on ecological resources, owing to the creation of new and regenerated forest habitat; the establishment and improvement of wildlife sanctuaries; and the greater availability of fresh water.

Impact Assessment and Management

74. There have been surveys of the flora and fauna in all the project-affected areas. In general, the aim of these surveys has been to establish the composition and status of the terrestrial ecology resources. This information can then be used as a basis for further studies, which will assess any potential impacts and develop mitigation measures and management strategies. Important survey work has included the following:

- *The Environmental Impact Study of 1983 prepared by (MSU).* This study included a botanical survey of the forest submergence areas in Gujarat. Lists of tree species and medicinal plants were compiled and recommendations for further, more detailed, work were made.
- *Preliminary Report on First Botanical Exploration and Plant Collection from Narmada Valley by the Botanical Survey of India in 1986.* This reports on field survey work carried out in the different phytogeographical zones of the Narmada Basin. More than 700 specimens were collected for laboratory study and a detailed species list of the flora was prepared. The areas investigated were located within the proposed Narmada Sagar Dam Complex (NSC) in Madhya Pradesh, outside the submergence area of the dam, but within the same ecological zone.
- *Report on the Survey of the Narmada Sagar Area by Zoological Survey of India, 1988].* This reports on a two-week field survey undertaken by a group of zoologists with expertise in five different animal groups in the submergence area of the proposed Narmada Sagar Project (NSP) in Madhya Pradesh. A list was compiled of animal species which were either found to be present or had been reliably reported in the area.
- *Note on Sardar Sarovar Project - Preparation of Environmental Work Plan for Forest and Wildlife by the State Forest Department, Maharashtra, 1988* This short note lists the main flora and fauna present in the submergence area of Maharashtra and comments on their frequency of occurrence in the state.
- *Status of Flora and Fauna in and Around Sardar Sarovar Project, Maharashtra is a preliminary report of an ongoing study by the University of Pune.* Section 3 of this report lists species of plants found in the submergence areas and reports on such aspects as the species abundance, density, frequency of occurrence, etc. It also lists the animal species identified in the same areas with the aid of field visits and interviews with the local population. Pune is due to complete its study in the submergence area by the end of 1993 and all other work by the end of 1994. In the interim, they will conduct more detailed qualitative and quantitative surveys of flora and fauna using standard, internationally recognized, methods.

- *Eco-Environmental and Wildlife Management Studies in the Sardar Sarovar Area in Gujarat, 1992*, by MSU reports on extremely thorough and comprehensive surveys of flora and fauna in the state of Gujarat. The surveys had the aim of assessing the present status and composition of flora and fauna in the submergence area and environs and noting the presence of any rare or endangered species. More than 70 field trips spending more than 2,000 staff days over a period of two and a half years were used to collect data in accordance with a rigorous statistical sampling regime.
- *Impact Assessment of Madhya Pradesh Land to be Submerged Under Sardar Sarovar Project and Adjoining Ecosystems* is an on-going study, which began in September 1990 and for which quarterly reports and two interim reports are available. The study is being conducted by the State Forest Research Institute (SFRI) in Jabalpur and financed by the NVDA. The final report will be available at the end of March 1993. Botanical surveys have been conducted, species lists have been compiled and the condition and utility to the local population of the flora are being assessed. Species lists of fauna remain to be compiled, although survey work and interviews with local residents have been conducted.

75. In Gujarat, the botanical survey work by MSU confirmed that much of the submergence area and surrounding catchment has all the characteristics of a highly degraded eco-system. In particular, the north bank of the proposed reservoir has very little vegetative cover apart from a few isolated patches of forest. On the south bank, there are still some areas of fairly good forest cover, however, located within the area designated as the Shoolpaneshwar Wildlife Sanctuary. These are somewhat degraded, but the presence of small numbers of indicator species of teak forest show that the area was once a good forest and has the potential to recover. No rare or endangered endemic species were found. The MSU identified important flora, which although not endangered or rare in the sub-continent as a whole, occur infrequently in Gujarat. Specimens of these were collected and are preserved in the University's nurseries.

76. The study of animal life also showed a marked difference between the degraded north bank and the comparatively diverse fauna of the Shoolpaneshwar Sanctuary. The north bank is almost devoid of wildlife. South of the river, however, particularly within the original boundaries of the Shoolpaneshwar Wildlife Sanctuary, there is diverse fauna. Overall, 539 species of animal were identified including 173 species of bird and 28 mammals. The presence amongst these of such notable species as the Heartspotted Woodpecker, the Rusty spotted Cat, the Barking Deer and others makes the Sanctuary a high priority conservation area.

77. In Maharashtra, the submergence area is highly degraded forest which has been subject to over-exploitation and encroachment for agriculture. The submergence areas are contiguous with those on the south bank of the Narmada in Gujarat and can be expected to support a similar, if reduced, flora and fauna. The survey done by the Forest Department and the preliminary report of the more detailed work being undertaken by the University of Pune confirm these expectations. Plant life includes only commonly occurring species. Animal life is not as abundant as it once was, but there is still a wide diversity of invertebrates, reptiles and birds. Larger mammals have almost disappeared from the area, although some traces of large cats were found.

78. In Madhya Pradesh, studies of the Narmada Basin catalogued a very rich and diverse flora and fauna, but no rare or endangered plant species were identified. These studies were undertaken as part of the preparatory work for the Narmada Sagar Project and so concentrated on the submergence area of that dam. Nevertheless, the study areas were in the same ecological zone as the submergence area of Sardar Sarovar in Madhya Pradesh and, therefore, the same species of flora and fauna can be expected to be endemic in the two areas, unless the natural biota has been disturbed by anthropogenic activity. The second annual interim report of the SFRI, however,

reports that the submergence areas in Madhya Pradesh are very highly degraded. Moreover, in Madhya Pradesh, only a small patch (2,732 ha) of very poor quality forest will be submerged by the reservoir. Ground flora such as grasses, herbs and shrubs are altogether absent in some areas and under-stocked, small and bushy in others. In the absence of vegetational cover, and with the scarcity of water holes and the lack of fodder, the area harbors little or no wildlife of value.

Management/Mitigation Measures

79. There will be extensive tree and grass planting as part of the CAT and CAF programs, and this will greatly extend and improve the wildlife habitat. Since no rare or endangered plant species are endemic in the submergence areas of the dam, and since areas in Gujarat and Maharashtra are contiguous with far larger areas which will be preserved and enhanced by the project, there is no need for further measures in the submergence area to preserve flora or to increase carrying capacity.

80. Fauna of the submergence areas will be preserved by: creating new wildlife sanctuaries or extending existing ones; encouraging migration to the surrounding forest areas; providing escape routes from the submergence area; and enhancing the carrying capacity of the surrounding areas.

81. A key mitigation measure for the project will be the preservation and enhancement of the Shoolpaneshwar Wildlife Sanctuary including the participation of local people in the sanctuary's management. To assist and inform the development of the wildlife management strategy and to facilitate the preparation of action plans, however, several more studies were undertaken which examined the available options. These included:

- *Workshop on Approaches to Integrated Wildlife Management in Gujarat: A Report, by the SSNNL, October 1990.* This reported the outcome of discussions of an event organized by the Wildlife section of the Gujarat Department of Forests in conjunction with the SSNNL. The 90 participants included representatives from the World Wide Fund for Nature, MSU, and other organizations. Papers presented discussed the various approaches to the management of wildlife reserves as well as specific issues relating to the wildlife of the reservoir area.
- *People's Involvement in Wildlife Management, by VIKSAT in 1991.* This report was prepared for the World Bank and looked at local people's use of forests and attitudes towards wildlife in conjunction with the aims and objectives of the Shoolpaneshwar Sanctuary. It suggested several approaches for the development of the sanctuary including the proposal that tribal people be allowed to remain within its confines and that they should be involved in its management.
- *Wildlife Management Studies in the Submergence and Catchment Areas of Narmada Project : With Special Reference to Shoolpaneshwar Wildlife Sanctuary, by the SSNNL, 1992* studied the distribution and status of flora and fauna in the submergence areas of Gujarat and went on to suggest management measures for the Wildlife Sanctuary.

82. The proposals of the three states for the conservation of wildlife are as follows:

Gujarat. The area of the Shoolpaneshwar Wildlife Sanctuary is to be enlarged to 607 sq.km, almost four times its original size. The northern boundary now extends to the shore of the reservoir, providing access to the waterfront for the animals, and steps are being taken to improve the habitat in the sanctuary.

Maharashtra. Animals will be able to migrate from the submergence area of Maharashtra to a contiguous area within the Shoolpaneshwar Wildlife Sanctuary in Gujarat, and to the surrounding forest. A felling plan has been prepared to ensure that animals are not trapped on islands when the reservoir begins to fill. The University of Pune is studying the carrying capacity of the surrounding areas to assess their ability to support the influx of fauna from Maharashtra, but since only a small number of animals reside in the affected area and large-scale planting of the receiving areas is planned under both the CAF and the CAT programs, no problems are anticipated.

Madhya Pradesh. The study in progress by the SFRI has recommended the creation of wildlife sanctuaries in Madhya Pradesh and (in an adjoining area) Maharashtra. In addition, they have prepared a plan for felling the forests which provides corridors for whatever little wildlife remains in the submergence areas. Final decisions on how to respond to these recommendations will be taken when the study is complete and the final report has been received.

Action Plans

83. To ensure that the wildlife conservation measures outlined above are implemented effectively, action plans for the three states are required including:

- a. felling plans for Maharashtra and Madhya Pradesh which will avoid the possibility of animals being trapped in the submergence area;
- b. plans for improvement works in the wildlife sanctuaries of Gujarat;
- c. plans for increasing the carrying capacity of forest areas receiving wildlife from adjoining submergence areas, where appropriate; and
- d. plans for preserving the gene pool of important flora.

84. The following plans are available to date.

- *Scheme for Clear-felling the Forest Areas to be Submerged in Sardar Sarovar Project, by the SFRI, 1991.* This presents a plan for felling the trees in the submergence area of Madhya Pradesh. The plan takes account of the need to leave corridors for the migration of wildlife, but notes that due to the heavily degraded nature of the forest in the submergence area, animals appear already to have moved deeper into the forest.
- *Action Plan on Development of Shoolpaneshwar Sanctuary, prepared by the SSNNL, 1992.* This includes details of construction work to be carried out, a timetable and a cost estimate based on the recommendations of the SSNNL study described above. The Forest Department, Gujarat is responsible for implementing the plan.

85. Improvement of carrying capacity has already taken place in Shoolpaneshwar and is an inevitable consequence of the CAT and CAF programs taking place in areas adjoining the dam in Gujarat. Action may be needed on habitat improvement in the Sanctuaries proposed in Madhya Pradesh and Maharashtra, but plan development must await submission of SFRI's final report and the evaluation of the recommendations by an expert committee.

86. The study by Pune University includes a felling plan for the submergence areas of Maharashtra prepared for the Forest Department, which is responsible for the felling.

Implementation

87. Initial improvements to the habitats of the Shoolpaneshwar Wildlife Sanctuary were completed by the end of 1992. There is also provision for five years of maintenance. Details of the work are recorded in NCA reports. The Government's policy is that no felling within submergence areas is to be undertaken until no more than six months before filling of the reservoir, so the felling plans for Maharashtra and Madhya Pradesh await implementation.

Summary of Work Outstanding

88. Baseline studies and analysis of management/mitigation options to conserve terrestrial flora and fauna have been completed for a majority of the area affected by the dam. These studies have indicated the condition of wildlife in the project affected areas of Maharashtra, but the final report of a detailed study of this area is awaited. Plans for developing sanctuaries in Maharashtra and Madhya Pradesh await the final recommendations of the on-going studies. Management strategies for all sanctuaries in the project are under development.

UPSTREAM AQUATIC ENVIRONMENT

89. The impoundment of the Narmada by the SSP dam will convert a stretch of river between the dam site and the upper limits of the reservoir from a comparatively shallow, free-flowing river into a narrow lake of about 210 km with a depth of up to 120 meters at the dam site. Also, whereas previously 90% of the annual flow occurs during the monsoon period, the dam will regulate the flow and a substantial amount of water will be retained throughout the year. As a consequence, there will be considerable changes in the aquatic environment.

90. A condition of the environmental clearance given to the project by the MOEF was that flora and fauna be surveyed including fish in the river from a conservation aspect. Also, the Loan Agreement with the World Bank stipulated that studies on fish and fisheries should be carried out.

91. The results of studies on the effects of the project on the aquatic environment upstream of the dam and the proposed actions to manage these are summarized below. A review of the downstream aquatic environment is given in the PCR for the Water Delivery and Drainage Project.

Sources of Impact on the Upstream Aquatic Environment

92. The impoundment of a river affects its physical characteristics such as the depth, water quality, grain size and nature of the sediments and therefore the nature of the ecological niches it provides. The dam itself also constitutes a physical barrier to the movement of fish. Impacts of the project can therefore be expected to include changes in the composition of the aquatic flora and fauna within the reservoir. Two kinds of impacts are of greatest potential significance upstream of the reservoir. First, there may be physio-chemical changes in the benthic environment or the water column and consequent impacts on the food chain leading to effects on important fish species. Second, there may be a loss of breeding grounds with adverse impacts on commercial fisheries.

Studies

93. A number of studies have been carried out to establish a baseline and help to predict future conditions for aquatic life behind the Sardar Sarovar Dam. Many of these studies predated the planning of the project, but have provided a useful basis for further work and have been reviewed and synthesized by the Central Inland Capture Fisheries Research Institute (CICFRI). Other studies undertaken as part of project planning include the following:

The Environmental Impact Study of 1983 prepared by MSU. This catalogued the flora along the river banks and examined the planktonic flora and fauna. Data on fish catches was also examined and some preliminary conclusions about the potential for increased fish yields were reached, although further in-depth studies of likely conditions in the deeper parts of the reservoir were recommended.

Narmada Basin Water Development Plan : Development of Fisheries, 1984, was prepared by the Narmada Planning Agency, Madhya Pradesh. This was a desk study to synthesize many of the earlier limnological and fisheries studies and develop proposals for fisheries management within the reservoirs planned on the Narmada. A detailed description of the physio-chemical characteristics and the biota in the upstream environment is given together with an analysis of fish catch statistics. Potential impacts of impoundment are discussed and a plan is proposed for future fisheries development.

Rapid Reconnaissance Survey of Limnological Aspects Parts I, II and III, 1984, carried out for Gujarat in compliance with the MOEF requirement for environmental information for their appraisal of the impoundment projects on the Narmada. The stretch of the river within Madhya Pradesh was divided into three zones, east, central and west, of which the western zone abuts the reservoir area. The physio-chemical and biological status of each zone was assessed by means of samples taken on several occasions at a number of sites in each of the three zones. This rapid survey provided background information for the setting up of a more detailed study described below.

Narmada River Basin Development Project: Fisheries Component, 1991. Consultants studied the potential for fisheries development in: the catchment area of the Narmada River; the Command Area; and the estuary of the Narmada River. The report covers the logistics and costs of fisheries development in the Narmada Basin, and also provides a summary of the environmental conditions in the Sardar Sarovar reservoir and makes recommendations for further studies.

Sociological Survey of the Fishing Families of the Narmada River, 1991. This study records the results of an investigation into the socio-economic status of the fishing communities of the Narmada Basin. Over 8,000 families in 453 fishing villages were interviewed and the results analyzed to provide information on the income, secondary occupations, demography, fishing methods, culture, access to social services etc. of the fishing families. The report also recommended strategies for fisheries development.

Aquatic Fauna (Fish) Studies in Indira Narmada Sagar Submergence Area, 1991, on behalf on the NVDA reported on the fish fauna of the Narmada. These studies were carried out for the Indira Sagar (Narmada Sagar) Dam; however, due to similarities in the limnological environment, comparisons can be drawn with the Sardar Sarovar Dam. The status of the present fauna was assessed, the changes which can be expected after impoundment were predicted and the ecology of more than twenty of the most important fish species described.

Pre-and Post-Impoundment Limnological Studies of Narmada Basin, 1989-1993, involves the three universities involved in the Rapid Reconnaissance Survey and is coordinated by Barkatullah University for the NVDA. The final report will not be completed until mid-1993, but two annual reports have been issued. They report the results of detailed limnological investigations in free-flowing regions of the Narmada and in some of the impoundments already completed. Analysis of around 20 physio-chemical parameters was carried out monthly for two years. In conjunction with this, sampling was undertaken to identify and assess the abundance of large plants and of the planktonic and benthic biota.

Studies on Fish Conservation in Narmada Sagar, Sardar Sarovar and its Downstream is a desk review sponsored by the NCA and undertaken by CICFRI. The review was commissioned in October 1992 to summarize the existing baseline information on the fisheries of the Narmada Basin, investigate potential adverse impacts on the aquatic environment and to recommend strategies for the conservation of important fish species. CICFRI considered over 140 articles of published research on fisheries in the Narmada, in the Indian sub-continent and in impoundments around the world. They also consulted 30 scientists and administrators familiar with the fisheries aspects of the Narmada Basin.

Ecology and Fisheries of the Narmada Estuarine System with Special Reference to Proposed Impoundment (Sardar Sarovar Dam), is an on-going study begun in 1988 by CICFRI. This comprises five sub-projects as follows:

- (i) monitoring of ecological parameters;
- (ii) assessment of fishery resources;
- (iii) biological investigations and stock evaluation studies;
- (iv) artificial breeding and rearing of Hilsa; and
- (v) identification of point pollution sources and monitoring of discharges.

The study was due to end in 1993, but has recently been extended to develop models of estuary water quality under different scenarios. In addition, pre-impoundment investigations for developing rational management practices are also being undertaken by CICFRI.

Findings

94. None of the aquatic fauna of the Narmada is listed as rare or threatened in the International Union for the Conservation of Nature and Natural Resources (IUCN) 'Red List'. Nonetheless, CICFRI compiled a list of eight species which it suggested could be considered 'vulnerable' in the Narmada Basin, though they are present elsewhere in India in abundance. Past experience of Indian impoundments has shown that all these species can adapt to the conditions in reservoirs and will usually thrive. The CICFRI review also presented findings on the artificial hatching and rearing of key fish species. The report concluded that, if appropriate management practices are adopted, there will be no threat to important fauna. The earlier CICFRI report and the report by GOPA recommended specific mitigation measures and CICFRI has also stressed the need for training of fishermen in techniques appropriate to the changed fishing conditions in the reservoir.

Proposed Mitigation Measures

95. Key measures to manage effects of the project on the upstream aquatic environment focus on the preservation of valuable fish species and proper management of fisheries in the reservoir. Protection of valuable fish fauna will, to some extent, be dependent on maintaining acceptable water quality upstream of the dam. In order to monitor water quality, the NVDA, CWC, CPCB and CICFRI have already set up water quality monitoring stations on the Narmada and its tributaries. The three state governments have submitted action plans on fisheries as follows:

The Narmada Basin Water Development Plan: The Development of Fisheries, 1984. This comprehensive plan for Madhya Pradesh addressed the development of fisheries in the Narmada Sagar, Omkareshwar, Maheshwar and Sardar Sarovar areas. Phasing and programming with respect to pre- and post-impoundment, clearance of the forests, training of fishermen, cooperative societies and post-impoundment management were proposed.

Environmental Work Plan: Sector Fish and Fisheries, Gujarat 1986 This work plan, prepared in compliance with the agreement of the World Bank included the establishment of fish

hatcheries and fish farms, training of fishermen, establishing primary cooperatives, and establishing an Inter-State Fisheries Board. In addition, it included proposals for conducting hydro-biological studies, studies on the morphology of the river, investigations into the physical and chemical characteristics of the water and soil, and studies on flora, fauna, fish yield, plankton, and productivity in the reservoir.

Preparation of Environmental Work Plan for Fisheries Development in Maharashtra, 1987. This plan included proposals for the felling of trees in the reservoir submergence zone, fish seed, hatcheries, stocking, fishing, manpower requirements, and training and management through the Inter-State Board. Projections of funding requirements were also included.

96. Subsequently, the state governments revised their plans to address further issues as they arose. The revised plan for Gujarat included proposals for the fishing population to be resettled on the periphery of the reservoir or in R&R sites in Maharashtra. In addition, the establishment of low-cost hatcheries and irrigation tanks, the development of pen cage culture fisheries, and intensive fish farming were proposed.

97. Detailed plans for fisheries development and exploitation were presented in the CICFRI and GOPA reports described above and have been accepted by the project authorities. The main elements are as follows:

- a. selective stocking of the reservoir with a combination of indigenous fish species;
- b. research into and instigation of pilot projects for the artificial propagation of important species;
- c. setting up of an Interstate Fisheries Development Board (IFDB) to control and monitor fisheries exploitation and to coordinate research and development;
- d. monitoring of potential pollution sources;
- e. training and/or rehabilitation of fishermen; and
- f. completion of studies to predict the post-impoundment condition of the reservoir.

Progress of Implementation

98. CICFRI has established one hatchery in Gujarat for augmenting the numbers of the Hilsa fish in the reservoir. This currently produces around 250,000 spawn per year. CICFRI has also been commissioned to monitor the whole of the estuary and their study has been extended to examine pollution and to undertake modelling studies in the downstream environment.

99. A draft plan for the creation of an Interstate Fisheries Development Board (IFDB) has been prepared by the NCA and agreed, in principle, by the governments of Gujarat and Maharashtra. The organization will be constituted in accordance with the recommendations of GOPA and CICFRI and is expected to be set up and fully functioning prior to reservoir filling. The IFDB will be an autonomous organization, with the NCA represented on the Board.

100. In order to avoid any possibility of the formation of hydrosulphuric sludge after the inundation of forests, all three state governments have prepared plans for the clear-felling of the forest areas due to be submerged. Execution of felling will await the commencement of impounding.

101. Gujarat has provided 16 hectares of land to the project for the development of fish farms. In addition, the State Fisheries Department is exploring the development of riverine fisheries and the development of the reservoir for commercial and game fisheries.

Summary of Work Outstanding

102. Survey work has identified the ecologically and commercially important aquatic fauna and provided information on the likely water quality in the reservoir. Detailed recommendations have been made concerning the development and exploitation of fisheries in the reservoir. A plan for the development of a coordinating body for fisheries development has been drawn up but remains to be implemented and in-depth limnological studies to predict the productivity of the reservoir are yet to be completed. These studies may generate further recommendations for the implementation of fisheries development strategies. Implementation of the recommendations, if any, will be the responsibility of the IFDB. A socio-economic survey of fishing families for the entire basin has already been completed and a contingency plan for the rehabilitation of fishing families is in preparation. The IFDB will have the responsibility for the detailed planning of fisheries development, including training and rehabilitation of fishermen and the planning and control of fishing activities.

PUBLIC HEALTH

103. One of the benefits of the project will be the increased availability of fresh water for domestic, agricultural and industrial use in areas otherwise prone to drought; this improved access to domestic water supplies has the potential to yield substantial public health benefits. There are also health risks since, without proper control, the transport and storage of water can lead to a higher incidence of water-related diseases. Plans are needed to control disease vectors and to provide health facilities for migrant construction workers and the resettled population.

104. Health provision in India is defined by the National Health Policy (NHP) and national disease programs such as the National Malaria Eradication Program (NMEP). The NHP entitles all Indians to access to medical facilities, the number and distribution of which is determined by the local population density. The NMEP was developed as a nation-wide strategy to combat the spread of malaria. All three state governments will integrate development of new facilities for the project with proposals already made under the NHP and NMEP. Such integration will avoid duplication, maintain parity within the project area, and provide better access to health care than would otherwise be achieved.

105. In addition to the general obligations of the states under national policy, a specific requirement for the project contained in the MOEF Clearance Order (1987) was the provision of health facilities to workers and residents of the affected areas. The World Bank Loan Agreement also stipulated that each state should take necessary measures to minimize the risk of malaria, filaria, schistosomiasis and other diseases associated with water that may result from implementation of the project.

Sources of Impact

106. There are three main potential sources of health impact associated with the reservoir and its irrigation system. First, the occurrence of pools of standing water, during construction and operation of the reservoir and irrigation system may provide breeding areas for disease vectors, especially mosquitoes that spread malaria. Second, the spread of irrigation may expose more people to water-borne diseases. Third, construction workers may bring with them diseases or parasites, to which the permanent population has low immunity. Diseases associated with water are sub-divided into several groups as summarized below:

Water-borne: Water supplies contaminated by faeces from a human carrier of the infective organism (typhoid, cholera, dysentery, giardia, diarrhoea).

Water-based: Infections caused by worms, flukes and trematodes. Faeces from infected humans containing worm eggs enter secondary host through contaminated water. Larvae then invade human host (schistosomiasis, guinea worm infection).

Water-related: Insect vectors breed in or around water and transmit disease by biting infected human host, then feeding on unaffected human (malaria, sleeping sickness, onchocerciasis, viral diseases).

Water-washed: Faecal-oral transmission associated with poor hygiene, lack of washing. Incidence decreased by improved water availability (diarrhoea, ulcers, scabies, trachoma, fungal infections).

The project is expected to confer significant public health benefits, since increased water availability will help to reduce the incidence of 'water-washed' and 'water-borne' diseases which are associated with poor hygiene and restricted water supply. Management of the potential health impacts of the project will focus primarily, therefore, on the exclusion and/or control of the disease vectors which spread 'water-based' and 'water-related' diseases.

Studies

107. A large number of studies have been carried out on the health profile of villages in the three affected states. The key studies are summarized below.

Narmada Program - Schistosomiasis - Back-to-Office Report, 1986 describes the schistosomiasis assessment carried out by the National Institute of Communicable Diseases (NICD) and the World Health Organization (WHO). The assessment confirmed the incidence of schistosomiasis in Gimvi Village, Ratnagiri District, Maharashtra. This is the only location in India where the disease had been recorded. The report also concluded that the Ratnagiri pocket was stable and that concerns expressed over the spread of schistosomiasis due to the project were unfounded.

Proceedings and Recommendations of the Meeting on Schistosomiasis Research and Surveillance 1985. In 1985, the NICD carried out a survey of several Narmada submergence villages in Gujarat and Madhya Pradesh. Several thousand urine samples were tested for parasite eggs yielding negative results. The results and conclusions of the survey were presented and discussed at the 1985 workshop.

Disease Profile of Command Area by the Commissariat of Health, Medical Services and Medical Education (SCHMS), 1986 This study contained an analysis of the disease profile in the Command Area and formed the basis of the Gujarat state work plan for environmental health. As part of the study, the potential impacts of the project on public health were considered and discussed with the World Bank and Government officials. Conclusions from these consultations were used to assist in formulation of the work plan.

Health Statistics, Maharashtra, 1987. The state department of health produced a report on the health profile of 33 project-affected villages in Dhule District, Maharashtra. This report concluded that:

- (i) schistosomiasis was only found in one village and was unlikely to spread because of the project;

- (ii) the influx of laborers, formation of irrigation canals and cesspools along the canals could lead to increased incidence of malaria;
- (iii) measures should be taken to prevent the possible spread of cholera and gastroenteritis due to misuse of irrigation waters for washing etc; and
- (iv) filaria is not present in the project areas, but careful monitoring should be undertaken to ensure it does not enter the area.

These results were used to formulate the initial Maharashtra action plan for public health and the modified plan was finalized in 1992.

Health Statistics 1982-84, Madhya Pradesh. 1985 presented an analysis of the distribution and prevalence of water-related diseases in the Narmada Basin and provided baseline data for the state action plan for public health. The study concluded that malaria, guinea worm infections, goiter, gastroenteritis and worm infestations were the most common diseases. Schistosomiasis and leishmaniasis were not found to be endemic to the area. The study concluded that careful monitoring for malaria and filaria would be needed, but that guinea worm was likely to be eradicated once the reservoir was full.

The Sardar Sarovar Narmada Project Studies on Ecology and Environment by MSU in 1983 considered public health in Chapter 3. To obtain an overall picture of the health profile of the Narmada River, MSU visited 42 sites from Hanf to the river mouth. Data was collected from public health centers and public health units to establish the rates of occurrence and distribution of disease over the previous five years. This data was used to produce an assessment of the likely health impacts upstream and downstream of the dam site.

Health Aspect and Water Quality by the NVDA, 1988 reports on the status of the more common diseases in the Narmada Sagar area, but suggests that its conclusions apply also to the Sardar Sarovar Project.

Studies on Water Related Diseases in SSP Command Area including the Area Downstream of the Dam], is an ongoing environmental assessment of the health impacts of the SSP on the Command Area commissioned by SCHMS in December 1992. This assessment will include the cataloguing of existing facilities in Gujarat, the collection of time-series data on diseases, the identification of problem areas and a summary of recommendations for additional facilities required. A final report is expected by end of March 1993.

Findings

108. The MSU study of 1983 and other studies concluded that the most common diseases in the Narmada Basin were malaria, scabies, dysentery and diarrhoea. Of these diseases, only the threat of increased incidence of malaria need be of concern to the project authorities. Occurrence of other diseases is, in general, related to poor hygiene, poor sanitation and the lack of drinking water. The study concluded that the incidence of these hygiene-related diseases would be reduced by better water availability.

109. Several other studies have also identified malaria and Japanese Encephalitis as the greatest potential health threats in the project-affected areas, but have indicated that timely mitigation measures would greatly reduce any risk. The SCHMS report, for example, pointed out that parts of the Command Area were already under irrigation and that the addition of new areas would not have a marked impact on malaria incidence. Moreover, the vector would not be able to breed in the

irrigation branch canals under flow. The report did recommend, however, that the incidence of malaria should be subject to surveillance and recommended that practical measures be implemented where necessary, to protect agricultural communities.

110. A consensus was reached that schistosomiasis will not constitute a serious health issue. This view was put forward in the NICD report and confirmed by the subsequent World Bank/WHO missions.

111. According to the MSU report of 1983, filaria is confined to the coastal areas of Saurashtra and South Gujarat. Filaria has also been reported near to the reservoir site, but the study concluded that the disease was unlikely to spread to the reservoir area.

112. The NVDA report concludes that, given the rise of the water table and consequent reduced potential for cyclonic proliferation, the likelihood that guinea worm infestation will increase is extremely remote.

Proposed Management/Mitigation Measures

113. As required by the Government guidelines and in compliance with the World Bank Loan Agreement, each of the three states affected by the project have submitted environmental work plans covering public health. Studies on the disease profile in the region and past experience with major water resources projects suggested that health action plans for the project should focus on the following:

- a. provision of health care for displaced people and migrant workers;
- b. control of malaria and potential breeding sites for malarial vectors; and
- c. monitoring for the incidence of other water-related and water-borne diseases with a view to preventing their establishment.

All three states have submitted action plans for public health to the Central Government. The principal components of these plans are discussed below.

114. Gujarat. The Gujarat work plan covers villages within a 10 km radius of the reservoir including resettled populations and makes provision for the monitoring, surveillance and control of malaria. The 1986 plan is still in force, although modifications and additions have been made since its publication. The principal features of Gujarat's program are:

- a. establishment of a hospital at Kevadia near the dam site;
- b. strengthening of laboratory facilities including establishment of a mobile unit;
- c. provision for laboratory technicians in existing public health centers (PHCs) and expansion of malaria treatment depots;
- d. an Urban Malaria Scheme for centers over 40,000 (anti-larval operations) not currently covered;
- e. strengthening of state level health organization to ensure monitoring of malaria, filaria, dengue and encephalitis;
- f. strengthening of district level health organizations for monitoring or implementation; and

g. residual insecticidal spraying operations;

115. Maharashtra plans to strengthen state and district health facilities in existing villages and in resettlement areas. These provisions included the establishment of a monitoring and laboratory cell at the Rural Hospital and strengthening of the existing Primary Health Center.

116. Madhya Pradesh. This plan included a summary of the existing health profile in the submergence villages and discussed the likely impacts of the SSP. The plan contains specific provision for:

- a. strengthening of health facilities already in place under the NHP and Minimum Needs Program of the Seventh Five Year Plan;
- b. establishment of a Health Monitoring Cell;
- c. establishment of health centers for construction workers; and
- d. strengthening of district organizations for malaria control established under the NMEP.

117. In addition to the State Health Plan, Gandhi Medical College, Bhopal will undertake monitoring of malaria and other diseases through a study of mosquito vectors in the Narmada area and the collection and analysis of time-series data on disease incidence.

Implementation

118. Gujarat. The entire population of Gujarat will receive protection under the National Malaria Eradication Program, the extended Urban Malaria Scheme, and project-specific programs. By the end of 1992, the intensified malaria control program was underway in several villages, impacted by the project in Gujarat and the construction of a 25-bed hospital at Kevadia was complete.

119. Maharashtra. In accordance with state provision for health care facilities, two cottage hospitals, eight primary health centers and 55 primary health units have already been established in Dhule District. Taking into account the inaccessibility of some of the villages, provisions were made for eight additional public health units, 10 mobile units and a floating dispensary for villages within 10 km of the submergence zone. One hospital at Somawal resettlement village is already functional.

120. Madhya Pradesh. During 1992, Gandhi Medical College continued surveillance studies of the impact area of Madhya Pradesh and work commenced on additional facilities for the Nisapur village hospital, Dhar district. Extension of the Nisapur hospital is due for completion by 1994-95 when submergence of areas in Madhya Pradesh is due to commence.

CULTURAL HERITAGE

121. The Ancient Monuments and Archaeological Sites and Remains Act, 1958 charges the Central and/or State Departments of Archaeology with responsibility for the protection of important cultural sites. Under the Act, sites are classified into three categories as follows:

- Type 1: monuments of national importance which are protected by the Central Government;
- Type 2: monuments of religious or cultural importance which are protected by the State Governments; and

Type 3: monuments which are neither Centrally nor State-protected, but which are considered to be an important part of cultural heritage.

Under the same law, authorities charged with the protection of the monuments are permitted to take suitable measures to ensure the preservation of any protected site under threat from decay, misuse or economic activity.

122. In the case of Sardar Sarovar, where several sites may be submerged, the NWDT award stipulated that the entire cost of relocation and protection should be chargeable to Gujarat. Relocation work is to be supervised by the Department of Archaeology under the provisions of the 1958 Act.

Sources of Impact on Sites of Cultural Interest

123. The principal impacts of the project on the cultural environment are likely to be: the loss of access to historical, cultural or aesthetic sites which are submerged by the reservoir and direct disruption or damage to sites through construction activity, or indirect effects resulting from resettlement of people.

Studies

124. The three state governments carried out a complete survey of cultural and religious sites within the submergence zone. The principal aim of these surveys was to list all archaeological sites, identify and name any sites under state protection and further identify sites of religious or cultural significance which, although not protected under national law, are of sufficient value to merit relocation. These studies are summarized below:

Archaeological Survey of Nineteen Villages in Gujarat Submerged by Sardar Sarovar Reservoir, 1989. The Department of Archaeology has surveyed archaeological sites in 19 villages of the submergence zone in Gujarat.

Maharashtra: Survey of Department of Archaeology. A survey was carried out by the Department of Archaeology of cultural sites in 24 villages of Akkrani Taluk and nine villages from Akkalkuva Taluk, Dhule District. A brief summary note was submitted by the Director of Archaeology in February 1992 which stated that no State-protected monuments were located in the area, but recommended the preservation of monuments at the village of Manibeli, Dhule District.

Madhya Pradesh: Survey of State Department of Archaeology and Museum. The Archaeology Department of Madhya Pradesh compiled a detailed report of archaeological sites in 120 villages likely to be affected by the project. A second study of 73 villages was completed in July 1991. Each study contained photographs together with detailed descriptions of the current use and historical significance of the sites.

125. In addition to baseline studies on archaeological aspects, work has been carried out on the anthropological heritage of the Narmada Basin, including examination of evidence of ancient dwellings and cultural artifacts. The principal studies in this area are described below:

Anthropological Survey of India. Narmada Salvage Plan. The Narmada Salvage Plan contains detailed background data on palaeo-anthropological, human ecological and other aspects of the Narmada Valley. By May 1992, surface scanning of 17 sample villages coming under

submergence had been carried out and 424 specimens including ancient tools etc had been collected.

Anthropological Survey of India. Peoples of India. This project entailed a complete survey of 33 tribes of India including those of the Narmada Basin. The study covered all aspects of tribal culture in India and was published in 61 volumes in 1992.

Parishad, A.K. Survey of Material Culture in the Narmada Valley. Work was completed and a report published by the National Museum of Humanity, Bhopal, on cultural objects from tribal artisans in Madhya Pradesh in 1990. Copies of the interim report were circulated to the Ministry of Environment and Forests and the Narmada Control Authority in April 1991.

Findings

126. No centrally or state-protected cultural sites are located in the submergence area of the project. Baseline studies, however, identified several sites which were considered of cultural value and should be relocated where practicable.

127. Gujarat. The Department of Archaeology concluded that the temples of Shoolpaneshwar and Hamfeshwar were important monuments and should be moved to high ground. Six other temples within the submergence zone were not considered of sufficient value to merit relocation.

128. Maharashtra. No state-protected sites were found in the villages surveyed; however, the Department of Archaeology and Museums recommended the relocation and proper preservation of the Shoolpaneshwar temple in the village of Manibeli, which lies on the border of Gujarat and Maharashtra states.

129. Madhya Pradesh. Following the initial survey of the State Department of Archaeology and Museums, a list of temples and other monuments was prepared for further consideration. This list comprised 15 monuments from Khargone, 20 monuments from Dhar and 2 monuments from Jhabau. No state-protected anthropological sites were found within the submergence zone.

Proposed Management Measures

130. Gujarat. In Gujarat, the Shoolpaneshwar temple is to be relocated in 1993 and the Hamfeshwar temple in 1994.

131. Maharashtra. The Director of Archaeology reports that no state-protected sites would come under submergence.

132. Madhya Pradesh. A large number of sites were identified for relocation although none of these sites are protected under the 1958 Act. It was proposed, therefore, that any decision on whether they should be relocated would be made on a case-by-case basis by an independent expert panel.

133. Of the sites submitted for consideration by the panel, it was decided that six temples and two excavation sites needed protection. In addition, 200 or so of the scattered sculptures within the region would be moved to the Indore Museum or Lal Bagh Palace. It was also decided that excavation work would be carried out on the burial mound at Khedinema. A draft action plan was submitted for consideration at the end of 1992 and a final draft is expected by mid-1993. In addition to the action plans for archaeological sites, a separate plan was drawn up for the protection of anthropological sites from dam activities. The final plan, Anthropological Salvage Plan for

Narmada Valley, produced by the Anthropological Society of India, contained three main components:

- a. a study of the palaeo-ecology of quaternary fossils in the central Narmada Valley;
- b. excavation of upper-palaeolithic site of Mehtakhaeda and exploration of Nimar; and
- c. collection of tribal artifacts in Madhya Pradesh.

The first two elements are to be completed by Deccan College, Pune and the third by Adivasi Kala Parishad for the Rashtriya Manav Sangrahalaya (National Human Museum), Bhopal.

Implementation

134. Gujarat. Sites have been selected to relocate Shoolpaneshwar and Hamfeshwar in consultation with temple Trustees. Shoolpaneshwar has now been relocated and reconstructed near Gora, about 15 km downstream from the present location, and Hamfeshwar is being moved to higher ground in consultation with the temple trustees.

135. Maharashtra. Monuments at Manibeli village have been surveyed and Gujarat has now completed the relocation operations.

136. Madhya Pradesh has submitted a list of proposed sites to the central panel for approval. Phase II operations, involving the actual relocation, are scheduled for completion by the end of March 1993. An action plan has been prepared detailing the scheduling of the temple relocations and a Final Report is due by the end of March 1993. Some steps have been taken to acquire additional land at Pipaliyahada which will be the main museum for sculptures; however, more work is needed to prepare display cabinets and catalogues for new artifacts. Four sites have been approved for excavation.

137. From the results of the three states surveys, it is clear that the impacts of submergence on cultural properties will be minimal in the states of Gujarat and Maharashtra, although there will be somewhat more significant impacts in Madhya Pradesh.

HYDROLOGY

Impacts

138. The natural flow of the Narmada River is highly seasonal with 82% of the annual flow occurring during the monsoon period in the months of July, August and September. The main purpose of the Sardar Sarovar Reservoir and other reservoirs in the basin, therefore, is to store some of the monsoon flows for use in the dry season (October through June). The stored water will be released in the dry months to meet urban and rural water demands in areas which presently suffer from drought and to intensify agriculture through irrigation of land which would otherwise be idle in the dry season. In addition, the project will produce hydroelectric power in two powerplants, one located at the head of the main canal and one at the river bed level.

139. Storage and diversion of water will have some impacts in the river and estuary downstream of the dam. These will vary with time and depend on the rate of upstream development. The combined effect of the Sardar Sarovar Dam and other proposed upstream dams, especially the Narmada Sagar Dam (which has greater storage capacity than Sardar Sarovar) will be to increase the downstream flow during the dry season and reduce it in wet season. These dams will also reduce the frequency of damaging floods in the lower reaches of the river.

140. A significant factor shaping the Basin's environment in the long-term and the planning of its land and water development, is the apportionment of benefits derived from impoundment of the Narmada amongst the surrounding states. The NWDT was established in 1969 to formulate an overall development plan for the basin and to devise a system of allocating water which would be acceptable to all the states concerned. After ten years of deliberations, the Tribunal gave its Final Order in December 1979. As a basis for the Order, the 75% dependable flow was accepted as being 28 MAF, and of this 18.25 MAF was allocated to Madhya Pradesh, 9 MAF to Gujarat, 0.5 MAF to Rajasthan, and 0.25 MAF to Maharashtra. The Order also specified key parameters governing the design and operation of the two main water resource projects, Narmada Sagar and Sardar Sarovar. A review of the basic hydrological data and the future pattern of water demands on the Basin has recently been carried out. The main findings are as follows:

- a. The basic hydrological data used by the NWDT, and in particular the record at the Garudeshwar stream gauging site (close to the Sardar Sarovar Dam), is an acceptable basis for the water resources planning of the Basin.
- b. the 75% dependable flow of 28 MAF adopted by the NWDT is just above the subsequent calculation of 26.6 MAF as the long term 75% dependable virgin flow. However, Gujarat has access not only to 32.24% of that flow by right, but also to excess flows reaching Sardar Sarovar and to substantial groundwater in the Command which has been developed since the Tribunal sat.
- c. It will be many years before projects in Madhya Pradesh have been developed to the point where that state will be able to consume its share of water. In the meantime, the availability of water in Gujarat will, except in unusually dry years, substantially exceed 9 MAF. As a result, power generation and flows to the downstream river as well as irrigation diversions will be higher than envisioned for the ultimate stage in Basin development.

Management

141. The NCA is responsible for coordination between the states in implementing the NWDT Order and will, therefore, be equipped to conduct the data collection and detailed operation studies needed to maximize multi-purpose benefits as the Basin develops, and to anticipate and manage conflicts between different purposes.

SEDIMENTATION AND BACKWATER EFFECTS

Impacts

142. The water in the reservoir will be moving far less quickly than the waters of the Narmada travel pre-impoundment and so its capacity to hold and transport sediment will be reduced. Sedimentation in the reservoir will in time reduce its storage capacity, and have some effect on the morphology of the downstream river and estuary.

Studies

143. Many studies have been carried out to investigate and assess the impacts described above. Key studies include the following.

Sedimentation Studies and Life of Reservoir was a report published by the Narmada Project Dam Designs Circle in 1982. The report describes a study of predicted reservoir sedimentation in the Sardar Sarovar Project. Estimates of the sediment load in the Narmada River were

derived from sediment-gauging records. Allowance was made in the study for the amount of sediment that would be trapped by the Narmada Sagar reservoir upstream

Sedimentation Study of Narmada Sagar (1990) describes a study carried out by the Central Water Commission. Sediment yields from sub-catchments were estimated and allowance was made for sediment trapping by existing projects.

A study of sedimentation in Narmada Sagar carried out by NVDA in 1986, using data from gaging stations, and used to calculate sediment yields from each sub-catchment. It took into account existing and proposed projects in the catchment area. Its results were comparable to those of the above study.

Findings

144. Estimates of sub-catchment sediment yield for Sardar Sarovar were of the order of 0.057 ha.m/sq km/year. These sediment yields are comparable to those determined for similar catchments in other parts of the world. Estimates of the reservoir trapping efficiencies and sediment yields have been used to predict the annual storage loss of the reservoir. With an assumed trapping efficiency of 96%, the annual storage loss of the Sardar Sarovar is estimated at 0.35% of the total storage volume or 0.52% of the live storage. The annual percentage storage loss for the project comes at the lower end of the range of data from other schemes around the world. The half life of the storage of the project, that is, the time required to lose half the storage volume through sedimentation, would be between 90 and 120 years. This would suggest that sedimentation will not be a major problem. If the proposals for other projects upstream go ahead, the life of the reservoir would be increased.

145. During a high flood, a sloping water-surface profile will develop upstream of the dam, and this will extend some distance into the river channel above the reservoir. This is the "backwater effect" of the dam. Studies carried out by CWC show that, for the 100-year flood, the water level at the head of the reservoir would be about seven meters above the tail end of the reservoir. However, the surface profile of the reservoir would eventually merge into the natural surface profile of the river upstream of the head of the reservoir.

146. The policy laid down by NWDT requires all land and property below Elevation of 140 m to be acquired (this is about two meters above the full reservoir level without a flood). Between this level and the water profile for a 100-year flood, only buildings will be acquired. Experience has shown that this will be the preferred option of most farmers, who normally will not want to leave their home villages simply because their land may be flooded for a short time by a relatively rare hydrologic event.

147. Sedimentation in the reservoir may eventually lead to some change in the 100-year flood profile. On the basis of studies by the CWC this change might be on the order of three meters in some 200 years. This would mean some additional inundation in a few villages at the head of the reservoir for a 100-year flood as currently calculated. However, the magnitude to a 100-year flood will be considerably lower by that time because of the effect of upstream reservoirs. Therefore, the effect of sediment on the backwater profile is of no great significance. However, the Indian practice is to make periodic surveys of sediment deposition in the reservoir; the results will be used in studies to verify the backwater studies and to ensure future flood levels can be accurately predicted.

148. Sedimentation in the reservoir could lead to an increase of some three meters in the backwater level, potentially flooding occupied land. In view of this, and since flooding due to

sedimentation will develop slowly over the next 200 years and as surrounding land uses are predominantly agricultural, no immediate actions are required. A flood warning system exists in India and the NCA has proposed that a computer network be installed for real-time data collection and flood forecasting throughout the basin. The proposal has been accepted and is currently under implementation.

DOWNSTREAM RIVER AND ESTUARY

149. The downstream river channel and estuary of the Narmada together with the relatively narrow strips of land on either bank which form the downstream drainage basin cover 10% of the total drainage basin area of the Narmada River. There are two main tributaries downstream of Sardar Sarovar, the Orsang on the right bank and the Karjan on the left. There already exists a major dam on the Karjan (recently completed) from which a large portion of the land on the left bank will be irrigated. Canals from the Ukai Dam on the Tapi River (the next major river south of the Narmada) are also being built to irrigate some of the remaining lands on the left bank of the Narmada. The Orsang is less regulated than the Karjan, but dams may be built in the future. Also, the right bank of the Narmada lies within the command area to be irrigated from the canals supplied from Sardar Sarovar.

150. At the head of the estuary lies the town of Bharuch. This was an ancient port and commercial center, but with the ever-increasing size of cargo vessels, Bharuch's restricted access and high tidal range made it unsuitable as a modern port, with the result that very little traffic has used it since the early part of this century. Commerce and industry have continued to flourish, however, partly because the main road and rail links from Ahmedabad and Vadodara (Baroda) to Bombay cross the Narmada at Bharuch. Industrial development is expanding on both banks (at Bharuch on the right bank and Ankleswar on the left), with fertilizer and chemical factories particularly dominant and a new thermal power station is being built on the right bank of the Narmada upstream of Bharuch. In addition, reserves of oil and natural gas have been found around the estuary and there is, at present, a rush of exploration and exploitation.

151. Any impact on the downstream region, which results from the Sardar Sarovar Dam should, therefore, be seen in the context of the overall development of the region. In particular, there are few areas remaining in which the natural ecology has not already been, or will soon be, modified by human activities largely unrelated to the dam and the current and planned levels of industrial development are likely to be dominant factors in relation to future environmental changes in the region. However, the PCR feels strongly that the advent of SSP will add to the present deteriorating situation through a reduction of the Narmada flows and also through irrigation return flows in mid- and long-term. It believes, therefore, that the completion of a detailed environmental assessment of the estuary to determine in which way these impacts could be mitigated and in particular through regular releases from the Sardar Sarovar has become a prerequisite to dam operation plans.

Studies

152. Two studies commissioned by the Government of Gujarat form the primary sources for previous overviews of the downstream impacts and have been used for this report:

Sardar Sarovar Narmada Project, Studies on Ecology and the Environment: a report produced by MS University in 1983 is widely quoted and its data and conclusions have never seriously been challenged except for the fact that the field surveys were for a rather short period (6 months).

An approach paper on the Environmental Impact Assessment for the river reach downstream of Sardar Sarovar issued by the Sardar Sarovar Narmada Nigam Limited (SSNNL or NIGAM) in 1992 provides a more detailed technical understanding of the likely hydrological changes and discusses possible impacts in relation to these.

To ensure that no significant impacts were overlooked, consultants used the check-list of environmental impacts of the International Congress on Irrigation and Drainage (ICID) to identify key issues.

Hydrological Changes

153. Before any significant water resource development took place in the Basin, the natural flow of the Narmada was typical of rivers in a monsoon climate: high and widely varying flows in the wet season from July to September followed by sharply declining flows in the dry season from October until May/June. In the lower reach of the Narmada, the flow dropped almost to zero in the dry months and the salt front moved some 70 km up the river from the estuary. As a result, most wells in this reach were saline and the river was unusable for drinking or irrigation. Since the Bargi Dam was built, there has been a marked increase in regulated flows throughout the dry season and water is usable along the entire river throughout the year.

154. The potential for environmental changes in the lower river and estuary have to be seen in the context of the long-term development of the Basin. The current stage is clearly beneficial. Three further stages can be broadly identified:

Stage 1 covers the period roughly from the completion of the Sardar Sarovar Dam in 1997 to the year 2015. Events occurring during this stage include (a) the SSP canal command will have reached full development and requires diversion of some 9 million acre feet (maf) of water, 30% of the mean annual flow; (b) the upstream demand in Madhya Pradesh will reach about 8 maf by 2010; and (c) the Narmada Sagar Dam will have been built and placed in operation.

Stage 2 covers the period from 2015 to 2030 during which demands upstream of SSP continue to grow and will reach about 12 maf, still below the volume of 18 maf that Madhya Pradesh can take in a 75% year.

Stage 3 covers the period up to and beyond full basin development.

155. Considering first the impact on wet season flows, the SSP reservoir will modify the pattern of river flows downstream of the dam. In virtually all years, the SSP reservoir will be filled by intercepting the July floods. The August and September floods will pass through the reservoir and will not be affected. As further upstream storage such as Narmada Sagar is built, the August floods will be increasingly modified by the need to fill upstream reservoirs. The effect will be to (a) reduce the volume of wet season flow; (b) produce a more even flow with less daily and monthly fluctuations; (c) reduce the magnitude and frequency of high floods; and (d) greatly reduce the sediment flow into the lower river and estuary.

156. Dry season flows will continue to increase at least through Stage 1 and well into Stage 2. In the ultimate development of the Basin, late in Stage 3, the dry season flow could be greatly reduced under an operating regime which maximizes diversions for irrigation. However, system operation to produce minimum power generation in the dry months would lead to significant dry-season flows in the lower river. Such a scenario is not unlikely, because the need to maintain minimum power output from the Narmada Sagar Dam and two smaller downstream dams, Omkareshwar and Maheshwar, may outweigh the benefits to be derived from irrigation diversions upstream of Narmada Sagar.

Organic and inorganic pollution

157. The project will not in itself be a source of organic or inorganic pollution. The Gujarat Pollution Control Board has the responsibility for enforcing the State's stringent regulations governing industrial effluents. Therefore, the control and treatment at the source will be the main safeguard of water quality in the lower river and the estuary. To the extent that a year-round flow is needed to dilute effluents, the project will have a positive impact for many years to come. Clearing of vegetation from the reservoir will limit the potential for production of hydrogen sulphide. If residual vegetation does create such a problem, it will be relatively minor and short-lived.

Saline intrusion

158. During the closure of the construction sluices at the foot of the Sardar Sarovar Dam in 1994, the Borrower took all necessary measures including the release of water from the Karjan reservoir and the pumping of water from SSP to maintain a minimum flow in the Narmada River. In stages 1 and 2, increased flows in the dry-season will reduce saline intrusion. In stage 3, the dry-season flows will revert to the conditions prior to development of the Basin, and the flows could drop to about zero for longer periods. Further studies are required to determine the extent to which a certain level of releases will have to be maintained to control saline intrusion and protect the economic and environmental conditions downstream of the SSP reservoir.

Erosion and sedimentation

159. Sardar Sarovar Dam will trap over 90% of the incoming sediment load and once Narmada Sagar Dam is completed, the proportion of sediment trapped will be even higher. The sediment which passes SSP will comprise only the finest particles and will be released almost entirely during the periods when flood discharges pass over the spillway. Thus, the potential for erosion of the downstream river channel and the effects of such erosion have to be considered. The downstream channel has a rocky bed for 10 or 20 km after which the bed material changes from sands to fine sands and silts as the estuary is reached. Degradation of the channel is anticipated, but is unlikely to affect the five downstream bridges or the freshwater intakes since they appear to have adequate scour protection. Deepening of the channel may lead to reduced flood levels, especially in the reach between Garudeshwar and Jhanor. Further erosion is unlikely after Stage 1 since flood peaks will be progressively reduced. Bank protection has been provided at the freshwater intakes which should be adequate since the channel is not expected to be any less stable than without the dam. Map studies have shown that the channel in the lower reaches approaching Baruch has been relatively stable over a period of 130 years.

Estuary morphology

160. Estuaries are seldom stable even when there are no upstream hydrologic changes and the Narmada estuary is no exception; channels silt and scour and islands appear and disappear for reasons which are difficult, if not impossible to determine. The estuary is virtually devoid of any plant life: the last small area of mangrove was cut down some years ago. It is a wintering area for some migratory waterfowl, but apparently they thrived in the years when the dry-season flow was almost zero and there is no evidence that modest increase in the dry-season flow will affect them adversely. The only communities dependent on the estuary are the fishing villages. The potential impact of the project on fisheries is discussed below under a separate heading. The impact of the change in the river's hydrology on the estuary's morphology will be difficult to predict and there is no evidence that changes will be harmful except, perhaps, for the fishery resource. Nevertheless, studies are underway by several leading research organizations in India to assess a range of

impacts in the estuary. The Central Water and Power Research Station (CWPRS), Pune has completed a study of channel morphology and is coordinating their work with the Central Inland Capture Fisheries Research Institute (CICFRI) who are continuing work on the fisheries issue.

Fisheries

161. The studies so far conducted have not identified any rare or endangered species anywhere along the Narmada valley or in the estuary. A study is being conducted for NCA by CICFRI to assess the likely impact on fisheries. Subject to the findings of this study, the following impacts are put forward as likely to be the most important:

Hilsa: Changed flow patterns during the monsoon could affect migration which appears to be triggered by freshwater flows at the estuary mouth. Also, changes in the duration of flows greater than a given threshold may affect the success of fry in reaching maturity. Consideration of hydrological changes in Appendix 3 suggests that there will almost certainly be effect on hilsa after Stage 2. However, current knowledge is insufficient to predict with precision how soon the modifications of monsoon flows by the dam will begin to have a noticeable impact on catches. An impact on hilsa spawning may affect the incomes of marine fishermen who catch hilsa at sea, but data on the significance of hilsa in marine catches are not available.

Giant Prawn: Migration of giant freshwater prawn is in the reverse direction to that of hilsa. Spawning, in this case, takes place in the mouth of the estuary. This pattern of breeding is less likely to be affected by flows than that of hilsa, but spawning would probably be affected by salinity intrusion and water quality changes in the estuary. However, such changes are unlikely to be significant for many years.

Other fish: Most other species are unlikely to be affected unless flows fall very low. Some species may benefit if mangrove is reintroduced around Aliabet Island.

162. The impact of the above changes on fishermen will depend on how readily they can adapt to alternative forms of employment (marine or culture fisheries, carpentry, farming). A study of the sociology of fishing families has been carried out by CICFRI.

Socioeconomic impacts

163. The hilsa and giant freshwater prawn fisheries may decline after Stage 2, some 30 years from now. The loss of hilsa would be significant in relation to stocks on the west coast of India, but not in relation to global resources. Thus, loss of genetic resources is not an issue either with hilsa or giant freshwater prawn. Likewise, loss of fish supplies for consumption is not a major issue since new supplies will be provided from reservoir fisheries. The most significant impact would be on the livelihoods of the fishermen. The following mitigating strategy has been proposed by the project authorities to ensure that fishermen do not suffer:

- a. retrain and equip fishermen with boats more suitable for marine fishing in the Gulf of Cambay. This is a feasible option for fishermen in villages within the estuary, although the economic viability of additional marine fisheries, part of which currently relies on marine catches of hilsa, should be investigated;
- b. retrain and equip as culture fishermen in brackish ponds on coastal mud flats and freshwater ponds inland. In general, catch fishermen do not adapt readily to fish farming, but many hilsa fishermen are already part-time farmers, so the changes may not be too severe. The potential for fish farming is large;

- c. retrain and equip for reservoir fisheries. Undoubtedly, there is a large potential for reservoir fisheries which, it is estimated, will more than offset any loss of estuarine and river fisheries. However, it does not seem appropriate for river and estuary fishermen to move to new locations around the SSP reservoir, so this cannot be considered as an option for their rehabilitation;
- d. employ the fishermen in hilsa, carp and giant prawn breeding stations to supplement natural stocks in the river after Stage 1 and to supply hilsa to the SSP reservoir and to brackish ponds in the estuary and giant prawn to the freshwater ponds. The artificial rearing of hilsa has proved to be viable, but relies on obtaining spawn from adults caught in the estuary. Whether this cycle could be maintained if hilsa migration ceases is unknown; and
- e. equip fishermen to switch to activities which they had previously practiced part-time. Many of the riverine fishermen already spend the period when hilsa are not in season engaged in other occupations such as carpentry and farming.

164. In addition to the above, fishermen may choose to move to one of a wide range of industrial and agricultural employment opportunities which will present themselves in the region as current plans for development take shape.

PROJECT COMPLETION REPORT

INDIA

NARMADA RIVER DEVELOPMENT - GUJARAT SARDAR SAROVAR DAM AND POWER PROJECT (Credit 1552-IN/Loan 2497-IN)

RESETTLEMENT AND REHABILITATION

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PROJECT COMPLETION REPORT**INDIA****NARMADA RIVER DEVELOPMENT - GUJARAT
SARDAR SAROVAR DAM AND POWER PROJECT
(Credit 1552-IN/LOAN 2497-IN)****RESETTLEMENT AND REHABILITATION
OF
PROJECT AFFECTED PERSONS****I. Introduction**

1. This note provides the background, genesis, and implementation experience associated with the resettlement and rehabilitation (R&R) aspects of the Sardar Sarovar Dam and Power Project in India¹. The review is necessarily limited because resettlement and rehabilitation of people affected by the project has yet to begin in full force because the reservoir will not begin to have significant impacts until 1994, reaching a peak in the 1995-97 period. In March, 1993 the Government of India (GOI) decided to cancel the remaining proceeds of the Bank loan (the associated Credit had been fully disbursed by this time). India is proceeding with construction of the dam on its own, the Bank is no longer directly involved in the project. The dam is expected to be completed in 1998. A separate R&R report is being prepared for the companion Water Delivery and Drainage project which closed in July 1992.

II. Background

2. The idea for a dam on the Narmada, India's least used river, was initially discussed in the 1940's. However, agreement on allocation and use of the river waters by the riparian states (Madhya Pradesh, Gujarat and Maharashtra) proved elusive. To resolve the matter, the Government of India, under the River Water Disputes Act of 1956, established a special tribunal in 1969 entitled the Narmada Water Disputes Tribunal. It heard intensive submission from all parties over a 10 year period and in 1979 handed down a decision on allocation and use of the Narmada river waters, binding on the riparian states until the year 2024. Subsequently, detailed planning for the Sardar Sarovar dam and command area commenced.

3. Among other things, the Tribunal stipulated the parameters under which people displaced by the Sardar Sarovar reservoir were to be resettled and rehabilitated. During the decade of litigation, Madhya Pradesh lobbied for its exclusive right to the waters of the Narmada River that pass through its own territory. In 1979, the NWDT authorities granted them this license in view of the GOI Act of 1935 and Seventh Schedule of the Constitution of India. The ruling stated:

1

Loan Agreement between India and IBRD, Narmada River Development (Gujarat) Sardar Sarovar Dam and Power Project, 10 May 1985, loan amount - \$200 M. Development Credit Agreement between India and IDA, Narmada River Development (Gujarat) Sardar Sarovar Dam and Power Project, 10 May 1985, credit amount - \$100 M.

"The Narmada River belongs to the state whose territory the river passes and the Union of India has no right of ownership of the river bed."²

Under historical English law, an owner had the right to take profit from the soil. In India, such a right is regarded as a benefit which arises out of the land and is referred to as "immoveable property." Gujarat did not protest this right of Madhya Pradesh. Hence, the NWDT Decision stipulated that Gujarat, having no legal right to the Narmada waters that do not pass through its own state, would be liable to pay for the irrigation, drinking water, and power benefits it would receive due to construction of the dam. The NWDT Decision addressed the oustees of the states of Madhya Pradesh and Maharashtra and created a scheme by which Gujarat initially would pay for the resettlement of these people as indicated in the following para.

4. The jurisdiction of the Tribunal with respect to oustees had three components: acquisition, compensation, and rehabilitation. The Tribunal effectively directed Madhya Pradesh and Maharashtra on land acquisition methodology, gave Gujarat compensation directives, and provided rules for all three states to follow for the rehabilitation of oustees from Madhya Pradesh and Maharashtra. The provisions of the Tribunal with respect to R&R are contained in Attachment I to this document and are summarized below.

The compensation directives are as follows:

- a. Gujarat shall pay compensation and other properties, charges and expenses incurred with regard to the resettlement of oustees within Gujarat, Madhya Pradesh or Maharashtra initially. However, all cost incurred by Gujarat on acquisition of land and rehabilitation of oustees in respect of Sardar Sarovar shall be charged to SSP estimate Unit I-Dam and appurtenant works³;
- b. Gujarat must provide civic amenities for the resettlement villages. This includes one park, one village pond, one dispensary, one Panchayat Ghar for every 500 families as well as one primary school for every 100 families and one drinking water well and one tree platform for every 50 families. Additionally, a house plot with dimensions 60'x 90' along with a resettlement grant of Rs. 750 must be provided to each oustee family by the GOG;
- c. Gujarat shall pay to Madhya Pradesh and Maharashtra all costs, charges and expenses required to be incurred by them for the rehabilitation of the oustees in their respective territory in accordance with the NWDT directions;
- d. Submergence will not take place until all compensation is made.

The land acquisition directives are as follows:

- e. Within 1 year of the decision of the Tribunal (1980), Madhya Pradesh and Maharashtra will identify the land to be acquired and the number of oustees willing to move to Gujarat;

2 Narmada Water Disputes Tribunal. New Delhi, 1979. Volume II, p. 113.

3 NWDT Award Clause XI, sub-clause V (12)

- f. Within 2 years of the decision of the Tribunal (1981), the general location of rehabilitation villages in either Gujarat, Madhya Pradesh, and Maharashtra must be determined; and
- g. One year in advance of the submergence, Gujarat should make irrigable land and house sites available to the oustee families.

The entitlements for oustees can be summarized as follows:

- h. Every "landed" oustee who loses more than 25% of their land is entitled to a minimum of 2 hectares of irrigable land elsewhere. If the value of resettlement land is greater than compensation received for submerging land, an interest-free loan will be provided by the Governments of Gujarat, Maharashtra and Madhya Pradesh with a payback scheme involving 20 yearly installments.

As implied above, the Tribunal award does not apply to the "landless" although the percentage of oustees who were categorized as such ranged from 23% in Gujarat to 47% in Madhya Pradesh.⁴ Estimates of PAP numbers has increased over time, partly due to increase in population over time, partly due to incorrect enumeration, partly due to the addition of people affected by temporary backwater effect and, in the case of family numbers as opposed to numbers of people, due to the liberalization of the R&R policies and the later inclusion of landless (agricultural and non-agricultural labourers), major sons (and daughters in Maharashtra) and encroachers.

5. The difference in the number of affected families between SAR estimates and PCR estimates (10,758 compared to 41,014 persons) is explained largely by changes in eligibilities and definition of oustee families. It also results from improved surveys, enumeration and population growth. In 1979, the NWDT authorities estimated the number of oustee families at 7,366 or - using an average multiplier of 5 - a population of approximately 36,830 persons. By utilizing 1981 Census Population and growth figures of 2.2% per year, the Bank Appraisal estimates in 1985 grew to a total population of 67,340 persons. These estimates were thereafter revised at negotiations to 11,850 families or about 74,230 persons as per NCA's Supplementary Report of October 1984. The latest estimates which are now based on partial house-to-house surveys and new categories of oustee families such as adult sons, landless laborers and encroachers lead to a figure of about 41,014 families corresponding to a population of about 131,245 persons using an average multiplier of 3.2. However, these figures are still not final because of uncertainties regarding the total number of PAFs in Maharashtra and MP because of anomalies still persisting in NCA's quarterly R&R Status Reports. For example, in NCA's R&R Status Report of May 1994, the multiplier coefficient between the number of families and the population affected works out to 4.0 in Gujarat, 7.0 in Maharashtra and 2.7 in MP. These strong variations show that: (i) the states are not using the same criteria for reporting the number of affected families; and (ii) NCA is not exercising adequate control over the figures submitted by the states. The high multiplier in Maharashtra leads the PCR to believe that this state is still not counting adult sons and maybe other categories of PAFs, and the low multiplier in MP, on the contrary, could mean that this state is inflating the number of PAFs by perhaps counting a larger number of adult sons than actually exist. Though the resurveying of families in MP is said to have been completed, the PCR has some doubts as to its accuracy with regard to the number of families and population affected.

6. In order to operationalize the NWDT award, both Maharashtra and Gujarat embarked upon a series of socio-economic surveys to determine with more precision the dimensions of the problem

4 Staff Appraisal Report. Narmada Development Project - Gujarat. Sardar Sarovar Dam and Power Project. February 1985, p.42.

as well as the social and economic milieu of the people affected. Madhya Pradesh, however, was not known to have completed any socio-economic studies available at the time of Bank appraisal in 1985

Gujarat

7. Since the NWDT did not stipulate R&R provisions for the oustees of Gujarat, the Irrigation Department of the GOG requested a socio-economic study be conducted to investigate the impact of the SSP upon the citizens of Gujarat. This study analyzed the 19 submerging villages in Gujarat and was carried out by Professor Vidyut Joshi, a sociologist from Gujarat, through the Center for Social Studies of Surat.

8. Within three years, 17 village reports were developed and the main findings of the study were presented to the Bank in 1983. Later two books entitled, "Submerging Villages - Problems and Prospects" (1987) and "Rehabilitation - A Promise to Keep" (1991) were published, focussing upon the work completed in 1983. The study emphasized a census survey; also, "participant observation" was a central objective of the survey and helped to gauge the attitudes of the oustees towards resettlement and rehabilitation. These works contributed significantly to the understanding of R&R issues, specifically with regard to tribal oustees. The salient message of this work can be summarized as follows:

- a. A tribal village is not one, single, homogenous social unit. There are ethnic as well as secular differences. Hence, en masse rehabilitation of entire villages is not desirable; and
- b. A tribal village is not an isolated and relatively stagnant entity. It changes with progress of the larger society, however it must have the autonomy to decide its own fate and the pace of such change. Such villages are separate and distinct, yet, are also increasingly part of the larger society.

Maharashtra

9. The Tribal Research Institute (TRI) in Maharashtra conducted socio-economic studies of tribal people displaced in the process of general public works projects. There was no evidence of incorporation of this data into either the Bank's R&R pre-appraisal work or the Government's R&R plan at the time of project appraisal in 1985. The Tata Institute of Social Sciences, however, began using these studies in 1987 to create baseline data for further socio-economic studies of Maharashtrian oustees, so that by about 5 years prior to the first inundation this work had contributed to an understanding of the situation.

Madhya Pradesh

10. Though it is not known whether Madhya Pradesh had completed socio-economic surveys of tribal population affected by the project in 1985, this possible lacuna was remedied in August 1993, when NCA submitted to the Bank two extensive studies as part of the benchmarks fixed by the Board. The first study was carried out by the Indore School of Social Work and entitled "Socio-Economic and Cultural Milieu of Tribal Submergence and Resettled Villages"; and the second study was prepared by a team of consultants for the Narmada Valley Development Authority and entitled "The Bhil Track - A Study of Displaced Tribals in 17 Villages". These studies are amply described in Chapter V of the present Annex.

III. World Bank Involvement

Bank Policy

11. At the request of the Government of India for financial assistance, the Bank initiated project preparation work in 1980. Six preparation missions were undertaken; 2 pre-preparation missions in August and December of 1980 and 4 appraisal missions starting in March 1983 and ending in August 1984. The earlier missions in 1980 and 1983 focussed primarily upon the technical and economic aspects of the SSP. In September-October, 1983, however, a Bank consultant, Anthropologist, was sent to India, accompanied by 3 members of the Bank staff, to embark upon the first in-depth evaluation by the Bank on the social impacts of the SSP. The GOIs initial reaction to the Consultant's mission was seen as defensive; the GOI differed with the Bank's opinion that India's past R&R programs have not met Bank standards.⁵

12. The consultant's report highlighted what he termed the inadequacy of the information available on the magnitude and implications of displacement by the SSP. He also concluded that India's past record on R&R did not meet Bank standards. The consultant explained this record through the absence of a national R&R policy, inappropriate legal instruments to acquire property, and an inadequate means to implement R&R programs. He also reported what he characterized as the GOIs bureaucratic insensitivity and apathy towards the social and communal aspects of relocation. The consultant emphasized that the NWDT Award does not apply to the majority of oustees within the submergence area who are landless. He found the GOGs cost estimates and R&R plan both inappropriate and unreliable. Given these problems, the consultant doubted the GOGs intentions to establish an adequate R&R program for the SSP oustees. He concluded that (a) it would be desirable to handle resettlement in a way which does not further delay loan negotiations; and (b) "provided the necessary planning starts now, there is still time to plan and implement a sound resettlement program"

13. During this pre-appraisal period, the Bank's operational guidelines were in effect for both involuntary resettlement and tribal people. The 1980 Operational Manual Statement on Involuntary Resettlement recognized the rehabilitation needs of PAPs:

"...the major objective is to ensure that settlers are afforded opportunities to become established and economically self-sustaining in the shortest possible period, at living standards that at least match those before resettlement."⁶

The policy also explicitly called for an agriculturally based resettlement package for a large percentage of displaced people.

14. The 1982 Operational Manual Statement for Tribal People in Bank-Financed Projects emphasized the responsibility of the Borrower to implement R&R measures with respect to tribal people:

5 Internal Bank Correspondence

6 Operational Manual Statement: "Social Issues Associated with Involuntary Resettlement in Bank-Financed Projects." February 1980, para. 18.

"The Bank will assist projects *only* when satisfied that the Borrower can implement measures that will effectively safeguard the integrity and well-being of the tribal people."⁷

The Bank guidelines also recognized that tribal people have specific needs that should be attended to:

"Experience has shown that, unless special measures are adopted, tribal people are more likely to be harmed than helped by development projects that are intended for beneficiaries other than themselves...the design of projects should include measures or components necessary to safeguard their interests and, whenever feasible, to enhance their well-being."⁸

The policy statement addressed the need to have tribal people participate in the decisions affecting themselves. Additionally, a project cycle was outlined for tribal specific R&R.

Bank Appraisal

15. Appraisal of the SSP Dam and Power project devoted much attention to the R&R aspects of those persons living in the submergence area. The Staff Appraisal Report included a detailed outline of the R&R policy components, action items on the part of the state and national governments involved in the SSP, application of the NWDT award, the establishment of the Narmada Control Authority, cost estimates for R&R implementation and finally the treatment of R&R within the economic analysis. The following discussion will provide the salient points from the Bank's appraisal and/or legal documents for each one of these R&R dimensions.

R&R Policy Components

16. The Bank specified the overall R&R program to include the following:

- a. A time-bound schedule for land acquisition, payment of compensation, resettlement of oustees was envisioned by NCA on the basis of the NWDT directives and construction schedule of the dam approved in December 1989;
- b. Oustee preferences should be considered when identifying resettlement villages;
- c. The program should include an adequate social and physical rehabilitation package that ensures the oustees are integrated into their respective host communities and regain their previous standard of living; and
- d. The program should also include a comprehensive monitoring and evaluation system which includes semi-annual reports and an annual revision of the R&R plan based upon the past year's experiences.

Action on the part of GOI

17. The Bank stated that the GOI may have to relinquish land, currently protected under the Forest Conservation Act of 1980, to accommodate construction of resettlement villages in either Gujarat, MP, or Maharashtra. With the assistance of the Narmada Control Authorities (NCA), the

7 Operational Manual Statement: "Tribal People in Bank-Financed Projects." February 1982, para. 5.

8 Ibid, para. 4.

GOI must also furnish the Bank with semi-annual and annual R&R evaluation reports, commencing on June 1, 1986.

Action on the part of GOM, GOMP and GOG

18. It was agreed between the Bank and the three riparian states (and later incorporated into the legal agreements) that the states should adopt and implement within their respective boundaries an R&R plan consistent with the Bank's guidelines and the NWDT Award. The states should also assume an integral role in the institutional, monitoring and evaluation arrangements for the R&R component of the SSP. The states agreed to provide the necessary funds, facilities, and services to enable the NCA to assist the GOI with monitoring and evaluating R&R. It was further agreed that the states would respectively establish institutions to provide for the planning, coordination and implementation.

The NWDT Award

19. At the time of appraisal, the Bank was in full agreement with the provisions of the NWDT as outlined in 1979. However, the Bank stated:

"[The] NWDT's compensatory package would have to be expanded to include the landless and other provisions necessary to ensure that living standards and conditions for all oustees would be equal to or better than those existing prior to displacement."⁹

Salient among these "other provisions" was the need to relocate oustees as communities rather than individual households. Additionally, the Bank stated that Gujarat shall establish rehabilitation villages for its own oustees as well as for those from Madhya Pradesh and Maharashtra who prefer to resettle in Gujarat. The Bank added that the civic amenities associated with the NWDT established resettlement package should apply uniformly across all oustees, regardless of their resettlement location.¹⁰

20. As stated above, the Bank recommended extending the NWDT Award to include landless oustees. This relocation effort would require establishing Integrated Development Programs within each resettlement community to provide the landless with a full range of employment opportunities.

21. The Bank resettlement guidelines also applied to those residents "marooned" in villages where more than 75% of the people left as a result of partial submergence. The Bank contended that the remaining population is adversely affected by removal of the larger part of the community; therefore these people should also be granted oustee status.¹¹

22. Also emphasized by the Bank was the need to base compensation upon the current market value of resettlement land, comparable in size, location, and quality and in an area acceptable to each oustee. Moreover, the Bank advocated full compensation in the form of "land for land" as it

9 Staff Appraisal Report. Narmada River Development - Gujarat. Sardar Sarovar Dam and Power Project. February 1985, p.26.

10 Staff Appraisal Report. Narmada River Development - Gujarat. 6 March 1986. Supplementary Data Volume, Part I, p. 42.

11 Ibid, p. 44.

believed this approach to be more equitable for compensating oustees. The Bank questioned the advisability of giving the oustees cash compensation as these funds may be diverted to purposes other than land acquisition. Additionally, the Bank perceived the yearly installment payments to be unduly complicated and for this reason also became a proponent of "land for land" rather than purely cash compensation. This viewpoint reflected the Bank's belief, as expressed in the 1980 Operational Manual Statement on Involuntary Resettlement, that cash compensations should not be made in substitution for actual rehabilitation.

Clarity of Entitlements

23. In a February 1992 memo, the Bank's legal department re-emphasized the distinction between R&R entitlements as defined in the Tribunal and the entitlements outlined in the 1985 legal agreements. The SSP IDA/IBRD agreements reached with Madhya Pradesh, Maharashtra and Gujarat respectively, confer R&R benefits upon project affected persons whereas the NWDT confers these benefits upon project affected families. Under the agreements, an oustee is defined as:

"...any person, whether landed or landless, who, since at least one year prior to the designated benchmark date has been ordinarily residing or cultivating land or carrying on any trade, occupation, or calling or working for gain, in Gujarat, Madhya Pradesh and Maharashtra, and who would be displaced from his usual habitat due to the carrying out of the Project."¹²

24. Since the resultant focus is upon the PAP, the agreements do not explicitly address the entitlements to members of families, such as major sons. Under the language of the agreements, the entitlements of a major son should be determined subsequent to categorizing the PAPs as either a landed or landless oustee. The agreements provided definitions for both landed and landless oustees as follows:

- a. "Each landed oustee shall be entitled to and allotted irrigable land....of equal size to that which he owned prior to his resettlement..."¹³
- b. "Each landless oustee shall be rehabilitated in the agricultural or non-agricultural sectors, as the case may be, and shall be entitled to stable means of livelihood."¹⁴

Accordingly, the compensation provision for a major son is determined by his landholding status. For purposes of the agreements, encroachers are also included within either the "landed" or "landless" category. It must be noted that the Borrower has given a broader meaning to PAPs by considering them as project affected families including their wife, minor children and other dependents. Major sons and their families have been treated as separate families and counted as PAPs. This interpretation is logical as the benefits can only be provided to the heads of families and not to their minor children or dependents.

12 Development Credit Agreement between India and IDA. Narmada River Development (Gujarat) Sardar Sarovar Dam and Power Project. May 10, 1985. Section 1.02(q).

13 Ibid. Schedule 3, Paragraph 3.

14 Ibid. Schedule 3, paragraph 4.

The Narmada Control Authority

25. The Narmada Control Authority (NCA), created as an interstate organization, would implement the NWDT's directions and decisions, including those relating to the implementation and monitoring of resettlement. Additionally, the Narmada Review Committee (NRC), comprised of the GOI Minister of Irrigation, now Ministry of Water Resources, and the beneficiary state chief ministers was established to review the decisions of the NCA. The role of the NCA was defined in the 1985 appraisal document as follows:

"[the NCA will] do any or all things necessary, sufficient and expedient for the implementation of the Orders with respect tocompensation and rehabilitation and settlement of oustees."¹⁵

To facilitate a more uniform relocation policy among the three states, the NCA was to play an active role in coordination of the R&R policy.

26. In October 1984, the NCA produced a document entitled the "Sardar Sarovar Project R&R Program" outlining the R&R responsibilities of each state as well as the GOI. Monitoring and evaluation of the R&R programs was to be the responsibility of each respective state whereas the NCA was responsible for coordination amongst the three states. Semi-annual and annual evaluation reports were to be furnished by the appropriate state governments to the NCA for overall R&R evaluation.

27. The Supplementary Report attached to the appraisal document included a detailed plan for Stage I (up to contour level 350 ft) R&R, covering 52 villages from the period of initiation to June 30, 1987. Additionally, the document provided the number of PAPs to be displaced over both Stage I and Stage II (up to FRL 455 ft) of the SSP; Estimated at 2,876 and 8,974 families respectively, the aggregate displacement across the 234 total villages in all three states was at that time projected to be 11,850 families or approximately 59,250 persons.¹⁶

28. Additionally, in response to the land acquisition cost calculation by the Bank's August 1984 appraisal mission, the project authorities increased their initial estimate of US \$100 M for R&R published within their April 1984 R&R document entitled "Sardar Sarovar Project, Land Acquisition and Rehabilitation of Ousteas", by 50%.

Cost Estimates

29. In October 1984, the project authorities estimated the costs associated with the SSP land acquisition and rehabilitation to be US \$201 M (Rs. 2416.6 M at prevailing exchange rate), comprising less than 5% of total project costs. A breakdown of this total estimate was included in table 14 of the February 1985 appraisal document.¹⁷

15 Staff Appraisal Report. Narmada River Development - Gujarat. Supplementary Data Volume Part I. March 1985.

16 Note: The multiplier for translating affected families to people had normally been 5 in the Narmada project. However, as more socio-economic data and the broadening of R&R entitlements revealed the number of major sons as "single family" beneficiaries, the multiplier was changed from 5 to 3.2.

17 Staff Appraisal Report. Narmada River Development. Sardar Sarovar Dam and Power Project. 12 February 1985, Table 14 p. 93.

30. Gujarat is essentially the payor of the land acquisition and rehabilitation costs although there has been some dispute arising from the NWDT language. Under NWDT stipulations, Gujarat would compensate both Madhya Pradesh and Maharashtra for the majority of the submerging land they must acquire below FRL of 455 ft (138.7 m). Gujarat must also pay the GOI for government lands made available to them for the purpose of the SSP. For the area affected by backwater flood lift between 455 ft. and 460 ft. and only buildings with appurtenant lands would have to be acquired by Madhya Pradesh and Maharashtra. Although the NWDT stipulated that Gujarat must undertake all R&R costs, R&R costs resulting from submergence are chargeable to the designated "Dam and Appurtenant Works" of which Gujarat pays 50.6% and Madhya Pradesh, Maharashtra, and Rajasthan collectively pay the remaining 49.4%.¹⁸ This has led to different interpretations of the NWDT award.

Economic Analysis

31. In the appraisal document, the economic costs for R&R are referred to in Annex 10 (paragraph 33) of the Supplementary Data Volume, Part I. While the opportunity cost of lost production was included in the economic analysis the financial costs of land acquisition were excluded since this is treated as a transfer cost within the economy.

Bank Negotiations

32. Negotiations for the Sardar Sarovar Project were held in Washington from November 8-21, 1984. Prior to negotiations, representatives from the Bank as well as from the Governments of India, Gujarat, Madhya Pradesh, and Maharashtra respectively accepted the R&R plans as outlined in the October 1984 NCA document entitled "Sardar Sarovar Resettlement and Rehabilitation Program Supplementary Report".

33. During negotiations, the GOG, GOM, and GOMP agreed to take all action necessary to adopt a full R&R plan prior to the effectiveness of IDA credit. The GOI agreed to finance a specialist to monitor and evaluate the overall R&R program. Additionally, the GOM, GOMP and GOG agreed to *consider* the Association's suggestion to purchase land for those landless oustees who wish to receive rehabilitation by "land" rather than cash assistance. This land could then be resold to the landless oustees with 50% of the sales price regarded as an interest-free deferred payment to be recovered over 20 years.

34. Attachment I to the "Agreed Minutes" (negotiations) document was specifically devoted to R&R. It noted the desirability of extending the NWDT award to include landed oustees from Gujarat, phasing of R&R implementation with construction of the reservoir inundation schedule and appointing a commissioner of rehabilitation within the GOG. Additionally, the attachment stated that the GOI should *consider* the release of forest land on a case-by-case basis if no alternative land is available to protect the rights of the oustees. Finally, the association accepted an overall R&R plan together with the more detailed R&R plan of the 52 Stage I villages.

Legal Understandings

35. Legal understandings, with respect to R&R issues, were reached during negotiations and incorporated into the Loan and Credit documents, in May 1985, as well as the Staff Appraisal Report in February 1985. The agreements reached with the GOI are as follows:¹⁹

- a. "Take all actions necessary to release forest lands as per the provisions of the Forest (Conservation) Act, 1980, within boundaries of the State of Gujarat, MP and Maharashtra if required for the purpose of implementing the Sardar Sarovar Dam and Power Project including the resettlement of rehabilitation programs and plans";
- b. "With the assistance of NCA, carry out the overall monitoring and evaluation of the resettlement and rehabilitation of the Sardar Sarovar dam and reservoir oustees within the boundaries of the participating states of Gujarat, MP and Maharashtra"; and
- c. "On June 1 of each year, commencing on June 1, 1986, and thereafter until June 1, 1995, furnish the Bank semi-annual and annual reports, of such scope and detail as the Bank may reasonably request, regarding the resettlement and rehabilitation of Sardar Sarovar Dam and Reservoir oustees within the State boundaries of Gujarat, MP, and Maharashtra".

Also by September 30, 1985, the appraisal agreement stated that the GOI must employ for the NCA, a social scientist with qualifications satisfactory to the Bank.

36. The legal agreements that were reached with the state governments, with respect to R&R issues, are as follows:²⁰

Agreements with Government of Gujarat

"Carry out the project in conformity with appropriate...resettlement and rehabilitation components including evaluation and monitoring activities that lie within its state boundaries..."

Agreements with GOM, GOMP

"...provide to NCA as needed....carrying out its responsibilities under the NWDT decision related to inter alia, the overall operation and maintenance of the hydro-meteorological network and carrying out the overall monitoring and evaluation of the resettlement and rehabilitation of the Sardar Sarovar Dam and Reservoir oustees."

"In collaboration with one another, furnish the Bank for its approval by December 31, 1985, a suitable training program of R&R of the oustees for the responsible staff of GOG, GOMP, and GOM..."

37. The Bank recommendation of an IBRD loan of US \$200 M and IDA credit of US \$100 M was conditioned upon meeting the "Conditions of Effectiveness" as outlined within the appraisal document:

19 Staff Appraisal Report. Narmada River Development - Gujarat. Sardar Sarovar Dam and Power Project. February 1985, p. 63.

20 Ibid, p. 64-68.

" As a condition of effectiveness....all the necessary governmental actions have been taken for adopting and thereafter implementing a plan satisfactory to the Bank for resettlement and rehabilitation of all persons who would be displaced (oustees) as a consequence of the project, in accordance with the decisions of the NWDT and with the principles, objectives and institutional, monitoring and evaluation requirements..."²¹

38. The Credit Agreement between India and the IDA contained Schedule 3 - Resettlement and Rehabilitation of the Outees. This schedule reiterated the R&R objectives to ensure the oustees improve or regain their standard of living, relocate according to their preferences, become fully integrated into the host community and receive appropriate compensation and rehabilitation. The Schedule also described entitlements for both landed and landless oustees and added that cash compensation should not be used in substitution for rehabilitation.

39. In a Meeting of the Executive Directors of the Bank on March 7, 1985, a discussion concerning the lines of responsibility for the SSP resettlement program was initiated. The Directors queried the staff on how the responsibility for implementation and monitoring of the resettlement program had been allocated among the states involved and the Government of India. The staff responded that each state had established a resettlement wing, staffed with responsible and experienced officers. The staff added that the states were also expected to contract with independent research institutions that would monitor and evaluate its implementation. Furthermore, the central Government and the interstate Narmada Control Authority would coordinate overall monitoring and evaluation of the resettlement plan.²²

IV. Project Implementation

40. Attachment III gives the current policies for R&R in the submergence area for each state. Attachment I shows the original NWDT award. It is clear from this that very substantial strides have been made in R&R policy. The main elements of improvement have been the provision of 2 ha. of irrigable land for the landless in Gujarat, and for all landless agricultural laborers who wish to move to Gujarat, the provision of 1 ha. for the landless in Maharashtra, the de facto recognition of encroachers in Maharashtra, the inclusion of major sons as eligible in all states and of major daughters in Maharashtra. In addition, there have been a number of improvements in the cash elements of the compensation.

41. Differences in the R&R entitlements between the three states has been an ongoing area of concern while addressing the improvement needs for the overall R&R implementation process. These differences are highlighted in Attachment III to this document. Gujarat's R&R entitlements are by far the best of the three as its provisions go much beyond the guidelines of the Tribunal Award. In 1987, Gujarat added both the landless and encroachers to its definition of a PAP, thereby granting both these categories of oustees a minimum of 2 ha. of land. Additionally, Gujarat offers ex-gratia payments - applied only to non-government land - to cover the difference between compensation for the acquired land and the purchase price of the resettlement property.

42. Maharashtra and Madhya Pradesh mainly lag Gujarat in allotment of land to landless and major sons. The R&R policies and provisions of Madhya Pradesh and Maharashtra have improved and only a narrow difference now remains. MP is now guaranteeing the rehabilitation of

21 Ibid, p. 69.

22 Summary of Discussions at the Meeting of the Executive Directors of the Bank and IDA, March 7, 1985. Dated March 21, 1985.

the landless and encroachers with the allotment of 1 ha agricultural land for encroachment upto 1 ha and 2 ha for encroachment above 2 ha. Regarding landless families, Maharashtra is providing 1 ha land to each family, and Madhya Pradesh is providing cash compensation upto Rs.40,000. Madhya Pradesh is offering full cash ex-gratia payment to landed oustees of SC/ST and other categories with land holding upto 2 ha. Further those owning land from 2 to 8 ha will be eligible for an additional amount of Rs.2,000 per ha or 50% of the difference in the cost of allotted land and the compensation received whichever is less. The R&R policy as stipulated by NWDT award has been liberalized by the party states from time to time, keeping in view the improvement and upliftment of socio-economic and cultural conditions of the displaced persons. The issue, however, with respect to differences in R&R entitlements in relation to the Bank's guidelines should not be whether they are different but whether, in any of the three states, R&R policies do not meet the standards required to regain the previous standard of living. It is not a part of the Bank guidelines that other states should be forced to pursue the most generous state on R&R. We argue here that the policy of Gujarat goes beyond what is necessary to meet the principles of adequate resettlement, that the policy of Maharashtra is adequate, and that the policy of Madhya Pradesh is barely adequate and should be improved to the level of Maharashtra. We do not accept that a difference in entitlements is prima facie an unacceptable situation. R&R in India is a state subject - differences are inevitable, and, because of differences in local situations, may well be desirable.

Evolution of R&R Policies

43. Gujarat : Although work on the dam did not begin in earnest until 1987, acquisition of land for the establishment of the colonies and infrastructure associated to the construction of the SSP was initiated in the 1960's. During the early 1960s, the Government of Gujarat acquired land belonging to residents of six villages to build project headquarters at the Kevadia site in Gujarat. Several hundred families lost land for which they received a small cash compensation. Although some family members received jobs in the project, the issue of adequate cash compensation soon emerged as a contentious matter that drew the attention of NGOs and eventually senior Bank management. Gujarat's policy at the time was limited; cash compensation was given to landed oustees who were left to buy replacement land on their own. However, land was often undervalued in official records for purposes of tax evasion so in the absence of alternative employment replacement land in the resettlement villages would not always ensure an "equal standard of living" as stipulated by Bank policy guidelines. Additionally, the large percentage of the oustees were landless and were thereby excluded from land compensation benefits. As a result, hardship ensued, protests were initiated, and many NGOs became inextricably involved in taking up the cause of the submergence oustees. The problem was compounded by issues associated with oustees from Maharashtra and MP who indicated a preference to move to Gujarat. The award of the Narmada Tribunal effectively provided an option to landed MP and Maharashtra oustees of resettling within the Gujarat command area. To accommodate such oustees, Gujarat was required under the Award to acquire and prepare with Award-stipulated facilities land at specific sites. For MP oustees, Gujarat made available about 200 hectares of land classified as forest at Guttal. For Maharashtra oustees, some 470 hectares of land classified as forest were made available at Parveta. Developments at these two sites in the early stages fueled the Narmada controversy further because of allegations of poor planning, inadequate infrastructure and, in the case of Parveta, allegations by the Maharashtra state monitoring agency, TISS, that several infants of oustees had died because of poor sanitation.

44. In 1983, Arch Vahini, a prominent NGO in Gujarat, wrote to the Bank protesting on behalf of the families being displaced by the early construction stages of the dam. Arch Vahini's major criticism was that the poor and illiterate tribals should not be expected to purchase their own replacement land. Furthermore, the waiting period for "basic amenities" was excessively long. Arch Vahini referred to the consultant's findings.

45. In response to escalating protests, the GOG, in 1985, extended the NWDT policy decision of 1979 to include oustees from Gujarat. Subsequently, a Bank mission in April 1987 uncovered inadequate facilities at the resettlement sites and encouraged the GOG to ensure equitable treatment for all oustee categories. Later in 1987, the GOG expanded its policy to include both encroachers and the landless within the definition of a PAP. Gujarat made this decision on the rationale that the majority of PAPs resettling within Gujarat were tribals or members of isolated communities. In fact, approximately 95-98% of the oustees in the submergence area were primarily Tadvi, Bhil, or Rathwa tribal people.²³

46. In 1988, the GOG further extended its R&R policy to include major sons (those sons 18 or older), of both the landless and landed, as PAPs. Within the same year, Gujarat also allowed co-sharers (joint holders of agricultural land) and their major sons to be extended the same compensation benefits as PAPs. Eventually, Gujarat's liberalizing policy engendered a change in the position of many NGOs towards the construction of the dam. Both the Arch Vahini and Anand Niketan Ashram, prominent NGOs in the Narmada Valley, turned into supporters of the SSP as most of their criticisms were addressed and the GOG seemed committed to fulfilling the Bank's R&R guidelines. However, the focus of concern for the NGOs, quickly became, and still is, to ensure proper implementation of Gujarat's R&R policy.

47. Maharashtra : GOM's first statement of policy was a Government Resolution (GR) passed only in June 1989, after the first World Bank SSP resettlement and rehabilitation review mission to visit Maharashtra noted the lack of any R&R policy there. GOM's 1976 Resettlement of Displaced Persons Act did not apply to inter-state projects such as the SSP. The April/May 1989 mission imposed a condition for extending the credit for the loan beyond June 1989 that Maharashtra policies should meet the requirements of the Tribunal's award and "legal aspects of the Projects".

48. The June 29, 1989 GR was amended in a GR of February 26, 1992. This latter GR tried to clarify entitlements and made minor changes in them. Under the new GR, benefits were allocated according to whether oustees were classified as "landed" or "landless." "Landed" included those with land title; encroachers before March 31, 1978; and those whose encroachments were regularized. They and joint holders were allotted a minimum of 2 hectares of land.

49. "Landless" were major sons and major unmarried daughters of "landed" oustees (except those recorded as "joint holders"); encroachers who encroached after March 31, 1978 and encroachers whose encroachments were not regularized; landless agricultural laborers; village artisans; and persons engaged in non-agricultural trades and callings. These were allotted a maximum of one acre of irrigable land if it was available near the relocation site and if the oustee moved with the other oustees to the resettlement site. A grant-in-aid was offered to those unable to avail of this option, which was on a first-come-first-serve-basis. Major sons of the "landless" still had no status as either "landed" or "landless" and hence did not qualify for any land. The major change between the 1989 and 1992 GRs was in giving major sons of the "landed" oustees a claim to land, albeit only one acre if available.

50. The IRR criticized GOM's 1989 policy for being in "fundamental conflict" with the 1985 SSP Bank agreements. A major portion of lands, it said, were encroached after 1978. Major sons made up between 30 and 50 percent of oustees. One acre was not a viable agricultural holding. And GOM had no policy commitment to acquire sites large enough to accommodate both landed and landless oustees, even at the level of one-acre plots. The majority of "landless" were only so

under law. They were, in fact, tribal farmers with both family plots and forest resources under customary usage. GOM's offer of training and employment opportunities in lieu of the lost resources would represent a fall in economic status — from farmer to laborer.

51. The IRR found the GOM 1992 policy in conflict with the Bank's ODs which, inter alia, recognize de facto resource use versus purely legalistic criteria. They were of the opinion the policies of GOM and GOMP did not fully conform with the spirit of the 1979 Tribunal award.

52. The Maharashtra policy's treatment of major sons and encroachers and the inadequacy of its provision for the landless were major criticisms by the IRR, by Bank missions and by the Narmada Bachao Andolan (NBA). The latter carried the criticism a step further. It asserted that any discrepancy between the three State policies meant injustice for those oustees covered by the less liberal provisions, that, in fact, Gujarat's policy had faced up to problems which were endemic not only to its population but to the socially and culturally identical tribals across the state borders. The Bank, on the other hand, took the position that some discrepancy was unavoidable given the federal system of government in India and that the issue was more simply whether or not legal agreements were met and oustees would likely regain their former standard of living. This remained a fundamental difference in approach throughout the Bank's direct involvement in the project. This PCR argues that the Bank's position was correct, and that the issue is simply whether any of the policies in the three states are inadequate to regain living standards.

53. Other criticisms directed by the Bank at Maharashtra alone were that GOM did not provide a year's subsistence allowance as Gujarat and Madhya Pradesh did and that resettlers had to bear the cost of land development. Maharashtra also modified its policy to treat villagers whose lands would, in effect, be surrounded by water ("Tappu", or Island, oustees) the same as those directly affected. Likewise, MP made similar provisions.

54. In its response to the IRR, the Bank reiterated its "incremental" approach of attempting to replicate the advances in Gujarat's policy in Maharashtra and Madhya Pradesh through persuasion and sometime threat of suspension. GOM, for its part, resisted any liberalization of its policy, arguing that the precedent for its many other projects would be too costly. It also did not respond to Bank suggestions, that at least with regard to major sons of "landed" families, it bring its policy into line with the 1976 Resettlement of Displaced Persons Act which provided land according to family size.

55. After the July 1992 mission, sent to evaluate the IRR findings and make recommendations, Maharashtra's policy was again amended as part of a series of actions agreed to between the Bank, GOI and the three principal SSP states. The Master Plan for Resettlement and Rehabilitation of Project Affected Persons of Maharashtra State dated December 31, 1992 describes these changes in the light of "tribal needs." The preparation of an updated R&R plan taking into account tribal needs was one of the benchmarks the Bank had, by that time, laid down.

56. The 1992 Master Plan for R&R said that the February 26, 1992 GR had been "partially revised" to increase land allocation to the landless and major sons and daughters. It based its analysis of tribal needs on studies by Gujarat in its tribal submergence area and by the Tribal Research Institute, Pune, both carried out in the early 1980s; on TISS studies from 1988 onwards; and on "interaction of Govt. field agencies with the tribal PAPs over the years."

57. The new provisions gave each landless family one hectare, on the grounds that "legal ownership is only a formality in the tribal areas." Each major son belonging to either landed or landless families was likewise to be given one hectare, to "compensate for the lack of expandability of agricultural land at the resettlement site." The new plan provided transition allowances of Rs.4,500 per family and provided land and irrigation development free of cost. The plan also

provided for the reservation of a minimum of 5% of the total agricultural area for intensive growing programs for fodder and fuelwood.

58. This latest policy went a long way towards addressing Bank concerns that one acre was a non-viable land holding and that the encroachers and major sons should receive land benefits. Bank field trips to the area prior to March 31, 1993 to assess the ongoing efforts at meeting the benchmarks also found that many tribals had apparently accepted this compromise and were, for the first time, willing to take advantage of GOM's R&R program.

59. By the time GOM's December 1992 R&R master plan was published, the focus had shifted to whether or not enough land could be made available within Maharashtra to meet even the requirements of the previous and more modest policy. By the March 1993 deadline, Maharashtra had still not met the benchmark that it obtain formal release of about 2,000 additional hectares of unencumbered forest land for R&R or acquire an equivalent amount of other suitable land. Subsequently 1,500 ha of forest land identified by GOM has been released by MOEF.

60. Madhya Pradesh: GOMP's policy for SSP oustees resettled in Madhya Pradesh was, like that of Maharashtra, formulated only in 1989 as a response to the Bank's April/May mission of that year. This mission noted that a central problem for MP's R&R was "the lack of policy in Madhya Pradesh." As with Maharashtra, the new policy statement was a response to Bank conditions for extension of the Credit Closing Date past June 1991.

61. The 1989 SSP R&R policy was a revision of policy approved by GOMP for the oustees of the Narmada Sagar, where MP seems, in general, to have been more proactive in R&R. This, in turn, was based on a combination of the terms of the Tribunal award with MP's own 1985 legislation for the resettlement of people displaced by any public utility project, the Madhya Pradesh Project Displaced Persons (Resettlement) Act.

62. The 1989 R&R policy was included as Annexure III of the Sardar Sarovar Project: Action Plan of Rehabilitation & Resettlement of Outees of Madhya Pradesh, January 1992. Under the R&R policy, only revenue landholders were entitled to land on resettlement. The policy provided that those families with legal title to their land, confirmed by government records, would receive, in addition to compensation, two hectares of irrigated land. If the land was un-irrigated, GOMP would provide assistance with irrigation. Families would receive four hectares of un-irrigated land if the land received was deemed un-irrigable.

63. On occasion, NVDA officials gave Bank missions verbal assurance that the landed oustees remaining in MP could receive land in nearby project command areas. The NVDA's own Jobat command area was mentioned as a possibility. The Jobat project was within a reasonable distance of the 76 tribal villages in MP scheduled to be entirely inundated by the SSP, and the tribal configuration was the same. However, Jobat appeared to have its own displaced people to resettle, and the GOMP's main intention appears, from the beginning, to have been that landed and other oustees would go to the SSP command area in Gujarat. From MP's point of view, this was considered a liberal solution in line with its own 1985 R&R legislation and the Tribunal award.

64. Encroachers who encroached prior to April 4, 1987 were to receive compensation for the land acquired and be allotted a minimum of one hectare and a maximum of two hectares of land, even if more than two hectares was acquired. No mention was made of irrigation nor of the means of establishing the date of encroachment.

65. Land would not be allotted to major sons, encroachers who encroached after 1987, or the "landless." Special benefits for the "landless," which included major sons, encompassed occupational training and a three-year income supplement grant. Among other provisions more or

less standard between the states, such as civic amenities and houseplots, MP provided a rehabilitation grant of Rs.11,000 to all small and marginal farmers and all SC/ST. All agricultural landless labourers and SC/ST labourers Rs.11,000 each. All other labourers and landless families Rs.5,500 each. It also gave a rehabilitation grant of Rs.5,500 each to all other farmers.

66. While the 1989 policy endorsed the main objectives of the 1985 credit and loan agreements and the terms of the Tribunal award, its specific terms of policy did not always concur with these. The IRR judged that it differed only in detail from the Maharashtra policy and likewise that "the overall effect of this policy is that encroachers and major sons, who are agriculturalists on lands they regard as their own, are threatened with dispossession."

67. Bank missions subsequent to 1989 emphasized a need to "harmonize" MP's policy provisions with those of Gujarat. The intention was that some differences would remain, provided the overall principle was maintained. GOMP, for its part, categorically refused to alter its basic policy principles, citing a large number of other inter-state projects that would be affected by any precedents in the SSP's R&R. GOMP's position was that Gujarat could afford a more liberal policy because the SSP was its only inter-state project.

68. Previous to 1992, the Bank had been satisfied that the policies of the three states largely met the stipulations of the Tribunal award. With minor modifications over time, the policies of Maharashtra and MP could also meet, it was felt, the "overarching principles" of the 1985 credit and loan agreements. By July 1992, however, the Bank had come to view the gap between the policies of the three states as "impeding project implementation." The Bank mission sent to India that month was charged with, to the extent possible, closing the gap.

69. Instead of Maharashtra's land-based compromise of one hectare, GOMP's actions, agreed with the Bank after July 1992, offered a managed bank account to major sons, landless and encroachers. The "landless" were given Rs.40,000 to be used for land purchase or for small businesses. The non-agricultural landless, such as small business owners or artisans, were to receive Rs.25,000. Major sons of landed oustees had the option, according to GOMP, of being treated as landed oustees by registering as co-sharers or opting to be treated as landless to receive a managed account.

70. The benchmarks set by the Bank for compliance by March 31, 1993 included for MP identifying and beginning to purchase 2,000 hectares of land to carry out its in-state R&R policy and reaching agreement with Gujarat about certain outstanding policy differences between the two states regarding MP oustees resettled in Gujarat. This particularly referred to awards for oustees in marginally affected villages. As in the other two states, the benchmarks also included studies for a tribal needs assessment and incorporation of the findings into an updated R&R plan. This R&R plan was to be based on a computerized data base for linking dam construction and the submergence schedule with progress in R&R. In MP, the R&R plan would accurately categorize oustees according to their entitlements for the first time.

71. The Bank sent an agricultural expert to assess the 1,000 hectares identified in MP by March 1993. Fifty percent of the land was scattered in 20-50 hectare blocks of cultivable waste or fallow lands, the rest was in smaller sizes. Although the land was in tribal areas similar to the submergence area, much of it was far away, 65-120 kilometers. About seventy five percent of the identified land was government land near irrigation sources and usually near roads. Other land was being offered by private sellers responding to GOMP advertisements through offers in writing including expected prices, ranging from around Rs.12,000 per hectare for unirrigated to Rs.18,000 for irrigated land. GOMP expected to obtain this land through consent awards under the Land Acquisition Act. According to NVDA, offers were continuing to come in at a promising

rate. The NVDA and GOMP authorities reported an estimated 5,000 hectares would eventually be identified.²⁴ It thus did appear that purchase of land in MP was possible.

72. With regard to agreement between MP and Gujarat on eligibility criteria for various oustees including landless and major sons, the two states agreed that: (a) Gujarat's policy of not giving land entitlements to non-agricultural based landless would prevail; (b) MP's wishes would be respected by Gujarat that the eligibility of major sons would be decided on the basis of one year before Section 4 of the LAA rather than January 1, 1987 as Gujarat had wanted; and (c) MP would agree to accept Gujarat's case that if a family's major sons are given 2 hectares of land each, the father should be limited to 2 hectares, not up to his previous holdings in MP as would otherwise be the case.

73. Prior to the above benchmark, the two states had already agreed as part of the post-July 1992 action plan that landless agricultural laborers in marginally affected villages in MP would be entitled for R&R in Gujarat if (i) their house was submerged and (ii) land on which they were working was to be acquired by the SSP.

74. This latter agreement was important (as were the others cited above) because Gujarat's policy towards the various categories of "landless" and "encroachers" had been designed for the tribals. While almost all submergence villages in Gujarat in and Maharashtra were tribal, 140 of the 193 submergence villages in MP are situated in the fertile agricultural belt of the Nimad, where the population is non-tribal and a large proportion of the population is made up of agricultural laborers. Only 79 of the 193 villages would lose more than 10 percent of their land. Of these latter, 76 villages are mostly tribal, located in the narrow valley closest to the dam site. In the generally more level areas of the Nimad farther upstream from the dam site, houses are submerged rather than land. These are usually in compact, nuclear villages. To Gujarat, providing the Nimad's agricultural laborers, many from marginally affected villages, with land under a policy designed for remote tribal villages would have created an intolerable burden of sheer numbers. Even with the above agreements with MP, Gujarat expects about 4-5,000 of the approximately 20,000 oustee households in the upper Nimad to choose resettlement in the SSP command area.

75. Because agricultural land more generally is not submerged in the upper Nimad, the movement of villages to new abadi sites usually 2-3 kilometers away is less problematic with respect to restoring incomes. Much of MP's R&R program in this area has been focused on planning and construction of the new village sites. Of 55 abadi sites to be built, some 51 were planned in January 1993; layout plans were approved for 28; and construction was under progress in 10 sites. During 1993, the NVDA expected to have another 35 sites under construction. While critics argued that there would be an emergency situation during 1997 when the bulk of resettlement in MP was scheduled to take place, many of these ignored or underplayed the differences between the upper Nimad and the tribal areas downstream with respect to R&R policy requirements. The NVDA, in fact, was making considerable progress in providing new village sites for the large population in marginally affected villages coming under submergence during the later phases of the SSP.

76. In compliance with the benchmarks, GOMP carried out a tribal needs assessment. This has been deemed by the Bank to be well done. GOMP also established, as did the other two states, an accurate computerized data base for purposes of linking construction with R&R progress and prepared an updated R&R plan based on this data base. Unfortunately, the Bank withdrew from the project before a full assessment of MP's new R&R plan could be carried out. It is, however,

24 Back-to-Office Report, SSP Assessment of Suitability of Land Identified for R&R of PAPs in MP. April 12, 1993.

unlikely that the results of the tribal study were incorporated into its provisions, since both the tribal study and the R&R plan were completed about the same time.

77. While theoretically the most recent changes in MP's policy might conceivably have allowed its "landless" oustees to purchase land within the state through managed bank accounts, it has not been possible to ascertain how this proposed solution has actually worked on the ground. It should be noted that a similar provision has had some success in the Upper Krishna Irrigation Project II, and one of the lessons of this PCR is that such arrangements might in some cases not only be acceptable but allow for greater flexibility for oustees to choose their own land in their own time.

Criticisms of R&R implementation

78. Retained by the Bank in 1989 as a consultant to a Bank supervision mission, the consultant returned to the Narmada Valley to compare the current R&R situation with findings from the 1983 preparation mission. His main conclusion was that the 1989 situation, with respect to R&R, had significantly deteriorated from those conditions in 1983.

79. The consultant reported R&R planning efforts for land acquisition as poor in both Madhya Pradesh and Maharashtra; neither state had identified land for the majority of oustees who chose to relocate within their own territories. The consultant concluded that the absence of land acquisition plans reflected the desire of the M.P. and Maharashtrian officials to have the PAPs move to Gujarat, rather than stay within their respective states. Additionally, the consultant criticized the GOG for providing an R&R package which focussed heavily upon resettlement rather than rehabilitation.

80. The consultant also criticized the R&R implementation process. In M.P., disillusionment and frustration among the oustees ensued after preparation of Guttal - the first resettlement village for MP oustees within Gujarat - had been delayed for over a year, according to the consultant. In addition, the mission reported that the conditions of the village were extremely poor. The consultant also criticized the GOGs refusal to accept various categories of oustees, such as the rock filled dyke people, as directly affected by the project.

81. The consultant believed that the GOG would not be able to reverse this unsatisfactory record and was generally pessimistic about the potential for coordination between the three governments to carry out a proper R&R program which would enable the oustees to "regain or improve their standard of living". He advised the Bank to stop disbursements for the SSP until the government agencies were in compliance with the Bank's R&R policy guidelines, including adherence to an R&R schedule that is synchronized with construction of the dam, initiation of NCA responsibilities with respect to R&R, and purchasing oustee land through the GOG. The full Bank mission did not accept the consultant's recommendation with respect to cessation of disbursements, arguing, among other things, that his conclusions did not give sufficient credit to the evolving beneficial Gujarat R&R policies and improving institutional delivery capability, and were based on very limited field exposure (no more than a few days in Gujarat). The mission further concluded that, from a strategic standpoint, the Bank could help achieve overall R&R objectives better by staying with the project rather than effectively dropping out. It was agreed that this "incremental strategy", which was to be highlighted subsequently in the report of the Independent Review, had worked and showed evidence of continuing to work.

82. Many NGOs outside of India were, at the same time, making their own pleas for a moratorium on Bank disbursements to the SSP. In May 1990, Survival International, a human rights organization based in London, criticized the GOG for showing little sign of implementing its liberal R&R policy established in 1987. Survival International also argued that the cost/benefit

analysis conducted at the time of appraisal did not include human, social and cultural losses. Survival International noted that the costs of the SSP continued to escalate while the benefits remained the same as stated at inception; they suggested an economic reappraisal be undertaken before construction proceeded further.

83. Other NGOs also increased their criticism of the project: the Environmental Defence Fund of the US, Oxfam of the UK, Probe International of Canada and Japan Friends of the Earth in Tokyo. Their main points of opposition were India's poor track record on R&R, a lack of baseline information with regard to oustees at project inception, no detailed R&R plans by the state governments, and a lack of proper consultation with affected people.

84. The Narmada Bachao Andolan, an India based NGO formed in 1989, united different social and environmental organizations from around the world with the PAPs of the Narmada Valley. In May 1989, many international NGOs joined the Bachao Andolan in calling for work to be stopped on the SSP dam and foreign funds to be suspended "until sufficient lands are identified and there is a comprehensive resettlement plan in a form acceptable to the people affected, and the whole project has been reappraised, on environmental and economic as well as social grounds."

85. At about the same time, a law suit was taken up by the M.P. oustees against the NCA and the Nigam (Gujarat) with regard to the timing of resettlement and its relationship to the submergence schedule within the reservoir area. The suit was eventually brought to the Supreme Court of India and the ruling called for additional monitoring of the R&R process for the SSP. Specifically, the

Court designated the central Ministry of Social Welfare to prepare quarterly reports on R&R, focussing particularly on the submergence schedule and its potential impact.

86. While the Bank continued funding to the SSP, on May 22, 1990 the Japanese aid agency decided to halt disbursement of the remaining US \$130 M on its initial loan (US \$150 M) for SSP turbines and generators. The decision appeared to be a result of the strong, local opposition in India and growing opposition in Tokyo.

The Independent Review

87. In June, 1992, R&R policy concerns raised by the Bank's Board and various NGOs led the Bank president to commission an Independent Review of the Sardar Sarovar Project focussing on R&R and environmental aspects of the projects and appropriate remedial measures.

88. The main conclusions of the Independent Review on R&R may be summarized as follows; on the Bank's side, the main problems were:

- a. despite the existence of explicit operational guidelines with respect to involuntary resettlement and tribal peoples, the Bank failed to insist on proper preparation of R&R plans by the Government and accordingly did not appraise adequately the resettlement components of the Sardar Sarovar projects;
- b. the Bank's preparation and appraisal similarly did not address displacement of people by the Sardar Sarovar canal system in Gujarat. There was, and is, no agreed resettlement strategy for the canal. Elsewhere, provisions for tribals affected by the project and who had access to, or cultivated, land for extended periods, were inadequate or absent because they were treated as landless; and
- c. the Bank's efforts during the last few years to compensate for the lack of an adequate appraisal have helped to achieve some improvements, particularly in Gujarat, but this

"incremental approach" is not achieving the changes needed, particularly in Madhya Pradesh.

89. On the Borrower's side, the principal problems identified were:

- a. insufficient baseline data gathered on the affected population. This made it impossible to develop an effective resettlement plan;
- b. lack of consultation with the affected population and a failure to inform them of their resettlement options;
- c. lack of compliance with the provisions of the Government's Narmada Water Dispute Tribunal Award; and
- d. failure to prepare a full resettlement plan before appraisal.

90. The Review also concluded that during the last 2-3 years the Government of Gujarat had taken several positive measures to improve the resettlement policy and institutional framework for the resettlers displaced from the project's submergence area; however, in the canal system in Gujarat, the report finds that there has been no progress on resettlement and very little progress on R&R in the other two states. Madhya Pradesh, in particular, which contains the majority of the resettlers, still lacks an adequate policy framework, capable institutions or means to ensure that resettlers do not suffer a significantly adverse impact after resettlement.

91. The Independent Review, while stating that it would not make recommendations, did in fact conclude that the Bank should "step back" from the project and re-evaluate the current situation and potential for improvement.

Management Response to the Independent Review

92. In its response of June 23, 1992 to the findings of the Independent Review (ref. Sec. M92-849), Bank management accepted the findings with respect the policy guidelines in force and the failure of the preparation and appraisal to take these fully into account. These deficiencies were particularly noteworthy in areas that today have become important parts of the preparation and appraisal process -- i.e., insistence on Government consultation with affected parties; development of socio-economic data on project affected peoples; assessment of the Government's implementation capacity for resettlement.

93. The Management response went on to note that application of relatively new operational guidelines in the early 1980s demanded high quality resettlement project components. This was not a simple task for either the Borrower's or Bank staff. It required major improvements in the practices of many Bank Borrowers as well as a comprehensive change in approaches and resource allocation for all Bank units dealing with such projects. During this adjustment process, particularly in the first few years after the 1980 adoption by the Bank of the new guidelines, there were a significant number of departures from the guidelines, including in the Narmada projects. Specifically, Bank management generally agreed with the description of R&R experience in the three states (as contained in the Independent Review) and in the canal areas in Gujarat. Management also agreed that (a) adequate resettlement plans were not prepared by the Borrower for appraisal by the Bank; (b) while the development of resettlement policy in Gujarat is indeed a notable achievement, R&R policies in the other two states needs urgent improvement and implementation needs to be further strengthened in all the states. In conclusion, the Bank management stated that rather than "stepping back" from the project, the most promising course of action would be to take advantage of the Government of India's recent agreement that dam

construction should be linked to progress on resettlement. This, the management argued, provides the basis for a new approach under which the Bank, as a matter of urgency, would work with Government to operationalize this commitment. Practical and monitorable steps would need to be agreed to ensure that the improvements include consultation with PAPs, a five year draft estimate for financing R&R, improvements in R&R monitoring and clearing the backlog of PAPs waiting for land after having selected it. Finally, the Action Program re-affirmed Government's commitment to link the pace of dam construction to progress on R&R.

Board Review

94. On the basis of the Government's Action Program, Bank management proposed several benchmarks for measuring project performance and recommended continued support for the projects, provided there was satisfactory progress in meeting the performance benchmarks by March 31, 1993. The benchmarks and related discussion were contained in the memo to the Board dated September 11, 1992 (Sec. MR92-168), October 1, 1992 (R92-168/1) and October 20, 1992 (R92-168/2/Rev.). The Board met on October 23, 1992 and after lengthy debate endorsed the management's recommendations.

In arriving at their decision, the Board emphasized the following points:

- a. a special Bank mission would go to the field in April, 1993 to review progress as report in a document to be prepared by the Government and presented to the Bank no later than March 31, 1993;
- b. if, based on the findings of the mission, Bank management concluded that project performance has failed significantly to meet the benchmark tests, steps would be taken to suspend disbursements and the Board would be so informed; and
- c. in the event performance is judged to be satisfactory in relation to the benchmarks, the basis for this judgement would be set out in a report to the Executive Directors and a discussion arranged. A final decision on continued support for the project will take full account of the sense of the Board. The benchmarks with respect to R&R included the following:
 - i. Satisfactory improvement in the data describing the number of PAPs in the reservoir area, including an analysis of affected tribal people. This analysis of tribal rehabilitation needs must be reflected in detailed R&R plans. The computerized data system covering all three states must be significantly enhanced. Additionally, both Madhya Pradesh and Gujarat must agree on the eligibility criteria for the landless, agricultural laborers and major sons;
 - ii. All three states must complete a satisfactory R&R plan which includes providing resettlement for 4000 PAPs each year beginning in 1993. Additionally, the states must revise their R&R plans to include budget provisions; These are to be approved by project authorities and the Bank's April 1993 review mission;
 - iii. The state governments must strengthen the institutional arrangement for implementing R&R and include an appropriate role for local, non-governmental organizations. Furthermore, a separate R&R agency reporting to the Chief Minister of Gujarat should be established. The Board of Directors for this agency should include appropriate representatives from Madhya Pradesh and Maharashtra as well as a substantial representation of local NGOs. This agency is anticipated to improve coordination of R&R among the states and should be able to operate in MP;

- iv. The three states should satisfactorily demonstrate improved consultation practices. Additionally, Gujarat NGOs should facilitate the consultation process for oustees in Madhya Pradesh; and
- v. Both Maharashtra and Madhya Pradesh should satisfactorily demonstrate the feasibility of land acquisition on the required scale. Specifically, formal releasing or acquiring of about 2,000 additional ha. of land should be expected for resettlement sites within Maharashtra. In Madhya Pradesh, land purchasing committees should start acquiring and identifying about 1,000 ha. of good quality land for resettlement sites within the state.

Government Cancellation of Bank Loan

95. On March 29, 1993, the Government of India announced to the Board that after due consideration of project progress and other considerations it had decided to request the Bank to cancel remaining proceeds of the Loan for the Sardar Sarovar Project (about \$170 million out of the original loan of \$200 million equivalent; the Credit of US\$100 million had already been fully disbursed). In announcing the decision, the Indian Executive Director reaffirmed the continued commitment of the Government of India and the state governments to fully meet the R&R and environmental standards of this important project. The Bank subsequently agreed to this request and the Loan was formally cancelled.

Bank Performance

96. The performance on R&R aspects of the project had been summarized by management in the note to the Board in response to the conclusions of the Independent Review (ref. paras.....). Clearly, Bank performance was wanting in terms of the quality of appraisal of R&R plans and the adherence to guidelines. Later, however, during implementation, the supervision process resulted in major strides and a great deal of catching up. Lessons learned are outlined in the next section. However, the R&R failures and the incremental strategy issues warrant comment.

- a. There was a failure to prepare and appraise the R&R aspects in accordance with the Bank's operational guidelines in effect at the time. The explanation for this failure was that these were new guidelines and it takes time to build up the expertise, the processes and the methodologies to react rapidly to such guidelines. An R&R plan was reviewed and found acceptable at the time of negotiations. While this plan was weak by present standards, over the subsequent years there has been a great improvement in the quality and detail of the R&R plans including quite detailed computerized schedules for steps to be taken. The continuing criticism that there were no R&R plans (some critics still claim there are no R&R plans) is not supported by the evidence;
- b. The "incremental strategy" pursued has been widely criticised and at one point, this criticism was accepted by Bank management. It is argued here that whether or not this strategy failed remains debatable. Clearly it did not achieve ideal R&R policies. However, it did achieve unprecedented strides in policies and implementation over a period of 8 years. The change from essentially a land for land policy with nothing for landless and nothing for major sons to a minimum of 2 ha for all in Gujarat, together with a range of other compensation elements and the evolution of the Land Purchase Committee process and the improved planning and data systems has been by far the most significant stride ever made in R&R in India. It has already had enormous India-wide benefits. For the landless, who constitute 23% in Gujarat and as much as 47% in MP of the oustees, the policy now is an exceptionally good policy which will transform

the livelihoods of many of these families. It is difficult to argue that one strategy failed unless there is a clear alternative strategy that would have produced better results. The alternative strategy could only have been an early, or earlier, withdrawal of the Bank from the project. This is a card that can be played only once. It is improbable that a strategy of an early withdrawal from the project would have resulted in better R&R performance by 1993 than the "incremental strategy" that was followed.

Borrower Performance

97. The performance of the Borrower with respect to R&R was mixed and different in the three states. The Borrower failed to follow through sufficiently quickly on agreements with respect to detailed plans as agreed at negotiations and incorporated into the legal agreements. While there was some socio-economic information about affected people, it was limited and was not fully used in designing the R&R plans. A detailed survey had been done in Gujarat in the early 1980s (which was not acknowledged by the report of the Independent Review) but had been used while designing Gujarat's R&R plans policies in the early stages. Gujarat policy has evolved into the most enlightened in India in that it provides land for landless, land in the irrigated command area, a full complement of assistance for people moving, innovative mechanisms such as the Land Purchase Committee in which willing buyers and sellers could resolve issues and a range of other assistance. Progress also eventually was made in Maharashtra, even though there were, and still are, protracted and periodic problems with availability of forest land for resettlement and continued difficulties in consultation due to activist obstruction of the process. The issue of forest land posed a dilemma within the environmental community between those advocating the best possible deal for affected peoples and those more concerned with preservation of forest. Madhya Pradesh also made progress on both policies and data and implementation but, given the magnitude of the problem and no doubt the fact that the state stood to gain very little benefit from the SSP project, it did not have an incentive to comply promptly with R&R requirements. There is still some concern regarding the implementation of R R policies in Madhya Pradesh. It has been slow and the procedures for allocating land in MP as well as benefits to landless and adult sons could be improved.

V. Standard of Living Before and After Relocation

98. It is not possible within the context of this PCR to systematically compare living standards before and after relocation. It also may not be fair to attempt to do so. Only after PAFs are permanently relocated, without recourse to their old villages, and are provided promised irrigation and other economic generation schemes, will a fair comparison be possible. Even then, it will take seven to ten years before an adequate evaluation of rehabilitation is possible. There are two distinct areas affected by submergence. One is the wide valley in the upper Narmada of Madhya Pradesh known as the Nimad. The other is the tribal area just above the dam site, where the valley is narrow and PAFs are from all three states. The very different nature of the Nimad Plains in Madhya Pradesh from the tribal areas closer to the dam further complicates the discussion.

99. For the tribal areas, the main issues are whether the Bhil sub-tribes from the more remote subsistence agriculture areas can learn to live without the large areas of reserve forest lands they have traditionally encroached; and can they adapt to a new agricultural regime on lands very different from those they are used to. For the more "advanced" Bhil sub-groups, this is not considered a problem. Again, it is too early to make a judgment, because for the most part relocatees have not fully committed to their new lands. This will only happen when submergence occurs, and full rehabilitation will be possible only when irrigation has been supplied. This is still some way off.

100. The Nimad Plains Before and After Relocation: While there are many socioeconomic studies on the tribal areas, the Nimad does not seem to have received the same attention. Nevertheless, the area contains 19,380 families, approximately half the SSP's 40,725 PAFs and sixty-percent of Madhya Pradesh's 33,104 PAFs.

101. Of the 79 villages in MP that suffer inundation of more than 10% of their land, 76 are tribal. Only three of the 79 villages are in the Nimad. Relocation is mostly closely compact villages moving back 2-3 kilometers from the river's edge, leaving agricultural lands unaffected except by one in a hundred year floods. While Madhya Pradesh is currently laying out and constructing new *abadi* sites for these relocated villages, most of the Nimad relocation will not take place until 1997 monsoon.

102. The IRR describes the lands affected in the Nimad as "low-lying, fertile lands that are intensively farmed and that already benefit from an elaborate irrigation system." Irrigation is by "a plethora of irrigation pumps with a network of pipelines reaching as far as 5 km from river." The Kanbi-Patidars who settled in the Nimad during the last century installed these irrigation systems. The Kanbi-Patidars are "prosperous farmers, many of whom well educated and have connections with members of professional and political groups of the region, are competent to use the Land Acquisition Act process to ensure that compensation for their lost lands is not minimized, although in so far as they work areas of land over and above state ceilings they are at some economic risk."

103. Electrification of the region in the early 1970s has made it possible for landholders to "grow three crops a year, including chilies, cotton, papayas, bananas, sugar cane—produce with high market values." The IRR describes many families farming 20 to 30 hectares and employing as many as 30 to 40 permanent farm workers. The authors give the impression that inundation will destroy the irrigation network making this possible, although this seems unlikely.

104. Madhya Pradesh officials continually assert that the Nimad's large farmers are concerned about the jeopardy to their land holdings beyond the state ceilings, in MP about eight hectares. R&R officials suggest that the large landholders have secretly registered many of these lands in the names of scheduled caste and tribal agricultural laborers. Now, by virtue of the SSP, they will become PAFs. As PAFs, these workers are eligible for compensation and for land in the Gujarat command area. Whether these assertions are true or not, officials say the greater concern for large landholders is that valuable agricultural laborers who help bring in the region's commercial crops will be lost to R&R.

105. Officials also assert that, prompted by these concerns, wealthy farmers in the Nimad provide much of the funding for the NBA's opposition to the SSP. The NBA, in turn, focuses anti-dam attention on the welfare of tribal PAFs who in the Nimad, along with scheduled castes, are ironically the agricultural workers.

106. Apparently not aware of this issue, the IRR took a sanguine view of the Nimad's agricultural laborers, one not likely shared by many social activists in India. "The Scheduled Tribe and Scheduled Caste families, a large proportion of whom are not literate and whose land is not recorded in government records, are more vulnerable. Their sense of security comes from occupying a particular place in an integrated network of laborer-landowning relationships, which is threatened by the resettlement process":²⁵

Again and again the men and women of landless families expressed to us their reliance upon a place in community life. They have secure working relationships with particular landowners.

107. It is not exactly clear why these laborers are vulnerable, since most of the land in the Nimad will be unaffected except occasionally during severe floods. The relationship between scheduled castes and the upper castes in India has not been as trouble free, especially of late, as the authors suggest. Rise of political parties espousing the causes of the former castes suggests the relationship is often adversarial. It is not likely that the Nimad area is different in this regard.

108. Inundation of the Nimad does not occur until after 1995 at the earliest, and mostly in 1997. Nevertheless, Gujarat officials have taken measures to avoid large numbers of, in their view, non-qualified landless agricultural laborers arriving to claim PAF status and land in the command area. Concern over this issue prompted Gujarat to put pressure on Madhya Pradesh to agree that only agricultural laborers whose houses are submerged may claim PAF status, unless MP officials certify that such laborers are employed on permanently submerged land. The two states reached his agreement only after July 1992.

109. Further, Gujarat officials claim that many Nimad PAFs have already been allotted land in Gujarat, although submergence for the Phase I command area irrigation does not affect the Nimad. Phase I will be operational in August 1995 for Baroda and Baruch Districts. Since late 1992, Gujarat has tried to restrict the numbers of Phase II command area oustees until it takes care of the first 17 tribal villages affected by Phase I submergence.

110. Without systematic information, it is difficult to verify or quantify very much of the above. The IRR criticizes the Bank and the SSP for failure to collect baseline information. Because of this lack, the IRR relied a great deal on anecdotal data from the team's field visits. Among its Gujarat field trips, the IRR team visited Gatal, a resettlement site for Madhya Pradesh PAFs in Gujarat. PAFs from the village Bhawati in the Nimad expressed "intense dissatisfaction" with their new resettlement site. Bhawati relocatees told the team that they could get three crops per year at Bhawati and therefore "one and a half acres at Bhawati equaled five acres at Gatal."

111. All the PAFs from Bhawati claimed that they were worse off for coming to Gujarat. They said that they had been promised large, pukka houses such as the host villagers had. They told the team that half the Bhawati PAFs had left such large, pukka houses behind. Irrigation promised had not appeared. By coming to Gujarat, the Bhawati PAFs felt as though they had lost their parents. The "community leader" told the team, "We are like dead people. What is the point of living like dead people? When you are submerged, you are dead."

112. The IRR says it was puzzled by the difference between Gatal and other MP PAF settlements where the mood was more optimistic. The team decided it might have been because Gatal was larger and they spoke to more people there, or else it was because "once people have been persuaded to resettle, provision of services to them declines."

113. Head of Madhya Pradesh's M&E monitoring unit told the IRR that the relocation to Gatal from Bhawati was "a direct result of 'landless' persons seeking benefits in Gujarat." The team could not "confirm or qualify this statement" but did verify that Bhawati appears "on the submergence schedules for the year 1996-97."²⁶ Submergence would not affect the Bhawati PAFs at Gatal for a minimum of another five years²⁷ IRR's uncritical acceptance of the intense dissatisfaction of Bhawati PAFs over their resettlement appears, in this context, questionable. The team might have asked why the Bhawati PAFs came to Gujarat so far ahead of submergence given the lack of any immediate need for them to do so. They might have asked whether and in what way their dissatisfaction was justified, given the apparent voluntary nature of their presence in Gujarat and the fact that from landless they became landed with 2 ha holdings each.

114. Besides the above described encounter with Nimad relocatees in Gujarat, there is little to go on for describing the before and after situations for the Nimad. Very little resettlement has taken place there. Where it has, it appears to have been voluntary relocation to Gujarat some time before strictly required.

26 IRR (1993), pp. 186-7, 191-193.

27 This is confirmed by: NCA. 1991. Submergence of Villages in Gujarat, Maharashtra and Madhya Pradesh with the Construction of Sardar Sarovar Project. Indore. March. This detailed schedule, known as the "Blue Book" shows Bhawati (spelled "Bhawati" in the Blue Book and "Bhawati" on NVDA maps) affected by temporary submergence in 1996 and permanent submergence in 1997.

115. The Tribal Areas Before Relocation (Gujarat): A series of anthropological baseline studies carried out in Gujarat's submergence villages between 1980-82 quite well documented the before relocation situation in Gujarati tribal villages. The Centre for Social Studies (CSS) at Surat carried out 19 individual monographs.²⁸ The monographs describe, in great detail, infrastructure, social structure, economic conditions, leadership patterns, and attitudes toward rehabilitation in each affected village. These monographs also contain a great deal of ethnographic information about tribal culture and society. The researchers point out, however, that they carefully edited this data for relevance to R&R concerns.

116. The methodology included a census, village maps, household surveys, and participant observation. CSS's 23 researchers included different disciplines: Sociology, social anthropology, human geography, social work, and political science, and 11 tribal youths. The latter, who administered the household survey, were high school graduates. CSS gave them a month's "rigorous" classroom and field training in research methods.

117. The researchers evolved a common framework through a two-day seminar before the field work. They used a long list of research "check points" provided by the World Bank to assure coordination with the R&R policy the Bank adopted only a few months earlier. CSS appended these to the main report and the research team critically appraised them. CSS carried out the research in close collaboration with NGOs and social activists in Gujarat, some of whom participated in its field work.

118. The general report that summarizes the monograph findings contains a detailed review of R&R experience in India, including an assessment of the Kevadia Colony and Rock-Fill-Dyke villages displacement²⁹; a review of NGO involvement in the SSP R&R; a critique of R&R policy in India; and a list of policy, implementation, and organizational recommendations that eventually became the basis of Gujarat's liberal R&R policy and its effective implementation program. In describing the report, the study's principle author pointed out:

This study is a first of its kind. Though there are several socio-anthropological studies dealing with specific problems of the tribals, almost all are post facto analysis of the specific situations. It is for the first time that we are dealing with a problem, and that too a very sensitive and complex one, beforehand. There are no ready made theoretical approaches available to analyze this sort of situation, and it is through trial and error that we could develop . . . understanding . . . Hence, it would be too much to expect ready made models for the solutions . . . This study provides sound descriptive and analytical understanding of the problem on the basis of which more sophisticated work can be done in the future.

119. The CSS report describes the tribal submergence area in Gujarat as "more or less undulating topography and scattered habitation amidst scanty forest." Its house-to-house survey found a population of 14,214 in the 19 villages. From infrastructure, external market linkages, and socioeconomic development, the report divided the area into three zones: (1) five rock-fill-dykes villages; (2) six dam site villages; and (3) eight interior villages. The following table shows the distribution of these various criteria across the three zones. The CSS used such data to show how facilities, access to markets, and socioeconomic development declined from zone one to zone three:

28 The 19 monographs were summarized in: Vidyut Joshi. 1983. Rehabilitation of Submerging Villages. General Report: Sardar Sarovar Project. Surat. July.

29 These five displaced villages are among the nineteen monographs. Fourteen of the monographs are on submergence villages.

Infrastructure Facilities in Submerging Villages: Zonewise Distribution

FACILITY	Rock-Fill-Dyke Zone 1	Dam Site Zone 2	Interior Zone 3	Total
Primary School	6	7	1	14
Post Office	1	2	-	3
Dispensary	1	1	-	1
Pukka Road	2	1	-	3
Kachcha Road	3	3	1	7
Bus	4	2	-	6
Grain Shop	4	4	1	9
Distance from Market (in Kms)	5	15	25	-

Facility and Population Coverage

	Rock-Fill-Dyke Zone 1	Dam Site Zone 2	Interior Zone 3
Population per school	104	146	608
Population per post office	624	540	-
Population per dispensary	624	-	-
Percent of landowning HHs	62%	76%	93%
Percent of landless HHs	38%	24%	7%
Percent of literacy	39%	23%	2%
Population per bicycle	36	116	3,804
Population per watch	27	41	476
Population per radio	73	100	634

120. The CSS found the social, economic and leadership patterns between and within villages different in each zone. It concluded "their problems of and attitude toward rehabilitation will also differ." The following briefly summarizes their findings for the three zones.

121. CSS described the Rock-Filled-Dyke zone one with 597 households and a population of 3,894, as "a developing and advancing area" occupying one-third of the total submergence area. It had a modern market economy and considerable institutional networks. Because land was a commodity, land alienation in the 1980s had already been underway for about twenty years, and quite a sizeable percentage (38%) of the community was landless. The literacy rate (39%) was above the national average, and some families had three generations of educated members. "The villages of this zone are very much like non-tribal villages near towns."

122. The Tadvī tribes, who consider themselves descendent of Rajputs, are the majority. Early work on the dam site had helped in creating occupational diversification, and well defined economic strata had emerged over a much longer period. The four layers were: big land holders, job holders, small farmers, and many landless laborers. Concerning resettlement, each of these represented a different interest group. The large landowners, mostly Dhanka Tadvīs converted to a "Bhagat" form of strict Hindu observance, were educated and "don't mind going to far away places, away from their kinsfolk, if they can buy cheaper land there." The oustees who secured permanent jobs in the vicinity, often the SSP, "do not want to shift to far away places." Both groups, the CSS found, were small.

123. On the other hand, a larger group of small farmers -- Dhanka Tadvīs and lower status Tetariya Tadvīs -- preferred to "resettle in nearby villages amidst their kinsfolk." These were divided in their preferences to location. CSS identified the fourth group as the Kevadia Village and Rock-Fill-Dyke village oustees, who were "the poorest of the poor" and for whom no R&R policy

124. The Dam Site Villages *zone two* with 1,019 households, a population of 6,490, and more than one-third of the submergence land area, was "less developed in terms of infrastructural

facilities." For instance, although two villages were well-known centers of pilgrimage, not one village had medical facilities. "The houses in the villages of this zone are more scattered as compared to the houses of the first zone. In this zone one still finds persons who have not seen Rajpipla [the nearest large town], never eaten in a restaurant and never travelled by a bus or train. They welcome outsiders and spared ample time for the researchers." Forty-six percent of the total PAFs population was from this zone. Two tribes, Tadvis and Bhils live in this zone.

125. The CSS examined leadership and attitudes in the second zone concerning the comparative position of the Tadvis and Bhils. They found the Bhils followed their traditional Dayas (wisemen) in social matters, but new leaders were emerging around "the issue of rehabilitation which demands education and exposure to the outside world." Traditional Tadvi leaders were more knowledgeable; however, "the issue of rehabilitation [had] not emerged in a crystal-clear form in this zone" and leaders were yet undivided on the issue. Leaders were claiming that villagers would shift *en masse*, but the CSS made detailed predictions on how the oustees would be divided once "some definite proposal will start taking place."

126. The Interior Villages zone three with 608 households and a population of 3,840 was "the most backward and relatively isolated" of the three areas. "To get a fairly good picture of the interior villages merely by reading about them is like asking a princess, who has never gone out of her palace, to write an essay on poverty. This is the area where we saw the poorest of the poor, working and struggling hard for getting enough food for mere survival." "There are no roads, no bus, no post office, no electricity and no dispensary in the entire zone. Almost no non-tribal population. There is only one primary school. Out of 608 households only six possess radios and eight households possess wrist watches." The zone is inhabited mostly by Dungari Bhils, although there are also many Rathwa and Naika tribals:³⁰

Agriculture is the main source of livelihood. Ninety-three percent of the households own land. As land is rocky and situated on the terrains of the hills, its yield is very poor. They take only one crop in a year. Most of the households also cultivate forest land. As agriculture does not provide enough subsistence, they depend on other means like food-gathering, hunting and fishing. As there is no surplus production, economic differences have not emerged. All look almost alike in terms of economic conditions. But the social differences between the Bhils, the Rathwas and the Naikas are sharp.

127. The CSS found the traditional leadership in the third zone the most powerful, "while the new leadership that can understand the complex problem of rehabilitation is not likely to emerge in the near future . . . All the traditional leaders are against shifting . . . No one dares to utter a single word 'for' rehabilitation, because such an utterance is considered to offend the Dayas."

128. The Dhungari Bhils said that when the water came they would simply shift to higher ground, where encroachable land was yet available. Where this was not possible, as with one village, the leadership hesitated as yet to question this strategy. They would, however, likely accept relocation via an enlightened R&R program.

129. Rathwas and Naikas wanted to shift but were heavily dependent on encroached land, not covered under the 1983 Gujarat policy, so they were hindered from agreeing to official relocation.

130. A World Bank Consultant has more recently conducted a case study in a remote Dhungari Bhil "dam site" village, Makhadkhada. Bhils in this village prefer to call themselves "Vasavas," a higher status term denoting a putative Rajput descendency. The village is very isolated and has no facilities such as electricity, shops or even transport. The community is agricultural but is also dependent somewhat on forest produce. It is a self-sufficient economy, except clothes and jewellery, which the villagers buy for cash. They also barter for salt. The villagers have their own

religious beliefs that cannot be identified as Hinduism and they have a pantheon of village and household level gods. The society is organized by clans and by kin groups.

"The terrain in Makhadkhada is hilly, and slopes are cultivated without any terracing. The ground is very stony and allows for ploughing to a depth of approximately six inches. The hilly terrain allows for the water to drain off so that ploughing, sowing and weeding can be done at almost any time throughout the monsoon period." There is only one monsoon crop per year, and ploughing, sowing and weeding is required only at this time. Villagers sow a variety of crops within a year because rain is unpredictable. This is a risk reducing strategy. The villagers prefer to be self-sufficient in food. "Agriculture is carried out on a relatively loose time basis within the boundary of the monsoon months." A single monsoon crop in the hills leaves villagers free from January to June to attend fairs, rituals and weddings. Because the agricultural work is spread over a longer period in the new sites, villagers regard it as needing more effort.³¹

131. Dependence on jungle produce such as fish, wild roots, fruits, leaves, flowers and berries is highest in the monsoon when these are freely available. This is a critical time when grain is low and famine continually a possibility in rainfed areas. "Villagers always stress that they could survive on roots if the crop fails, but observation shows that most families eat barely 3-4 meals of roots in a year . . . the value of forest edibles is not that they are a major component in village consumption, but that they provide a fall back if ever needed, as well as providing variety to what is otherwise a very monotonous diet." The stress is on feeling independent and mental security.

132. The Tribal Areas Before Relocation (Madhya Pradesh): This has been documented to some extent by the monitoring and evaluation efforts of Doctor Hari Singh Gour University. In 1992, the Bank set as one of its benchmarks for continuing SSP funding that NCA and the project authorities carry out socioeconomic studies on the tribals of the three states and at the resettlement sites. This was prompted by concern about the IRR's findings that social and cultural aspects of the tribal community had been left out of R&R planning, that initial socioeconomic studies had not been carried out as Bank R&R policy requires, and that monitoring and evaluation was not a substitute for such studies.

133. The NCA Madhya Pradesh carried out studies in Jan-Feb 1993 using rapid rural appraisal techniques. NCA summarizes the findings of these tribal studies, their recommendations, and how they have been incorporated into state R&R plans, in its 1993 Annual Action Plan (1993-94) and Indicative Long Term Plan for Resettlement & Rehabilitation. (Indore. May. Chapter 13).

134. NCA commissioned a set of case studies of six tribal villages, two in Madhya Pradesh, two in Maharashtra, and two resettlement sites in Gujarat. These case studies are in the ISSW's 1993 Socio-Economic & Cultural Milieu of Tribals of Submergence & Resettled Villages - An Assessment (Indore School of Social Work: Indore, April). The NVDA carried out a study of the seventeen tribal villages to be the first affected by submergence in Madhya Pradesh. This 1993 NVDA study is in The Bhil Track: A Study of Displaced Tribals: 17 Villages - Sardar Sarovar Project (NVDA: Bhopal, March).

135. Unfortunately, these studies were not of the quality and thoroughness of the previous 1980-83 CSS studies in Gujarat, nor could they be. As the Bhil Track study commented: "A study of this kind should have been undertaken at the very beginning before the atmosphere began to be

31 1993a. "India - Sardar Sarovar (Narmada) Project Tribal Peoples Survey - R&R Programs: Draft Case Study Report for Makhadkhada Submergence Village in Gujarat." New Delhi: World Bank consultant, February; and Bank consultant. 1993b. "Resettlement & Rehabilitation in the Context of 'Vasava' Culture: Some Reflections." Paper prepared for the Narmada Forum & Workshop, organized under the Economic Security Program of the Centre for Development Economics (Delhi School of Economics) in collaboration with the Institute of Economic Growth. Delhi, December 21-23. pp. 1, 7.

vitiated by the . . . anti-dam activists." Nevertheless, despite their obvious limitations, the set of studies presents a comprehensive overview of important dynamics of tribal culture and society.

136. The Bhil Track puts the submergence villages in MP into the larger context of the Bhil homeland in that state. Of the first 17 villages facing submergence, 12 are in Jabhua District, four in Dhar District and one in Khargone District. These three districts represent 76% of Bhil tribals in MP. Jabhua and Dhar districts are on the Plateau of Malwa, whereas Khargone is part of the Nimar plain, known as West Nimar.

Percentage Distribution of Bhils by District Population in Madhya Pradesh³²

State/District	Population 1981	% of Bhil Population
Madhya Pradesh	2,500,530	100
Khargone	685,006	27
Jhabua	662,029	27
Dhar	546,764	22
Ratlam	165,142	7
Khandwa	131,122	5
Indore	60,405	2
Mandsaur	58,757	2
Dewas	52,394	2
Guna	39,946	2
Rajgarh	20,580	1
Shajapur	17,780	1
Ujjain	17,138	1
Sehore	19,175	1
Total 13 Districts	2,476,239	100

137. Although the submergence villages have been described as isolated and unable to cope with change, the Bhil "homeland" has many urban centers. It is in part electrified, is criss-crossed with black-top roads, and contains major NVDA irrigation projects besides the SSP. Alirajpur, Jhabua District's headquarters, is a large town, as are those of the other two SSP-affected districts.

138. The Bhil Track describes the Alirajpur area as "almost entirely hilly intersected by narrow valleys and low Vindhya ranges covered with small jungle. In this district, as also in the rest of the Bhil areas, forests and vegetation have been indiscriminately destroyed for decades and as a result, soil erosion has caused havoc at places . . . The terrain becomes harsher and harsher as one approaches the Narmada. The plains give way to slightly and then sharply undulating topography formed of treeless, hump-shaped, eroded hillocks." Villages are not compact, corporate entities but are scattered out in small hamlets, or "phalias," with individual homes close to fields. These share common water source and are largely family and clan based. Villages cover areas of about 2-3 kilometers.

139. The five major sub-tribes of the area are in a caste-like hierarchy, ranking as follows: Bhilala, Barela, Bhil, Mankar, and Naika. The dominant "Bhil" tribal group in these three districts, the Bhilala, specializes in many cash crops and has a generally progressive attitude toward development. Barela is in many respects similar to Bhilala.

140. The "Bhils" are Dhungari Bhils, as described by the CSS, in five of the villages closest to the Gujarat border. They are in the most remote and inaccessible part of the MP submergence

area. Their relocation promises to be the most problematic, as these Dhungari Bhil, or "Vasava," villages have been strongholds of anti-dam sentiment.

141. Mankars and Naikas are landless for the most part and rely on fishing, forest produce, illegal logging, ferrying and migratory labor for survival. In Madhya Pradesh, Naikas monopolize fishing and Bhilala agriculturalists look down upon them for this.

142. The Tribal Areas Before Relocation (Maharashtra): This is described in a study based on TISS's ongoing monitoring and evaluation work in the Akkalkuwa tehsil submergence villages. It is a consolidation of their understanding of the socioeconomic condition of tribals. The 1993 study is in the Report on Socio-Economic & Cultural Situation of Tribals in Submergence Villages of Sardar Sarovar Project in Maharashtra (TISS: Bombay. February).³³

143. There are 33 villages in the submergence area, all in the hilly land of the Satpura mountains. 16 are on the south bank of the Narmada, opposite the Gujarat submergence villages, and 17 on the south bank opposite the first submergence villages of Madhya Pradesh. 24 lie in Akrani and nine in Akkalkuwa tehsils of Dhule District. The population of these is almost entirely tribal, made up of various Bhil groups including Tadavi, Vasava, and Puara. In Maharashtra, the TISS study notes that "most tribal villages in the Satpuras, while being more homogeneous than the villages of the plains, are each inhabited by at least two . . . groups," for example Tadvis and Vasavas in Sinduri and Padvis, Valvis and Vasavas in Bamni village.

144. TISS describes 'Bhil' as a generic term. It says that from all accounts the Bhils do not form a single group but comprise several socially and culturally interlocked groups speaking related languages. These groups do not share a common homeland (*watan*), nor do they share a common occupation today, although most are involved in agriculture. "In fact, it might not be far-fetched to suggest that they were classed as 'Bhil' more for administrative convenience by the British than because the groups identify with each other."³⁴

145. *Population Growth and Depletion of Resources in the Tribal Areas of Madhya Pradesh and Maharashtra* are major themes of the NCA, NVDA, and TISS reports. Unfortunately, no systematic measurement using, for instance, satellite imagery has shown the extent of deforestation in the tribal submergence area. However, the studies describe massive deforestation caused by a high population growth rate, ongoing tribal encroachments onto reserve forest, collaboration in illegal timbering, and in the Dhar District of Madhya Pradesh overfishing possibly using dynamite and poison.

146. The IRR acknowledged the "deforestation and erosion" of the area, and that elders had said they thought the population had trebled in their lifetime; "Yet they insisted they were still able to live well on the same resources as had always been available to them."

147. The tribals abandoned slash and burn agriculture in the nineteenth century. This was due partly to British laws creating 'reserve' forest, but it was also due to population increase. This, in turn, led to a more intensive form of agriculture, with a heavy reliance on domestic animals, especially goats. Permanent fields became the norm. "In so far as these permanent fields were regularized within the British administration, they constituted 'revenue lands,' and the owners paid an annual tax. In so far as the tribals were using or creating anew fields that were not recognized, they became 'encroachers.' In this way, a large section of tribal economic life became illegal. Periodically, successive administrations recognized encroachers and increased the extent of revenue land. The scale of the problem, however, is reflected in the fact that in the Narmada valley entire villages are identified as 'forest villages,' that is, as lying outside the revenue system altogether."

33 A similar study on the Akrani tehsil villages of Paula and Bhusia was promised by TISS for April 1993.

34 TISS (1993), pp. 1, 4.

148. The IRR reported continued "extensive reliance on forest and forest produce" by tribals. But, "Even where the forest appeared to be extremely degraded, [the tribals] explained that in it there were still resources of great importance to them and that they also would travel far behind their villages, into better forests deeper in the hills, to gather what they needed."³⁵

149. The Indore School of Social Work (ISSW) description of a village, Chhachkuan, in Madhya Pradesh is, unfortunately, common in the region: "The village is surrounded by Vindhya ranges on the one side and the Narmada on the other side, beyond which are the Satpura hills. Although most of the area is hilly and rocky devoid of vegetation except some shrubs, there are limited patches of fertile soil in the valley. The land is mostly barren. The poor vegetation cover indicates that a large part of the forest has been destroyed. This has resulted in the disappearance of the wild life. Except for rabbits no other wild animals are reported near the village."

150. ISSW describes Bhusha village in Maharashtra similarly: "The people living here have cut most of the forest for their livelihood so very few trees are seen here. It can be observed up to a couple of kilometers that the forest surrounding the village has been completely cut off and cleared." Describing another village it studied in Madhya Pradesh, the ISSW says, "In the village Kakrana, the Vindhya ranges offer the Bhilalas teak wood, bamboo, fuel, fodder, tendu leaves, fruits, honey, gum, etc. Most of these are available only on the other side of the [Narmada] river in the Satpura ranges."

151. Deforestation is thus a widespread phenomena in the tribal submergence area. It is not, however, universal. The Bhil Track described considerable reserve forest left in two of the seventeen villages it studied in Madhya Pradesh, Akadia and Chilkada. It credited this to their distance from urban centers where timber could be sold.³⁶ The ISSW described Dhankhedhi of Maharashtra in similar terms. A village located "in an interior and inaccessible area, the village . . . has preserved its tribal culture. . . . The village is surrounded by a rich forest area."

152. Even in Dhankhedhi, however, the ISSW writes: "The dependence of the tribals on forest keeps decreasing in proportion to the forest denudation and forest destruction." In this village, where forest still exists, the ISSW attempted to gain some idea of the extent of dependence tribals had of forest and river 'common' resources. Although the study qualified their extremely notional figures, if they are believed, the 'estimated worth' of forest produce is approximately equal to income from agriculture and livestock:

35 IRR (1993), p. 69-70, 148.

36 NVDA. (1993), p. 250.

Estimated Annual Income from Forest Produce for a Family in Dhankedi

Forest Resources	Period of Availability	Estimated Worth
Fuel wood	12 months	Rs 1,600
Timber	12 months	Rs 1,000
Fodder	12 months	Rs 3,600
Fruit (Bor, Mahua, Temru, Charoli, Gular)	2-3 months	Rs 550
Tendu Leaf	2 months	Rs 650
Bamboo	12 months	Rs 125
Gum	8 months	Rs 60
Honey	8 months	Rs 80
Hunting (Rabbits, peacocks, birds, titar, bator)	12 months	Rs 60
Fishing (fish, crabs, tortoise)	8 months	Rs 500
Shivali Leaves (from Narmada bank)	4 months	Rs 40
Total:		Rs 8,265

Annual Income and Expenditure Pattern of Two Households - Dhankedi

Items	Income Amount	Items	Expenditure Amount
Maize	300	Agriculture	315
Juwar	2500	Chicken	45
Millet	900	Clothing	1000
Tur	1200	Food Items	4680
Urad	1200	Festivals, Rituals	270
Kodra	150	Ornaments	200
Tailoring	500	Utensils	80
Bhadli	750	Travelling	150
Goats	700	Liquor, Tobacco	250
Tendu Leaf	500		
Total	8700	Total	6890

153. In less isolated tribal areas, particularly of Madhya Pradesh, the ISSW and Bhil Track reported a greater reliance on income earned from illegal timbering activities. In Bhilala tribal areas, the landless Naikas regularly supplemented their main occupation of fishing by contracting to "carry wooden logs from distant places," about 10 to 15 kilometers away, sometimes taking them six to seven days. In Chhachkuan, they sold firewood in nearby market centers, earning up to Rs 7,000 per annum. The ISSW noted a "cycle of poverty and ecological degradation" in the village. In Kakrana, also in Madhya Pradesh, a focused group interview estimated an annual income from forest produce up to Rs 4,000.³⁷

154. Naika earnings in fishing are not reported, although prices for fish were about Rs.25 per kilo. While the Bhil Track describes their use of bamboo fish traps and nets, a sociological survey of fishing families along the Narmada suggests other means as well, leading to a decline in fish resources:³⁸

37 ISSW (1993), pp. 12, 45, 56, 58, 71, 89, 92, 122.

38 Central Inland Capture Fisheries Research Institute (Indian Council of Agricultural Research). 1991. Sociological Survey of the Fishing Families of the Narmada River. Barrackpore, June. p. 121.

From the general opinion of the fishermen, it was evident that there was a decline in the fishery of the [Dhar District] stretch. Fishermen of 13 villages . . . cited overfishing as the principal cause for the decline in fish yield. But two villages suggested indiscriminate fishing by the hilly tribals using dynamite and poisons to be the cause.

155. The Bhil Track describes a heavy dependence on forests in Madhya Pradesh villages with no appreciable forest of their own. According to the study, the tribals of Madhya Pradesh bring the wood six to seven days carrying distance from across the Narmada in Maharashtra, earning up to Rs 7,000 per year.³⁹

156. The Consultant reports the first recorded outsider to spend time in Makadkhada was a Moslem forest cutter in the mid sixties. His presence "resulted in many villagers getting legal title to some land in return for which they permitted him to cut and sell the trees from their land." According to the forest laws "only a tribal can have legal title to forest land and its produce."⁴⁰

157. Another reason for deforestation is clear cutting for the reservoir itself. The IRR reports this beginning as early as 1975 around Manibeli in Maharashtra.⁴¹ The psychology leading to deforestation could also be part of a much broader slowdown in development in the project area from "the hesitancy of government and other agencies to finance development in areas which may eventually be submerged."⁴² For the SSP, this period that lasted over twenty years. On the other hand, deforestation is a striking feature throughout the Bhil homeland in Madhya Pradesh at least, far inland from the SSP submergence area.

158. Besides commercialization, TISS cites population pressures and the ongoing phenomenon of 'encroachment,' (virtually a cultural attribute of the Bhils) as the primary reasons for widespread deforestation in the region.

Comprehensive population statistics covering the tribal areas have not been compiled, although population census figures for 1971, 1981, and 1991 are available. The ISSW reports an annual growth rate for Chhachkuan village, Madhya Pradesh, at approximately 4-5% from 1971 to 1991. In Dhankedi, Maharashtra, the study reports an average woman would have 8.02 live births during her reproductive period.⁴³

159. According to TISS "The current levels of fertility prevalent among the displaced people is high. The total fertility rate . . . is around seven. The high fertility is partly due to higher levels of infant and childhood mortality. . . . The villages have expanded considerably in the last five generations. Continuous land clearance to provide for the growing number of households has led to a scattering of the population over a wide area." It takes over two hours to reach a hamlet at one end of Bhamni village from a hamlet on the other end:⁴⁴

According to the culture of the tribal people, upon marriage, the men set up new households. The members of the new household with the assistance of the clan members cleared fresh land for cultivation around the village. In the normal course, when a man had more than one son, the last son remained with the parents and inherited the land cultivated

39 NVDA (1993), p. 253.

40 World Bank Consultant (1993b), p. 3.

41 IRR (1992), p. 153.

42 World Bank consultant. 1989. "Supervisory Report on the Resettlement and Rehabilitation (R&R) Component of the Sardar Sarovar Project (SSP)." May 28. p. 11.

43 ISSW (1993), pp. 54, 89. ISSW cites TISS for the figure.

44 TISS (1993), pp. 111-112.

by the family. The elder sons married and formed new households. Such households normally settled in newly cleared land. . . . Thus, for any new household that was formed, the land for providing sustenance came from fresh clearing."

160. ISSW put it more succinctly: "Obviously, there is an interplay between Vasava demography, land holding pattern, dwelling, and encroachment. The custom is that after marriage every son moves out and constructs a house for himself, cuts jungle and cultivates land independently, as well as keeps his claim on his ancestral land." Encroachment has so far put off mass migration, but whether a day of reckoning is far off remains to be seen.

161. The studies describe a kind of "frontier psychology," in which there is always more forest to move onto. This has had implications for R&R: "The tribals would like that the equal size of land being given to them should include encroached land also. Further, resistance to the shift may [be partly due to] in the interior forest there is hardly any official to check the encroachment, and even if he does come the matters are settled. But in the new site, this privilege will be lost. There is neither forest nor land available for agriculture to accommodate the increasing population. Hence the tribal surplus population at the new site has to forgo cultivation."⁴⁵

162. The Tribal Areas After Relocation (Gujarat): The major relocation is to Gujarat. Gujarat appears to have had an impressive success providing land to relocatees. The IRR quotes CSS's 1991 M&E report number 13 that, "on the whole, a majority of the oustees in the villages studied 'are happy with their economic condition and standard of living'. . . . This conclusion suggests that Gujarat has provided adequate agricultural plots to some oustees." The IRR described Madhya Pradesh's resettlement as taking "advantage of the Gujarat process, in particular the energy and thoroughness of that state's Land Purchase Committee."⁴⁶ Because the IRR was so critical of R&R overall, this is high praise. It speaks well for the prospects of Gujarat carrying out its promises of successful land-based rehabilitation. At least as far as getting land into the hands of the resettlers.

163. By December 1993, about 6,570 families were allotted 12,918 hectares of land in Gujarat. This represents 42% of the 15,702 PAFs scheduled to be resettled in the state and 33% of the 39,192 hectares expected to be required (See appendix "Entitlement Benefits").⁴⁷ Since only about 28% of the families receiving land in Gujarat are recognized landowners or encroachers, and only about 15% of these had rainfed landholdings above two hectares, it appears that about 85% of families stand a good chance of being substantially better off. A typical family of a father and three major sons can receive as many as eight hectares of irrigated land; with two major sons, six hectares and with one major son, four hectares of irrigated land.

164. For some tribals, such as Govar herders or Naikas -- the lowest on the tribal hierarchy and usually landless -- the opportunity to become land owners represents an increase in stature both socially and economically. For others, at the top of the tribal social hierarchy, the promise of new land appears more rewarding. Neither the IRR, nor any other study, has doubted the ability of Tadvis, Bhils, or other tribes from less isolated areas (and further along the Sanskritization continuum than Vasavas or Dhungari Bhils) to take advantage of the opportunity to own land in the SSP command area. Among these more 'progressive' tribes, though not discussed in detail, are Rathwas, Pauras, and Barelas. A breakdown in numbers of land receivers according to tribe would, in this light, be revealing.

45 ISSW (1993), p. 54.

46 IRR (1993), pp. 125, 187.

47 Based on: NCA. 1994. SSP: Status Report on R&R (Quarter Ending December 1993). Indore. February.

165. These tribes already are held up as success stories. When a July 25, 1993 India Today article, "Narmada Resettlement: Blessing in Disguise?" describes some of these R&R success stories in Gujarat, it refers to Rathwas and Tadvis:

Even the World Bank's Independent Review, . . . which was highly critical of R&R, praised Gujarat: "In 1987-88, Gujarat developed a policy for its villagers affected by the Sardar Sarovar Project (SSP) that has since been welcomed as among the most progressive packages of measures ever devised for securing the long-term rehabilitation of people displaced by large-scale development projects". . . . A journey through the 125 odd resettlement sites in Vadodara district where 6,000 of the 30,000 displaced families have been resettled proves this. Relocation sites around Dabhoi town are dotted with pucca homes, something unknown to the Rathwa tribals of south Gujarat who have resettled here. People who were previously leading a hand-to-mouth existence are living in relative comfort and have hand pumps, biogas plants, street lights and bullock carts . . . The Rathwas, who used to grow low quality cereals like jowar and bajra in the Narmada Valley have opted to grow paddy in the fertile land in Vadodara district, offering stiff competition to the traditional Patel farmers. The Patels paid just Rs 200 a bigha to farm labour; the Rathwas are offering Rs 400. "They can afford this because in their case joint families own anything between 10 and 40 acres," says H.L. Patel, a farmer near Dabhoi.

166. The article also quotes Ranchobhai Tadvi, "whose joint family of 15 adult males owns 75 acres in Simaliya village against a mere 15 acres earlier. Most of us were so poor in the Narmada valley that we had to subsist on wild roots for at least three months in a year. All that has changed'. . . . Bachubhai Shanabhal Rathwa and his brother used to grow Rs 5,000 worth of crops on encroached forest land in Hafeshwar. But in Kukad, where they now live, their harvest last year was worth Rs 60,000 from 10 acres of land. In addition, Bachubhai earned Rs 25,000 as profit from a contract to build an approach road. Now he is building a water tank that will fetch him Rs 4,000 . . . Many of the PAPs are doing so well that they have become objects of envy for the original inhabitants. Laxman Tadvi, a PAP from Vadagam now resettled in Golagambi on 40 acres of land, says that the local people are helpful but often resent the PAPs: 'They call us *sarkari jamais* (sons-in-law of the Government) because of the treatment we get from the Government.'"

167. The main issue for R&R is whether the Dhungari Bhils (also known as Vasavas) from the more remote subsistence agriculture areas in the submergence zone can learn to live without the large areas of reserve forest lands they have traditionally encroached. Can they adapt to a new agricultural regime on lands very different from those they are used to? Again, it is too early to make a judgment, because for the most part Bhil relocatees have not fully committed to their new lands.

168. The Vasavas have generally been in the more remote villages, or in the more remote hamlets of villages near the dam site. In the 1983 CSS report, they were said to prefer to wait until the reservoir waters rose and then they would retire higher up to lands they could encroach. They, not the Bhilalas, are providing the staunchest resistance to R&R in a pocket of the most isolated villages in Madhya Pradesh. In Manibeli, Maharashtra, when the Tadvis moved to Parveta in Gujarat, the Vasavas stayed behind to join with the NBA. On the other hand, the Vasavas of Gujarat have by and large agreed to participate in R&R and move to the SSP command area. This has been largely because of the CSS socioeconomic survey. The survey brought NGOs into the R&R process who then gave the Vasavas a voice and perspective to insist on an R&R policy they could live with.

169. The enlightened policy of 1987 made encroachers, landless, and major sons eligible for the same land allotments in the command area as was given to Madhya Pradesh and Maharashtra landowners by the 1979 Tribunal award and extended to Gujarat landowners in 1985. Recognition of the tribals' rights to just compensation for encroached forest lands was at the heart of the policy they finally agreed to accede to. It is the lack of similar recognition in Madhya Pradesh and Maharashtra that provides much of the impetus for the SSP critics.

170. With encroachment, the focus has been on the recognition of land already encroached. In the after relocation scenario, the focus will be on how tribals who have become accustomed to encroachment will adjust without the right or possibility of this safety valve for a high population growth rate.

171. The Consultant touched on the issue when she quoted a Vasava saying: "It is a very new concept to us that we have to survive only on the 5 acres of land that is ours. Our rights are limited only within the boundaries of the land we own. Everything else has to be bought for cash. There are no trees to pick fruit from, no river nearby, no high mountains that we cultivate and treat as ours. It is a very alien concept."⁴⁸ The informant could have added, "There are no forest lands to

172. It is significant, The Consultant notes, that the village Patel from Makhadkhada is most concerned about getting as many major sons recognized as possible. The issue at the time of her visit to the area in 1992 was that the government went by the age of 18 years, whereas tribals recognized reaching of majority when a boy starts his own family or, more symbolically, he grows a mustache. After settling in the new sites, further encroachment for sons reaching majority will not be a possibility.

173. TISS conceptualized the issue well with respect to Maharashtra. This is discussed in the Gujarat context here, because the situations are identical:

Two dimensions of access to resources will undergo change for the people being resettled in the Taloda forest area compared to the situation in their original habitat: 1) Non-expandability compared to expandability, and 2) contraction compared to diversification. . . . In the resettled area, the people cannot expand their control over resources because of the location. It must be kept in mind in forest land freshly cleared for the purpose. Further, the density of the resettled population is going to be very high. Unless appropriate policy interventions are taken, people would tend to do what they and their forefathers have done for generations: clear fresh land for cultivation. It must be made clear to the resettlers that expansion of the land base by encroachment is not possible in the new area. Expansion through purchase is possible, which was never the case in the original village.

174. While at Taloda in Maharashtra, at least the tribals are near encroachable forest; in the Gujarat command area they are surrounded by farmland. They cannot even think of encroachment. Two issues branch off from the question of encroachment: (i) population control and (ii) more efficient means of livelihood, including non-land based occupations. Concerning the first issue, TISS points out that the resettled areas cannot support the high levels of fertility common in the submergence area. These are largely, as in much of rural India, a result of high infant mortality due to poor sanitation. "It is not that the growing population cannot be supported by the land given to them. Improved agricultural practices can support a growing population. But to provide them with a house and land will not be possible under the currently prevailing fertility level among the displaced population. The couples should be made conscious of this fact and helped to limit fertility. The people may be willing to limit fertility if the level of [infant] mortality could be brought down. Provision of better health care services along with child welfare services can bring down the child mortality. This is an urgent task."⁴⁹

175. The second issue related to encroachment that TISS raises is "diversification of resources and sources of livelihood." An important aspect of this is the promised irrigation to improve agricultural productivity. In 1989, the consultant raised the issue that insufficient attention was being paid to "how relocatees at new sites are to cope with the minimum of five to seven years

48 Bank consultant (1993b), p. 14.

49 TISS (1993), pp. 112-113.

between the cessation of their subsistence allowance and provision of irrigation water from SSP."⁵⁰

176. While Gujarat has made much progress in providing land to oustees, irrigation is still far off. By March 1993 only about 10% of the PAFs given land had received any form of irrigation (appendix "Entitlement Benefits").⁵¹ Rate of coverage varied from 34% of those PAFs from Gujarat's submergence villages, 5% of PAFs from Maharashtra villages, and 2% of those from Madhya Pradesh. In a twist of irony, the project that caused the relocation of the tribals to the command area is now required to assure their being able to adjust to post-relocation, without access to encroachable land.

177. "Given the problem of non-expendability of land, its shortage will be acutely felt in the next fifteen to twenty years, when accelerated sub-division of land among the new major sons starts. In such a situation, the diversification of sources of livelihood holds the key to survival." TISS recognizes the tribals may not be ready for non-land based rehabilitation strategies. "In this context, education of children becomes important. If children are educated and possess technical skills, the pressure on land could be substantially reduced."

178. Another issue related to the non-expendability of land, or the loss of large tracts of forest land, is livestock, particularly goats. "Goats formed a crucial aspect of the socio-economy of the people in their original village. Currently people have about four goats per household. If we assume that about 2,500 families are going to resettle in Taloda forest area, at least 10,000 goats will move with the people. Such a large goat population cannot be supported by the area. It would be ecologically disastrous to have such a large population of goats in a small area. Thus, it may not be possible to rear goats in the resettled area."⁵²

179. The Consultant has also provided some insights into the current dynamics of the resettlement areas in Gujarat. While formally "relocated," many oustees nevertheless rent out their allotted land at the relocation sites to local farmers or leave elderly family members to watch the crops until harvest time.⁵³ Thus many families enjoy incomes from their land holdings in the submergence area and at the relocation sites, while spending as little time in the R&R sites as possible.

180. Delay in submergence puts off commitment to the new site and also subverts the economic promise of irrigation. The Consultant, an anthropologist who spent a year studying a Gujarat submergence village, notes that "since the new land is still considered as an additional source of income, the villagers have not experimented with a large variety of crops or vegetables as yet . . . they are liberal in their criticism of [the new land] and . . . are reluctant to make much of an effort on it."

181. The Consultant points out that "the difference in terrain, crop variety and agricultural methods have resulted in the oustees of Makhadkhada being unable to gain the maximum potential of their land. . . . The methods needed to gain maximum benefit of each type of land is very different. The new land becomes soggy quickly and so specific agricultural activities such as ploughing, sowing and weeding can be done only on specific days when the soil conditions allow it. Failure to do this results in lower yields. . . ."

50 Bank consultant (1989). p. 6.

51 Based on: NCA. 1993. SSP: Annual Action Plan (1993-94) and Indicative Long Term Plan for R&R. Indore. May.

52 TISS (1993), pp. 113-114.

53 Bank consultant. (1993b). p. 10; also Centre for Social Studies. 1987. M&E Report 5: Resettlement and Rehabilitation: Sardar Sarovar Project on the Narmada. Surat. September 30. p. 35.

"The tribals have not realized the importance of the time bound nature of agriculture on the new land. Due to the time bound nature of work, outside labor must be employed to get the most work done under the right conditions. The community is currently limiting themselves to family labor (half of which is in the old land). In most cases, they are still using old and traditional seed varieties, lighter agricultural tools conditioned for work on hill slopes, and they are not investing enough in pesticides and fertilizers. Most of this is likely to change when they move permanently. However, they will have difficulty adjusting to this and training themselves to work when they have to, rather than when they want to." The Consultant, as does TISS, points to the critical need of an agricultural orientation program for tribals to understand the requirements of agriculture in the new land.

182. The Consultant's observations cover a wide range and, given limitations of space, are beyond the scope of this discussion. She notices that while women complain about a myriad of problems at the new resettlement site, many seem to prefer staying in the command area, where the domestic workload is less even if agricultural labor is more exacting, and there is close proximity to towns and social services. She points out that whereas it might take a couple of hours to walk to another hamlet, or more for another village, public transport makes it possible to visit friends and relations in other resettlement sites much quicker. This is assuming money is available, which is a major worry for Vasavas who have lived in a subsistence economy for generations.

183. The Consultant notices that Vasavas will only reluctantly change their consumption patterns. They prefer corn to other foods, and it doesn't grow well. They have a reluctance to give up self-sufficiency in food and to switch to cash crops. "PAFs have gotten less than maximum yields because they resist switching to cultivation of the grains the hosts cultivate. They feel the new land grows only a few crops and the diet lacks the variety of edible crops and forest produce they had access to in Makhadhada. On the other hand, villagers are buying onions, potatoes and aubergines, previously absent in their diet. There is also increased use of oil and spices. Living in the new land will no doubt expose them to the food hierarchy. Observation in the new sites shows that many will change their food habits over time."

184. While the difficulties of relocation are very real, The Consultant, like TISS, suggests many solutions, such as agricultural orientation programs, education for children, and help in diversifying sources of income. She does not seem pessimistic about the Vasava's chances adapting: "When talking about resettlement, the villagers always focus on economy. Religious and social changes do not seem to be given much priority. They have a very accepting attitude toward these changes. They often say, 'Of course our dances and songs will change over time, but that is inevitable. These are specific to the mountains. If the area where we perform a rite or that we sing about changes, the rite will change too. When we go to the 'desh', we have to adopt their ways. We will celebrate our festivals with the host village. Once that becomes our village, that village god becomes our god.'"⁵⁴

185. Her view contrasts sharply from that of the IRR, which stressed a tribal reference for the Narmada and an inability to move their gods to a new location: "Even people who say they are prepared to move, and can see that there could be advantages, told us that if they had a choice they would stay in their isolated villages. As people said at meetings at Makadhada, they do not want to leave their gods behind."⁵⁵ The Consultant says that resettlement will likely decontextualize the Vasava myths from their current geography, but that anyhow the Vasavas are "not strongly ritualistic." "Religious rites . . . are not part of their everyday existence or thought processes. The area of the six village dev stones [in Makhadhada] is not visited except on the three festival days and that too only by men boys and young girls."

54 Bank consultant (1993a), pp. 10, 12fnt, 13, 46.

55 IRR (1993), p. 108.

186. The Consultant says that while outsiders worry about the Vasava's loss of cultural identity, the Vasavas themselves "... tend not to view the subtle pressure of the mainstream to make them conform to their ways as a form of oppression. Rather, the ways of the mainstream in certain spheres of activity have become their role model; this is more in their socio-religious behaviour than in their economic behaviour. They are therefore quite willing to adapt and change in that direction. This is why they have not developed a feeling of inferiority as has been observed with various other isolated groups who have been thrust into the mainstream over a short span of time.."

187. "In the past five years, the villagers of Makhadkhada have experienced change at a faster pace than probably took place in the last thirty years. ... The main reason for this change is the increased exposure to the outside world. Recently, men, women and even children have had opportunities to leave the village. The catchment area program as well as the ongoing shifting of upstream villages has resulted in trucks passing through the village occasionally. Although earlier, most people left the village only for a specific purpose such as shopping, it is now not uncommon to see some of them taking rides on the trucks just for an outing to the town or to another village."⁵⁶

188. The Consultant, TISS and the other studies quoted make numerous recommendations for programs to help in the rehabilitation of the PAPs. These detailed recommendations are not dealt with here. The Bank has closed, at India's request, the Narmada project. However, the relocation aspects of this project will take many years to be resolved. It may be that, once the controversy surrounding the project has subsided, the Bank may consider financing some of the rehabilitation programs. In 1989, an internationally known R&R expert participating in a Bank supervision mission for the Sardar Sarovar Project reported:⁵⁷

... while the Bank guidelines on R&R ... are the most comprehensive of any multilateral or bilateral donor, they are also the most expensive with costs apt to vary between \$2,000 and \$3,000 per capita. Yet, in spite of the absence of other donors, the Bank is rarely willing to finance R&R implementation. Though earlier GOG requests for additional Bank funding tied specifically to R&R issues date back at least to November 1987, in December 1988 the Chairman of SSNNL requested such financing from Bank officials. If the World Bank really takes R&R seriously, it should be more willing to back up its policies with finance.

189. The Tribal Areas After Relocation (Madhya Pradesh): Although Madhya Pradesh has begun designing and building *abadi* sites for the Nimad Plains, submergence does not affect large numbers of tribals there. Within the tribal area, on the other hand, Madhya Pradesh has taken steps to provide R&R for tribals who do not wish to dismantle their social networks within the state to move to Gujarat. The State has identified nearly about 1,228 hectares of land for agricultural purposes and has identified 62 relocation sites. Layout plans have been finalized for 41 and construction of civic amenities has started for 14 of which 5 were to be ready by May 1994.

190. The Tribal Areas After Relocation (Maharashtra): The 2,700 hectares provided at Taloda in Maharashtra represents an ideal that was possible before the Forest Act of 1980. GOM, with GOI's formal approval, has made reserved forest available for resettling tribals. MOEF has released another 1,500 hectares for holding the numbers of tribals likely to choose resettlement within Maharashtra. The sites are being developed scientifically and settlement has already started.

56 Bank consultant (1993b) pp. 20, 22.

57 Bank consultant (1989), p. 5.

VI. Lessons Learned

191. A number of documents have outlined the lessons learned. The PCR largely accepts these as they stand as the main lessons from the project. These lessons are outlined in the following paragraphs. On May 19, 1993, a Bank statement entitled "Bankwide Lessons Learned from the Experience with the India Sardar Sarovar (Narmada) Project" was published. Four separate reasons were used to explain the difficulties encountered within the R&R program of the SSP and can be summarized as follows:

- a. There was an initial lack of baseline information pertaining to the PAPs in regard to their economic activity, level of income, future options and preferences. This information is essential for R&R planning purposes;
- b. There was an overall lack of specific policies covering the variety of different PAPs. Specifically, the broad policy to ensure an adequate standard of living was not translated into a concrete monitorable policy measurement;
- c. There was a lack of institutional arrangements to implement a proper R&R program. As a result, the R&R plans agreed to in the negotiations did not have much operational meaning; and
- d. Finally, there was a lack of adequate monitoring arrangements at project inception as the NCA as well as the other state monitoring organizations were unproven in the area of R&R evaluation.

192. However, while all these criticisms are largely valid, it is also true that in all four of these areas enormous strides were made during the early years of the project to the extent that the R&R undertaken to date is better than of any R&R undertaken in India. Indeed, the R&R work done in Gujarat has been used as a model for such work in other areas.

193. The May 1993 document on lessons learned underscores the need to improve the quality of the R&R process at entry of the project; the need to empower the borrowing or executing agency to take greater ownership in the implementation of the R&R process; the need for the Bank to develop better communication and decision making policies with regard to R&R; and the need to maintain strong ties with NGOs. These points were elaborated as follows:

- a. Quality At Entry - The quality of the R&R component at entry of the project could have been greatly improved by gaining substantive knowledge of R&R issues through prior consultations with PAPs. It was also necessary to fully understand the land acquisition process, transaction costs and the need for more relevant training on tribal issues. The training program should have been developed by obtaining more input from NGOs with local knowledge of the PAPs. Additionally, a detailed review early on the R&R process itself would have improved performance;
- b. Ownership - The Bank should have ensured that the borrower or executing agency assumed greater ownership of the R&R implementation process. In the case of the SSP, this would have required GOI to supervise execution of the R&R policies while the Bank played an "arms-length" role, holding the borrower to the terms under the loan/credit agreements. The SSP was particularly difficult because the states actually execute the R&R policies whereas the GOI enters into the financial agreements with the Bank while the states actually executed the R&R policies. The alternative of establishing a common authority which in turn would

have taken charge of all operational issues as regards R&R was not considered under the NWDT award and was not possible under the Indian Constitution.

- c. Communications and Decision Making - There were major political difficulties to be faced in achieving R&R objectives across three states. Facilitating communications between the states should have been set as an early priority; decision making should have been made more explicit and timely. In addition, alternate views should have been both recognized and encouraged. A well-qualified sociologist/anthropologist should have been hired to be in a responsible position to handle R&R issues for the Bank. The SSP lacked this needed expertise and authority at the early stages of appraisal and supervision; and
- d. NGO Relations - Through the development of the R&R policy for the SSP, the Bank recognized the importance of obtaining inputs from NGOs to construct a more acceptable policy. During the early years of project implementation in Gujarat, NGOs played an increasingly useful role in the project. With respect to public relations, the report felt that NGO complaints should have been responded to by the borrower rather than the Bank.

194. The Management response to the Independent Review, prepared in September 1992, also made mention of the lessons learned from the experience with the SSP. The Management maintained that the SSP was an economically sound endeavor, even after full allowance was made for R&R costs; a very large drought-prone area in Western India would have access to water crucial for irrigation and basic human consumption. However, the Management added that the project's success would depend upon the successful implementation of its R&R component. Additionally, the capacity must be created within the project to take ameliorative action as R&R and environmental issues arise.

195. The "OED Special Study: Early Experience with Involuntary Resettlement - Overview", produced in May 1993, contributes to the Bank's overall understanding of R&R issues. After a thorough review of the R&R components of four separate agriculture and energy development projects, one of which was Sardar Sarovar, the following main conclusions were drawn:

- a. Systematic attention must be given to minimize displacement;
- b. Attention must be given to the rehabilitation program in addition to the displacement and resettlement process;
- c. High priority must be given to acquiring land in the command area to afford people affected by the project the opportunity to increase their income by resettling there; and
- d. Unlike irrigation projects, those projects which cannot promise an increase in income for PAPs should include a separate development project. This rehabilitation mechanism would begin after the people have moved and would help to increase the incomes of the affected families as its main objective.

196. In addition, the Bank and the Borrower both under-estimated the complexity and the time required for resettling and rehabilitating over 100,000 people mostly because it was the first time that such high standards of R&R were being applied to a project in India. Throughout project implementation, the Bank and the Borrower went through a learning process and are now much better equipped to tackle R&R implementation. During this process, NGOs played an important role in drawing the attention of the Borrower and the Bank to the inadequacies of implementation particularly in treating all categories of oustees whether they be landed, landless or tribal equitably. This project has been the source of many improvements in R&R policies and implementation which are now being applied to other projects. In the field of policies, the principle of land for

land was implemented on a large scale, adult sons were recognized as separate families, tribal people living in Government forest lands were considered as landed families, and the need for additional assistance for subsistence and house construction was recognized. On the implementation side, Gujarat developed a unique mechanism for acquiring replacement agricultural land at market price through Land Purchase Committees. Well developed R&R wings with central monitoring cells were established.

197. Based on both the findings of earlier reports and the findings of the PCR it is concluded that there are six main lessons to be drawn. The first lesson on R&R concerns the complexity of R&R and the need for well established and agreed objectives, policies and plans prior to project approval. House to house socio-economic surveys following a participatory approach are essential not only to gather data on village life and economic status of oustees but also to: (i) familiarize each family with their rights and benefits, (ii) register the wishes of the affected persons, and (iii) prepare realistic and implementable R&R plans. The R&R plans should cover not only the socio-economic aspects of R&R but also the physical planning of the new resettlement centers which includes: (i) site selection, (ii) layout of civic amenities and house plots, (iii) construction programs, and (iv) cost estimates. The initial surveying and planning phase is a lengthy operation which must be initiated at least three to four years prior to the date of resettlement depending on the size of the R&R program.

198. The second lesson on R&R relates to the proper identification and classification of oustees. Usually the Government has an official list which is based on the land acquisition procedure. This list is incomplete as it does not take into account the persons living on government lands - often called encroachers - or the tenants and migrating populations who own no land or house. The implementation of a house to house socio-economic survey is not only necessary to establish the pre-project situation but also to remedy the lacunas of the Government lists and help in preparing the R&R plan in line with the wishes of the oustees. Following the socio-economic survey, a final list of oustees should, therefore, be prepared by reconciling the Government and survey lists. This exercise should be done through village meetings during which the villagers, the Government officials and the surveyors discuss and agree on a final list. During these meetings R&R Identification Cards indicating the category and the benefits should be established for each eligible oustee. These ID cards provide the oustees a sense of confidence that: (i) they are officially recognized as oustees, and (ii) they are eligible to a number of benefits before resettlement takes place.

199. The third lesson on R&R refers to the participatory approach to R&R planning. This approach is essential to create an awareness and build up confidence between the oustees and the Government officials. NGOs can be used but, in places where they are not active, it is useful to select among the oustees R&R motivators who will act as intermediaries between the R&R officials and the oustees. Their role will consist in informing and communicating the R&R policies through meetings with oustees and distribution of leaflets describing the R&R policies. The socio-economic survey should follow the participatory approach and each surveyor should be perfectly aware of the rights and benefits of each oustee. At the end of the survey, the survey team should make recommendations on the needs of the oustees and assist the R&R officials in preparing the village-wise R&R plans.

200. The fourth lesson on R&R concerns the land for land principle for economic rehabilitation. This principle has been applied to landed oustees because it is one of the most reliable means to restore or even improve their living standards. This is particularly true when oustees are resettled in the irrigation command area as was done in Gujarat. However, this principle should not be considered universal because the evidence suggest a number of small land owners may want to move out of agriculture and be provided permanent jobs. The employment of oustees on construction sites or the provision of jobs under state employment guarantee schemes are not satisfactory solutions because they are not permanent solutions to employment. Therefore, economic rehabilitation schemes should be geared to provide permanent jobs such as: (i) allocation of government jobs to the extent possible, (ii) on the job training and provision of jobs in local industries or business concerns and, (iii) allocation of financial assistance for income generating schemes.

201. The fifth lesson on R&R concerns the procedure for the application of the land for land principle. The procedure for acquiring and allocating replacement agricultural land to landed oustees needs to be well defined as part of project preparation and appraisal. First, it is essential to carry out a survey on land availability, early in the program, to determine where land can be acquired and the likely market price. Second, oustees preference for places of relocation and desire to be allocated replacement land should be investigated through the socio-economic surveys. Third, resettlement centers must be located close to the places where replacement land is available and designed accordingly. And Fourth the responsibilities for financing and acquiring land must be defined in advance. In the case of SSP, Land Purchase Committees were set up by Gujarat to acquire land under the Land Acquisition Act, 1894 while the Irrigation Department with the assistance of the rural planners were given the task of locating, planning and constructing the resettlement centers. Both tasks were large and the lack of coordination between the two led to some difficulties in matching land availability with location of resettlements and oustees wishes. An alternative to this procedure, which has been implemented with success under the Upper Krishna II project, consists in locating the resettlement centers as per the findings of the socio-economic surveys and, thereafter, assisting the oustees in purchasing replacement agricultural land on their own through grants and loans deposited in advance in managed bank accounts.

202. The sixth lesson on R&R concerns the compensation to be paid to oustees for loss of land and structures. Government estimates have always been under valued and have led to a large number of court cases to enhance compensation. To avoid such situations, it is essential that compensation be based on actual market price. This can be achieved by setting up Land Valuation Committees comprising representatives of the Government and the oustees to fix a fair market price as was done in Gujarat. However, the fair market price is usually not sufficient to purchase land of equivalent size, or reconstruct a house and other structures such as a well or to replace an plantation crops. While fair evaluation of fixed assets can help, it is also necessary to provide additional financial assistance in form of grants and credit to the oustees. In cases where land acquisition has already been completed, it is essential to set up as part of the project a mechanism to redress inadequate land compensation and accelerate the outstanding court cases. This can be done through special courts whose mission is to arrive at a rapid agreement on an enhanced compensation amount followed by immediate payment by the Government.

203. Overall, there have been a wide range of lessons from the R&R experience in SSP and many of these lessons have already been incorporated in on-going further work on R&R both by the Bank and GOI.

Attachment I
Narmada Water Dispute Tribunal Award
Resettlement and Rehabilitation

Definition of an "oustees":

"An 'Oustee' shall mean any person who since at least one year prior to the date of publication of the notification under section 4 of the Act, has been ordinarily residing or cultivating land or carrying on any trade, occupation or calling or working for gain in the area likely to be submerged permanently or temporarily." (Clause I(1)).

Compensation aspects of the NWDT:

"Gujarat shall pay to Madhya Pradesh and Maharashtra all costs including compensation, charges and expenses incurred by them for or in respect of the compulsory acquisition of lands required to be acquired as aforesaid." (Clause III(1)).

"Gujarat shall also provide the following grants and amenities to the oustees:

- a) Resettlement Grant (Rehabilitation Grant) - Gujarat shall pay per family a sum of Rs. 750 inclusive of transportation charges as resettlement grant.
- b) Grant-in-aid.
- c) Civic amenities:
 - i. One primary school (3 rooms) for 100 families
 - ii. One Panchayat Ghar for every 500 families
 - iii. One Dispensary for every 500 families
 - iv. One seed store for every 500 families
 - v. One children's park for every 500 families
 - vi. One village pond for every 500 families
 - vii. Drinking water well with trough for every 50 families
 - viii. Each colony should be linked to main road by roads of appropriate standard.
 - ix. One platform for every 50 families
 - x. Every oustee family shall be entitled to and allotted a house site, i.e. a plot of land measuring 60'x 90' free of cost. In addition, a provision of 30 per cent additional area for roads, Government buildings, open space etc shall be made by Gujarat under civic amenities." (Clause IV(3)).

"Gujarat shall pay to Madhya Pradesh and Maharashtra land revenue in accordance with the respective Land Revenue Codes of Madhya Pradesh and Maharashtra in respect of all lands in their respective territories acquired for Gujarat or conveyed to it." (Clause III(3)).

"In no event shall any areas in Madhya Pradesh and Maharashtra be submerged under the Sardar Sarovar unless all payment of compensation, expenses and cost as aforesaid is made for acquisition of land and properties and arrangements are made for the rehabilitation of the oustees therefrom in accordance with these directions and intimated to the oustees." (Clause IV(6) ii).

Provision for Rehabilitation:

"Gujarat shall establish rehabilitation villages in Gujarat in the irrigation command of the Sardar Sarovar Project on the norms hereinafter mentioned for rehabilitation of the families who are willing to migrate to Gujarat. For oustee families who are unwilling to migrate to Gujarat, Gujarat shall pay to Madhya Pradesh and Maharashtra the cost, charges and expenses for establishment of such villages in their respective territories on the norms as hereinafter provided." (Clause IV(1)).

Allotment of Agricultural Land:

"Every displaced family from whom more than 25 per cent of its land holding is acquired shall be entitled to and be allotted irrigable land to the extent of land acquired from it subject to the prescribed ceiling in the State concerned and a minimum of 5 acres per family." (Clause IV(7)).

"Of the price to be paid for the land a sum equal to 50 per cent of the compensation payable to the oustee family for the land acquired from it will be set off as an initial installment of payment. The balance cost of the allotted land shall be recovered from the allottee in 20 yearly installments free of interest." (Clause IV(7)).

ATTACHMENT IIComparison of R&R Entitlements: NWDT Award and State Policies**STATE AND NWDT R&R POLICIES**

Individual Benefits	NWDT Award	Gujarat	Madhya Pradesh	Maharashtra
Definition of Oustee	Any person, residing or cultivating land or carrying out any trade or working for gain in the area at least one year prior to issuance of Notification under Section 4 of Land Acquisition Act.	Same as under NWDT Award. a) Cut off date for major son for (Gujarat & Maharashtra resettling in Gujarat) considered as a separate family, fixed as 01/01/87. b) For MP oustees to be resettled in Gujarat: Cut off date for major son is considered one year prior to date of issuance of Notification under Section 4 of Land Acquisition Act.	Any person ordinarily residing or carrying on any trade or vocation for his livelihood at least one year prior to issuance of notification under Section 4 of Land Acquisition Act or has been cultivating land for at least three years prior to such notification in an area which is likely to come under submergence, whether temporarily or permanently, due to the project or otherwise required for the project.	Same as under NWDT Award. Additional: (Major unmarried daughter will be considered separate family). (Cut off date for major son and unmarried daughter for considering them as separate family is fixed as 01/01/87.)
Landed Oustees	25% or more land submerged entitled to minimum 2 ha irrigable land with a ceiling set by the State. 50% of compensation payable as initial installment, balance recovered as 20 year loan.	As per NWDT Award. <u>Additional Benefits:</u> Co-sharer, Joint Holder will get minimum 2 ha land up to State Ceiling (6 ha). Ex-Gratia Payment.	As per NWDT Award. <u>Additional Benefits:</u> Cosharer, Joint Holder will get minimum 2 ha land up to State Ceiling (8 ha). If below poverty line, get "land for land."	As per NWDT Award. <u>Additional Benefits:</u> Co-sharer, Joint Holder will get minimum 2 ha land up to State Ceiling (7 ha). Free of cost.
Encroacher Oustees	No provision for land	2 ha land for encroachment one year prior to issuance of notice for land acquisition, and cash compensation for the balance of land, if any.	1 ha to 2 ha land for encroached land coming under submergence with 13.04.87 cut-off date and cash compensation for the balance of land if any.	2 ha land for encroachments up to 31.03.78 and cash compensation for the balance land, if any.

Individual Benefits	NWDT Award	Gujarat	Madhya Pradesh	Maharashtra
Landless Oustees	No provision for land	a) Landless agricultural laborer - 2 ha land with ex-gratia. b) Other landless - Land for shop at resettlement site and Rs 5,000 as financial assistance.	a) Landless agricultural laborer Economic package @ Rs.29,000 each. b) Other landless (except SC/ST) Rs.19,500 each.	(a)(b) - 1 ha land if Oustee moves with others.
Major sons of above categories of Oustees	No provision for land	a) Major sons of all categories of Oustees except non-agricultural landless - @ 2 ha land each. b) Major sons of non-agricultural landless family - land for shop at relocation sites and Rs.5,000 as financial assistance.	a) Major sons of SC/ST, small and marginal farmers and landless agricultural laborers: Economic Package @ Rs.29,000 each. b) Major sons of other Oustees. Economic package @ Rs.19,500 each.	1 ha land to each major son and unmarried daughter. Need proof of status before Jan 1, 1987.
Acquisition of Private land/Houses which get isolated or physically cut off.	Not dealt with.	Would be acquired and owners treated as Oustees.	Would be acquired and owners treated as Oustees.	Would be acquired and owners treated as Oustees.
House Plots	Oustee and major son will get house plot of size 60' x 90' free of cost.	As per NWDT Award.	As per NWDT Award.	As per NWDT Award. <u>Additional Benefits:</u> Major unmarried daughter also entitled separately.

Individual Benefits	NWDT Award	Gujarat	Madhya Pradesh	Maharashtra
Rehabilitation Grant-in-aid, Subsistence allowance, etc.	Rehabilitation grant Rs.750 inclusive of transportation charges to each family and major son. Grant-in-aid up to Rs.500 for each family if total compensation received is less than Rs.2,000.	As per NWDT Award. <u>Additional Benefits:</u> a) Subsistence allowance of Rs.15 per day for 300 days. b) Cost escalation @ 8% per year from 1980 on rehabilitation grant. c) Productive assets @ Rs.5,000. d) Special Assistance of Rs.10,000 to construct pucca house plinths.	Rehabilitation grant of Rs.11,000 to SC/ST, small and marginal farmers, landless agricultural laborers and their major sons. For other Oustees and their major sons @ Rs.5,500	As per NWDT Award. <u>Additional Benefits:</u> a) Subsistence allowance Rs.15 per day for 300 days. b) Cost escalation of 8% per year from 1980 on rehabilitation grant. c) Productive assets up to Rs.14,500 under different tribal welfare schemes. (Major unmarried daughter will also get separately).
Transportation Grant	Included in Rehabilitation grant of Rs.750.	<u>Additional Benefits:</u> Free transportation will be provided for shifting.	<u>Additional Benefits:</u> Free transportation will be provided for shifting (if not taken, a lump sum grant of Rs.500 to be given).	<u>Additional Benefits:</u> Free transportation will be provided for shifting.
<u>Compensation</u>				
(a) Land	As per Land Acquisition Act in operation at time of acquisition	As per NWDT Award	More liberal than NWDT Award. Rate of compensation for acquired land on the basis of price of similar land in the adjacent command area.	As per NWDT Award
(b) Houses	As per Land Acquisition Act	As per NWDT Award	More liberal than NWDT Award (replacement value of acquired houses).	As per NWDT Award

Community Benefits	NWDT Award	Gujarat	Madhya Pradesh	Maharashtra
Civic Amenities	<p><u>Each Colony:</u></p> <p>Electrification, water supply, sanitation, etc.</p> <p>Linked to main road by roads of appropriate standards.</p> <p><u>For every 50 families:</u></p> <p>One tree platform.</p> <p><u>For every 100 families:</u></p> <p>One primary school (3 rooms).</p> <p><u>For every 500 families:</u></p> <p>One Panchayat Ghar. One dispensary. One seed store. One children's park. Religious place of worship.</p>	<p>As per NWDT Award.</p> <p><u>Additional Benefits:</u></p> <p>Provision of NWDT Award has been relaxed for providing civic amenities as per requirement at relocation sites.</p> <p>Transit accommodation.</p>	<p>As per NWDT Award.</p> <p><u>Additional Benefits:</u></p> <p>Threshing ground. Cremation and Burial Ground.</p> <p>Social amenities for each municipal town, viz, water supply, sanitation, etc.</p> <p>Any other facility such as middle school which was existing in the affected village, and its improvement.</p>	<p>As per NWDT Award.</p> <p><u>Additional Benefits:</u></p> <p>Play ground for school (1 acre for primary and 2 acre for secondary).</p> <p>Public latrines. Open place for collection of animals.</p> <p>Khalwadi (Threshing platform). S.T. Stand. Grazing Land. Open place for Bazaar. Cremation/burial ground. Internal roads. Transit accommodation.</p>

Community Benefits	NWDT Award	Gujarat	Madhya Pradesh	Maharashtra
Other Facilities.	Nil.	<p>Ex-gratia payment to cover the difference of cost of allotted land and acquired land.</p> <p>Vocational and ITI training to Oustee families.</p> <p>Preference in employment.</p> <p>Implementation of all existing welfare schemes at relocation sites.</p>	<p>Grant-in-aid of Rs.1,000 per ha for 2 years if interest-free loan is not taken.</p> <p>Ex-gratia payment to cover the difference of cost of allocated land and acquired land for SC/ST and other land owners owning land up to 2 ha. For others, ex-gratia @ Rs.2,000 per ha or 50% of the difference in the cost of allotted land and acquired land which ever is less.</p> <p>Preference in Government employment and age relaxation in Government jobs.</p> <p>Implementation of all existing welfare schemes at relocation site.</p>	<p>House building (interest free loan):</p> <p>(i) Land holder - Rs.8,000;</p> <p>(ii) Landless Laborers - Rs.4,000.</p> <p>Preference in employment of Class-III & IV Posts and reservation in project establishment & ITI.</p> <p>Implementation of all existing welfare schemes at relocation sites.</p> <p>Occupancy price and development cost for allotted land at Taloda or nearby in Maharashtra will not be charged to Oustee families.</p>

Attachment IIISardar Sarovar Dam Resettlement Program

	<u>Gujarat</u>		<u>Maharashtra</u>		<u>M.P</u>		<u>Total</u>	
	<u>SAR</u>	<u>PCR</u>	<u>SAR</u>	<u>PCR</u>	<u>SAR</u>	<u>PCR</u>	<u>SAR</u>	<u>PCR</u>
Area Inundated (ha)	11,608	7,469	7,050	9,399	22,882	20,722	41,540	37,590
Villages (No.)	19	19	36	33	180	193	235	245
Families (No.)	1,900	4,500	1,358	3,500*	7,500	33,014**	10,758	41,014
Persons (No.)	10,593	14,400	11,747	11,200	45,000	105,645	67,340	131,245

* Estimate based on partial resurvey of 15 villages out of 33. It is likely to increase further

** May increase after land acquisition is completed

Source SAR, Feb. 1985, p. 24; R&R Status Report, NCA, May 1994

Attachment IVSardar Sarovar Status of R&R Implementation as of December 31, 1993

	PROJECT AWARD (A)	STATUS AS OF December 1993 (B)	ACHIEVEMENT (B) AS OF (A)
I. LAND ALLOTMENT BY BENEFICIARY CATEGORIES: 22,227 PAFs (of total 40,805 PAFs) will be entitled to an allotment of land in one of the three States.			
A. LANDED PAF (incl. cosharers and Tapu land holders)	NWDI Award. All States: 25% or more land submerged entitled to minimum 2 ha irrigable land with a ceiling set by the State. 50% of compensation payable as initial installment, balance recovered as 20 year loan.		
Gujarat 1,409 PAFs	Gujarat: Cosharer, Joint Holder will get minimum 2 ha land up to State Ceiling (6 ha). Ex-Gratia Payment to cover the difference of cost of allotted land and acquired land.		
Maha. 1,464 PAFs	Maharashtra: Cosharer, Joint Holder will get minimum 2 ha land up to State Ceiling (7 ha). Free of cost. Occupancy price and development cost for allotted land at Taloda or nearby in Maharashtra will not be charged to Oustee families.		
MP 9,540 PAFs	Madhya Pradesh: Cosharer, Joint Holder will get minimum 2 ha land up to State Ceiling (8 ha). If below poverty line, get "land for land." Grant-in-aid of Rs 1,000 per ha for 2 years if interest-free loan is not taken. Ex-gratia payment to cover the difference of cost of allocated land and acquired land for SC/ST and other land owners owning land up to 2 ha. For others, ex-gratia @ Rs 2,000 per ha or 50% of the difference in the cost of allotted land and acquired land which ever is less.		
TOTAL 12,413 PAFs			
B. ENCROACHER PAF	NWDI Award: No provision for land		
Gujarat 28 PAFs	Gujarat: 2 ha land for encroachment one year prior to issuance of notice for land acquisition, and cash compensation for the balance of land if any.		
Maha. 12 PAFs	Maharashtra: 2 ha land for encroachments up to 31.03.78 and cash compensation for the balance land if any.		
MP 445 PAFs	Madhya Pradesh: 1 ha to 2 ha land for encroached land coming under submergence with 13.04.87 cut-off date and cash compensation for the balance of land if any.		
TOTAL 485 PAFs			
C. LANDLESS PAF (agricultural laborers)	NWDI Award: No land provision.		
Gujarat 818 PAFs	Gujarat: Landless agricultural laborer - 2 ha land with ex-gratia.		
Maha. 490 PAFs	Maharashtra: 1 ha land if Oustee moves with others.		
MP 5,776 PAFs	Madhya Pradesh: No Land provision. (Economic package @ Rs.29,000 each).		
TOTAL 7,084 PAFs			
D. LANDLESS PAFs (non-agricultural)	NWDI Award: No land provision.		
Gujarat 28 PAFs	Gujarat: No land provision. (Land for shop at resettlement site and Rs 5,000 as financial		

Maha. —	Maharashtra: 1 ha land if Oustee moves with others.		
MP 2,235 PAFs	Madhya Pradesh: No land provision. (Rs 19,500 each, except SC/ST)		
TOTAL 2,263 PAFs			
E. Major sons of A. B. C	NWDT Award: No land provision.		
Gujarat 2,217	Gujarat: Major sons of all categories of Oustees except non-agricultural landless - @ 2 ha land each. (Major sons of non-agricultural landless family - land for shop at relocation sites and Rs 5,000 as financial assistance)		
Maha. 835	Maharashtra: 1 ha land to each major son and unmarried daughter. Need proof of status before Jan 1, 1987.		
MP 15,080	Madhya Pradesh: No land provision. (Major sons of SC/ST, Small and marginal farmers and landless agricultural laborers: Economic Package @ Rs 29,000 each. Major sons of other Oustees. Economic package @ Rs 19,500 each)		
TOTAL 18,132			
2. LAND ALLOTMENT BY STATE: A total of 45,092 Ha will be required for the three States.			
A. Gujarat PAFs - requiring land (Landed, co-sharers, encroachers & major sons):			
Gujarat: 4,472 PAFs	Target: 8,944 Ha	Gujarat: 4,243 PAFs allotted 8,447 ha agricultural land. Ex-Gratia paid to 4,212 PAFs	PAFs 95% Land 100% Ex-Gratia 94%
Maha. to Gujarat: 999 PAFs	Target: 2,000 Ha	Maharashtra: 604 PAFs have been allotted 1225 ha of agricultural land. Ex-Gratia paid to 294 PAFs	PAFs 61% Land 61% Ex-Gratia 29%
MP to Gujarat: 13,294 PAFs	Target: 28,248 Ha	MP: 1,723 PAFs have been allotted 3,246 ha of agricultural land. Ex-Gratia paid to 130 PAFs	PAFs 13% Land 12% Ex-Gratia 1%
Total requiring land in Gujarat: 15,702 PAFs	Target: 39,192 Ha (Gujarat has 16,446 ha currently available. Another 8,837 ha is identified or being negotiated. Including land already allotted, this leaves another 991 ha to be identified and acquired)	6,570 PAFs have been allotted 12,918 ha of agricultural land. Ex-Gratia paid to 4,636 PAFs	PAFs 42% Land 33% Ex-Gratia 30%
B. Maharashtra PAFs requiring land (Landed, co-sharers, encroachers & major sons): 1,802 PAFs	Target: 3,900 Ha (2,500 ha of land at Taloda, not including 200 ha for abadi sites, already acquired. An additional 1,400 ha has been applied for at Akkalkuwa, not including 100 ha for abadi sites).	687 Families have been allotted 1,105 ha of land for agriculture.	PAFs 38% Land 28%
C. Madhya Pradesh PAFs requiring land (Landed, co-sharers, encroachers & major sons): 803 PAFs	Target: 2,000 Ha	1,228 ha identified	PAFs 0% Land (a qualified 61%)
TOTAL ALL THREE STATES PAFs REQUIRING LAND: 22,227 PAFs	Target: 45,092 Ha	7,257 PAFs have been allotted land or it has been identified:	PAFs 33% Land 34%

3. HOUSE PLOTS	NWDI Award: Oustee and major son will get house plot of size 60' x 90' free of cost.		
A. GUJARAT:	Gujarat: NWDI Award, plus: Special Assistance of Rs 10,000 to construct pucca house plinths.		
From Gujarat: 4,500 PAFs		4,160 PAFs have been allotted house plots (103 sites).	93%
From Maharashtra: 999 PAFs		577 PAFs have been allotted house plots (13 sites).	58%
From Madhya Pradesh: 13,294 PAFs		1,374 PAFs have been allotted house plots (22 sites).	10%
Gujarat Total: 18,793 PAFs		6,111 PAFs (138 sites).	33%
B. MAHARASHTRA: 1,802 PAFs	Maharashtra: NWDI Award, plus: Major unmarried daughter also entitled separately. House building (interest free loan): (i) Land holder - Rs.8,000; (ii) Landless Laborers - Rs.4,000.	678 PAFs have been allotted house plots at Taloda.	38%
C. MADHYA PRADESH: Abadi Sites only: 19,380 PAFs Requiring both resettlement and rehabilitation: 830 PAFs MP Total: 20,210 PAFs TOTAL: 40,805 PAFs	Madhya Pradesh: NWDI Award	424 PAFs have been allotted house plots (6 abadi sites, from 8 villages).	2%
4. REHABILITATION GRANT, GRANT-IN-AIDE, SUBSISTENCE ALLOWANCES, ETC.	NWDI Award: Rehabilitation grant Rs.750 inclusive of transportation charges to each family and major son. Grant-in-aid up to Rs.500 for each family if total compensation received is less than Rs.2,000.	7,213 PAFs	18%
A. GUJARAT:	Gujarat: As per NWDI Award. Plus: a) Cost escalation @ 8% per year from 1980 on rehabilitation grant. b) Subsistence allowance of Rs 15 per day for 300 days. c) Insurance coverage		
From Gujarat: 4,500 PAFs		3,095 PAFs received rehabilitation grants. 4,110 PAFs received subsistence allowance (March 1993). 4,500 PAFs received insurance coverage. 4,500 PAFs received ration cards.	Grants 69% Subsistence Allowance 91% Insurance 100% Ration cards 100%
From Maharashtra: 999 PAFs		21 PAFs received rehabilitation grants. 316 PAFs received subsistence allowance (March 1993). 584 PAFs received insurance coverage. 250 PAFs received ration cards (March 1993).	Grants 2% Subsistence Allowance 32% Insurance 59% Ration Cards 25%

From MP: 13,294 PAFs		No PAFs received rehabilitation grants. 660 PAFs received subsistence allowance (March 1993). 1,021 PAFs received insurance coverage. 750 PAFs received ration cards.	Grants 0% Subsistence Allowance 5% Insurance Coverage 8% Ration cards 6%
Total: 18,793 PAFs		3,116 PAFs received rehabilitation grants. 5,086 PAFs received subsistence allowance (March 1993). 5,205 PAFs received insurance coverage (March 1993). 5,500 PAFs received ration cards (March 1993).	Grants 17% Subsistence Allowance 27% Insurance 28% Ration Cards 29%
B. MAHARASHTRA 1,802 PAFs	Maharashtra: As per NWDI Award. Plus: a) Cost escalation of 8% per year from 1980 on rehabilitation grant. b) Subsistence allowance Rs.15 per day for 300 days.	32 PAFs received rehabilitation grants. 659 PAFs received subsistence allowance. 100 PAFs received ration cards (March 1993).	Grants 2% Subsistence Allowance 37% Ration cards 6%
C. MADHYA PRADESH 20,210 PAFs	Madhya Pradesh: Rehabilitation grant of Rs 11,000 to SC/ST, small and marginal farmers, landless agricultural laborers and their major sons. For other Oustees and their major sons @ Rs 5,500.	No implementation	0%
5. TRANSPORTATION GRANT	NWDI Award: Included in Rehabilitation grant of Rs 750.		
A. GUJARAT	Gujarat: Additional Benefits: Free transportation will be provided for shifting.		
From Gujarat: 4,500 PAFs		Not clear	
From Maharashtra: 999 PAFs		500 PAFs (March 1993)	50%
From Madhya Pradesh: 13,294 PAFs		1,112 PAFs (March 1993)	8%
B. MAHARASHTRA 1,802 PAFs	Maharashtra: Additional Benefits: Free transportation will be provided for shifting.		
C. MADHYA PRADESH 20,210 PAFs	Madhya Pradesh: Additional Benefits: Free transportation will be provided for shifting (if not taken, a lump sum grant of Rs 500 to be given).		
6. COMPENSATION			
A. Land	NWDI Award: As per Land Acquisition Act in operation at time of acquisition.		
Gujarat: Compensation to be paid in 19 Villages	Gujarat: As per NWDI Award		
Maharashtra: Compensation to be paid in 33 Villages	Maharashtra: As per NWDI Award		

Madhya Pradesh: Compensation to be paid in 184 Villages (of total 193 Villages affected)	Madhya Pradesh: More liberal than NWDI Award. Rate of compensation for acquired land on the basis of price of similar land in the adjacent command area.	Section IV - 148 Villages. Award passed for compensation in 17 villages & Rs.2,718,000 has been distributed to 90 PAFs in 8 villages.	Section IV: 80% + Compensation: 4%
Total compensation to be paid (land acquired) in 214 Villages (of 245 affected).			
B. Houses	NWDI Award: As per Land Acquisition Act in operation at time of acquisition.		
	Gujarat: As per NWDI Award		
	Maharashtra: As per NWDI Award		
	Madhya Pradesh: More liberal than NWDI Award (replacement value of acquired houses).		
7. CIVIC AMENITIES	NWDI AWARD Each Colony: Electrification, water supply, sanitation, etc. Linked to main road by roads of appropriate standards. For every 50 families: One tree platform. For every 100 families: One primary school (3 rooms). For every 500 families: One Panchayat Ghar. One dispensary. One seed store. One children's park. Religious place of worship.		
8. OTHER FACILITIES			
A. GUJARAT	Gujarat: As per NWDI Award, plus: Provision of NWDI Award has been relaxed for providing civic amenities as per requirement at relocation sites. Transit accommodation.		
PAFs from Gujarat: Target 100 relocation sites for 4,500 PAFs.	Target: 30 Primary Schools 100 Health Services	From Gujarat: 4,243 PAFs @ 103 relocation sites. 15 Primary Schools (March 1993) 70 Health Services (March 1993)	Sites 103% PAFs 94% Primary Schools 50% Health Services 70%
PAFs from Maharashtra: 16 relocation sites planned for 999 PAFs.	Target: 10 Primary Schools 10 Health Services	From Maharashtra: 604 PAFs at 32 relocation sites. 1 Primary School (March 1993) 1 Health Services (March 1993)	Sites 200% PAFs 61% Primary Schools 10% Health Services 10%
PAFs From Madhya Pradesh: 155 relocation sites planned for 13,294 PAFs.	Target: 60 Primary Schools 155 Health Services	From MP: 1,723 PAFs from 33 villages @ 42 relocation sites 11 primary school built (March 1993) 15 Health Services	Sites 21% PAFs 13% Primary Schools 18% Health Services

Gujarat: Target 271 Relocation Sites for 18,748 PAFs.(Possibly up to 391 sites)		Gujarat: 177 Relocation Sites for 6,570 PAFs	Sites: 45-65% PAFs 35%
B. MAHARASHTRA Target: 4 Abadi Sites for 1,802 PAFs.	Maharashtra: As per NWDI Award, plus: Play ground for school (1 acre for primary and 2 acre for secondary). Public latrines. Open place for collection of animals. Khalwadi (Threshing platform). S.T. Stand. Grazing Land. Open place for Bazaar. Cremation/burial ground. Internal roads. Transit accommodation	Maharashtra: 1 Abadi site was established, May 1991 (Somawal, now called Narmada Nagar), 678 PAFs allotted sites: 120 transit sheds 1 school 1 dispensary 1 seed storage godown 4 hand pumps 1 overhead water tank 1 water trough, etc. completed. Ashram school is functioning. Electrification and internal/approach roads completed. Construction in progress at remaining two sites.	Site 33% PAFs 38%
C. MADHYA PRADESH Target: 114 Abadi Sites for 20,210 PAFs	Madhya Pradesh: As per NWDI Award, plus: Threshing ground. Cremation and Burial Ground. Social amenities for each municipal town, viz, water supply, sanitation, etc. Any other facility such as middle school which was existing in the affected village, and its improvement.	Completed: 5 relocation sites Under construction 14 relocation sites Layout Plans finalized: 41 relocation sites Surveyed: 62 relocation sites Total: 102 relocation sites Works Completed: 1,352 Transit Sheds 11 Primary Schools 12 Wells 48 Hand Pumps 7 km approach roads 33 km internal roads 31 tree platforms 14 electrification 1,296 ha identified/acquired	Sites: 1% completed 90% under planning or completed
9. <u>NON-LAND BASED INCOME GENERATION SCHEMES</u>	<u>NWDI Award</u>		
A. GUJARAT Target: From Gujarat: 4,500 PAFs From Maha.: 999 PAFs From MP: 13,294	Productive assets @ Rs.5,000.	From Gujarat: 3,892 PAFs From Maha: 325 PAFs From MP: 850 PAFs (March 1993)	Gujarat 87% Maharashtra 33% Madhya Pradesh 6%

Target: From Gujarat: 2,000 PAFs From Maha.: 300 PAFs From MP: 5,000 PAFs	Vocational and ITI training to Oustee families.	From Gujarat: 1,200 PAs From Maha: 250 PAFs From MP: 200 PAFs (March 1993)	Gujarat 60% Maha. 83% MP 4%
Target: From Gujarat: 1,000 PAFs From Maha.: 50 PAFs From MP: 500 PAFs	Preference in employment. Implementation of all existing welfare schemes at relocation sites.	From Gujarat: 356 PAFs From Maha: 11 PAFs From MP: 13 PAFs (March 1993)	Gujarat 36% Maha. 22% MP 3% % of targets for welfare schemes not known.
28 PAFs	Non-Agricultural Landless PAFs: Land for shop at resettlement site and Rs 5,000 as financial assistance.	Not known	
2,217 PAFs	Major sons of non-agricultural landless family: Land for shop at relocation sites and Rs 5,000 as financial assistance.	Not known	
Target: From Gujarat: 4,472 PAFs 8,944 ha From Maha.: 999 PAFs 1,996 ha From MP: 13,294 PAFs 28,248 ha	Irrigation Facilities	From Gujarat: 1,500 PAFs 3,000 ha From Maha: 50 PAFs 150 ha From MP: 250 PAFs 500 ha (March 1993)	Gujarat 34% Maharashtra 5% Madhya Pradesh 2%
Target: From Gujarat: 4,500 PAFs From Maha.: 999 PAFs From MP: 13,294 PAFs	Ration Cards (also listed under Rehabilitation Grants)	From Gujarat 3,000 PAFs From Maha: 250 PAFs From MP: 750 PAFs (March 1993)	Gujarat 67% Maharashtra 25% MP 6%
B. MAHARASHTRA			
Target: 1,802 PAFs	Productive assets up to Rs.14,500 under different tribal welfare schemes. (Major unmarried daughter will also get separately).		
	Preference in employment of Class-III & IV Posts and reservation in project establishment & ITI.		
	Implementation of all existing welfare schemes at relocation sites.	50 Poultry Units 18 Bullock Carts 8 Cow Units 140 Improved Agricultural Implements 164 Agricultural Input Units (seed & fertilizer) through Tribal sub-plan 5 Assistance for self employment 128 utensils distributed	% of targets not known
C. MADHYA PRADESH			
Target: Production Assets for 13,540 PAFs			

	Implementation of all existing welfare schemes at relocation site.	Not implemented as yet	
5,776 PAFs	Landless agricultural laborer: Economic package @ Rs 29,000 each.	Not implemented as yet	
2,235 PAFs	Non-Agricultural Landless PAFs: Rs 19,500 each, except SC/ST	Not implemented as yet	
15,080 PAFs	Non-Agricultural and Agricultural Landless PAFs (SC/ST), Small & Marginal Farmers, Major sons of SC/ST: Economic Package and Rs.29,000. Major sons of other PAFs: Economic package @ Rs.19,500 each.	Not implemented as yet	

Note: Above table taken from NCA, SSP: Status Report on R&R (Quarter Ending December 1993). Indore. February 1994 and NCA, SSP: Annual Action Plan (1993-94) and Indicative Long Term Plan for R&R. Indore. May 1993.

PROJECT COMPLETION REPORT
INDIA
NARMADA RIVER DEVELOPMENT
WATER DELIVERY AND DRAINAGE PROJECT - DAM AND POWER PROJECT
(Credit 1553-IN & Credit 1552-IN/Loan 2497-IN)
REVISED COST-BENEFITS ANALYSIS

Introduction

1. Nearly 5 million people will benefit directly from the irrigation provided by the development of the Sardar Sarovar Project. Most of these families are poor and spend their lives in a harsh and hostile environment. Rainfall in most of the area is barely enough for a single wet-season crop. Although in total the rainfall might be sufficient in some areas, much of it runs off the land during short and intense storms. During the long dry-season, crops cannot be grown without irrigation, and water for drinking is quickly depleted, especially where the groundwater is unusable. Every year some 1.5 million head of cattle are herded into the northern part of the project area in search of fodder and water. But the long dry-season and the risk of failures of the monsoon rains makes this a tenuous existence for the pastoralists.

2. Drought is an annual event, and people and livestock often have to depend on water trucked in by the state. There are a wide array of diseases endemic in the rural population and traceable to malnutrition and unsafe drinking water. A reliable and safe supply of domestic water will benefit some 30 million people who frequently experience severe water shortages in the dry season. Gujarat is one of the fastest growing industrial states in India and there is a rapidly growing demand for industrial water. These rising demands for irrigation, livestock, rural, municipal, and industrial water are outstripping the groundwater resource and the existing reservoirs. The present situation not only precludes further growth but is simply not sustainable because of the over-exploitation of the groundwater resource in the water-short areas. These conditions exist in the presence of the Narmada Basin's vast unexploited resources and, therefore, the Union and State Governments are committed to the Basin's development.

3. It appears from the project design that Gujarat's first and most important objective was to give priority to the social benefits of the project over any other consideration. The strategy consisted in spreading water over the largest area possible in order to reach the maximum number of people even at the cost of reducing the economic rate of return. This strategy was consistent with the trend of thought that has existed in India since colonial times and which, to some extent, continues even today. In those days irrigation schemes were mostly built for famine relief and protective irrigation rather than for productive irrigation.

4. The second objective for Gujarat, appears to be its desire to implement a large multi-purpose project including a large command area of 1.8 million hectares net, a very ambitious water supply scheme for domestic, municipal and industrial uses for 30 million people and a power generation station of 1,450 Mega Watts. To satisfy the full water requirements of such a large project, a second large reservoir, known as the Narmada Sagar Dam, is to be constructed simultaneously upstream in MP. The large project concept prevailed during the NWDT proceedings and finally was accepted after the distribution of water, costs and benefits satisfied all riparian states.

5. The updated economic analysis shows that the economic benefits resulting from power generation are somewhat higher than those derived for irrigation. The analysis also shows that the economic benefits derived from municipal and industrial water supply are likely to be more substantial than initially anticipated. As the main canal and command area are still in their initial stages of construction, there is still time to readjust the irrigation and water supply components so that this project could become economically more profitable. This would be possible by cutting out some of the higher cost locations within the command area¹. This would have little or no effect on the ERR. On the other hand, the hydropower aspects of the projects have reached a point at which adjustments are no longer possible. The dam height, the design of the riverbed powerhouse and the specifications of the turbine generators are interlinked and have reached a stage of construction and manufacturing which prevents any changes without major cost implications. Furthermore, as the characteristics of the Sardar Sarovar Dam and its power component are part of the NWDT award, any changes in their concept will require the agreement of all four party states.

Revised Economic Analysis

6. The revised analysis, which was completed in April 1993 as part of the benchmarks set by the Board, finds an Economic Rate of Return (ERR) of 12.2%. This is marginally lower than the 13% found in the original SAR analysis, but falls within the range of acceptable ERRs for a project of this type exhibiting a very large scale of benefits relative to any feasible alternatives and having substantial multiplier effects. The rate is moderately sensitive to the timing of up-stream storage development in the foreseeable future. The ERR would be about 1 percentage point lower in the absence of Narmada Sagar but this would assume appropriate adjustment of the size of the irrigated command area. It should be noted that had the SSP been conceived as a power project alone, the ERR would have been 14.2%. The command area alone exhibits a somewhat marginal ERR. However, it has always been apparent that the ERR of the irrigation component could have been substantially higher if certain higher cost zones in the command area were reduced or omitted and if the available water had been concentrated more heavily on a smaller area². The ERR excluding such costs is estimated at 17.4%.

The Model

7. A spreadsheet simulation model was built to carry out the revised analysis. In terms of its functions, the model is similar to the one used in the SAR economic analysis. However, the module to derive random distribution of the project ERR was not included. The water balance calculation and the calculation of irrigation intensity are also simplified. Using the SAR input/output data, the ERR derived by this model is almost identical to that projected in the SAR, verifying that these simplifications have not altered the basic structure of the model. An economic analysis can only be part of the overall decision-making process. At the end of the paper a qualitative discussion is included to test whether the results of this analysis seem sensible given the changes since the original analysis. It is probable that the efficiency of water transmission to the field will be lower than that projected in the original analysis. However, some of the losses would be picked up in groundwater and over time one could expect improvements in efficiency with advanced technologies and appropriate incentives. However, it would be wise to be circumspect

1 The Borrower draws the attention that a high ERR is not the only criteria for justifying a project. In the case of SSP, socio-economic considerations were also taken into account.

2 The Borrower stresses that the question of reducing the command area in the higher cost/lower benefit zones does not arise since the objective of the project is to make adequate water available to drought prone areas.

about the development of the final 30% of the command area³. Until performance data are available on the earlier portions. Any reduction of efficiency is likely to have some impact on the ERR but probably it would not be large since the lost water to seepage will enlarge the recharge on which groundwater extraction can draw and, as suggested above, reductions in size of the command area should come from the lower return areas.

Assumptions

8. The analysis is based on adjustments to the SAR economic analysis to account for changed quantities, prices and phasing since the 1984 analysis. The base year of the analysis has been brought to 1992. Year 1 of the analysis is 1984 when the investments actually started on the Sardar Sarovar Dam. The costs incurred before 1992 were inflated to 1992 cost levels. Costs are in Rs. million and have been adjusted from financial to economic prices using a standard conversion factor of 0.8. The analysis includes the construction of the Sardar Sarovar and a share of the Narmada Sagar Dams which are both required to provide regulated water for irrigation and power generation up to the quantities projected. The environmental component of the analysis has paid particular attention to the environmental costs or benefits which might have been underestimated or omitted in the original analysis, such as estuary changes, fisheries costs and benefits, fuelwood and wildlife. Information reviewed or used at the time of appraisal, or as part of this review, is contained in a wide range of documents both formal and informal.

Project Costs

9. Construction Costs. The total economic investment cost has been estimated in this analysis at Rs. 136.5 billion at the 1992 price level (see Table 17). The costs incurred before 1992 were inflated to 1992 prices with construction GNP deflators. No physical contingencies were applied for the costs already accrued. For future costs, physical contingency rates were re-estimated and applied for different cost components (see Table 17).

10. Dam Costs. The dam construction period is 17 years. In real terms the currently estimated cost of the dam, saddle dam and tunnel is lower than the original projection by about 4%. The cost of the dam itself, on the basis of the bid price, was lower than the original projection (by about 6%) but some contingencies have been retained. The 17% share of the costs for the Narmada Sagar Dam allocated to the SSP project were taken from estimates by the Narmada Valley Development Authority.

11. Opportunity Costs of Land. The SAR assumptions inflated to 1992 are used in deriving the opportunity cost of the reservoir-submerged area and the area used by the canal system in the CCA. An assumption for R&R costs of Rs. 150,000 per family for 25,000 families has been used. This excludes land purchase costs which are treated as a transfer cost and also excludes those elements of infrastructure in the resettlement village that go beyond what is a replacement cost. Since both items are relatively small compared to the total costs, further elaboration on these cost estimates is not considered worthwhile.

12. Power Costs: This item includes the updated power costs for the Riverbed and Canal Head Power Houses, the weir, dikes, etc. and transmission. Transmission costs, including annualized capital cost and O&M, were estimated and added. The annualized capital cost was estimated to be about Rs. 400 million per year. The other assumptions of the SAR analysis remain unchanged.

13. Irrigation/Drainage Costs: This item includes updated cost estimates on the main canal, branch canals, distribution system and command area development on the basis of recent contracts.

3 The Borrower does not accept this statement.

These suggest higher costs than originally estimated. These real cost increases have been projected into the future in the analysis. However, it is believed that as a result of changes in the way the contracts are packaged and improvements in efficiency with increasing experience, future unit costs may be able to be reduced.

14. **Environment Costs (Net):** Table 27 sets out each of the main environmental impacts with a cost column, a benefit column and a net column in 1989 prices. In transferring these to the overall economic analysis these have been adjusted to 1992 values. This table only includes items either not covered, or inadequately covered, in the original analysis such as wildlife losses, public health costs and benefits, cost of moving monuments. The original analysis did include a valuation of forest loss and agricultural land loss. It omitted any possible fisheries losses in the estuary but also omitted fisheries gains in the reservoir and command area. Both of these have now been added. Catchment treatment costs are not included; catchment treatment is needed with or without the dam and carries its own benefits in terms of increased agricultural production. These have been estimated in other catchment treatment projects in India to have adequate rates of return. The evidence from surveys indicates that there are no rare or endangered species likely to suffer, but, to be conservative, an amenity value for lost plants and wildlife and a separate minor forest products value has been included over and above the opportunity cost value estimated for the lost forest land. Summing all these items gives a value to the lost forest areas of Rs. 4,818 per ha per annum in 1989 prices which is probably an over-estimate given the degraded nature of the forest area. For example, in the Gujarat ecosystem study area, the biomass of the forest areas is 16% of what it would have been if those areas had been grade 1 forest. Furthermore, since most of the higher measured biomass areas lie outside the submergence zone, the percentage would almost certainly be lower for the submergence zone itself.

Benefits

15. **Power Benefits:** The economic price of power was estimated as Rs. 1.39/kWh (see Table 14). This is higher in real terms than the original analysis. The willingness-to-pay approach used in the SAR was followed in this analysis. Estimates on the willingness-to-pay and average prices for the various segments of the power market were updated by using the findings of the latest available study (SAR of Second Maharashtra Power Project). This methodology takes the economic value of the average tariff in each consumer category and adds half the additional economic cost of the alternative of private supply to account for the "consumer surplus".

16. **Build-up of Power Benefits:** Power benefits are based on the same quantities of power assumed in the original analysis. The original SAR equations were used to calculate the power generation. Power benefits were assumed to start in 1997. Estimates of water released for riverbed power generation were obtained by deducting diversions from the total source of water, i.e., the mean river flow minus the upstream diversion and the diversion of SSP. Due to expected delays in upstream water development, the SAR estimate on upstream diversion was adjusted downward substantially, with the diversion in 2026 reduced from 24,300 to 16,000 million m³. To factor in the impact of the delays in the construction of the Narmada Sagar Dam, water released for power generation was reduced by 25% during the first five years of the operations.

17. The incremental power benefits are shown in Table 15. This is higher in real terms than the original analysis. The Sardar Sarovar Project, while less able to meet purely peak and firm power during the later years as the discharge of water becomes increasingly dictated by the irrigation demands, can in the early years meet substantial quantities of peak power demand. However, to be conservative, a peak power adjustment coefficient has not been used. The quantities of water available for power (and irrigation) are likely to be greater in the earlier years than originally projected since the rate of use of water upstream now seems likely to be lower than was assumed

in the original water modelling, although it is the pattern of flow as well as the quantity that is important⁴.

18. **Irrigation Benefits:** The revised calculations assume the same incremental yield estimates used in the original analysis. The original yield assumptions were reviewed and considered reasonable: for example, in 20 years time, wheat yielding 3.5 tons/ha and paddy yielding 4.0 tons/ha. Yields in the less suitable soil areas, represented by three of the thirteen zones identified, where there would be risk of waterlogging and salinity should the drainage investments and conjunctive use for some reason fail to achieve the designed result, were adjusted downwards by 25% in the original analysis to allow for the more difficult conditions. This assumption was maintained in the revised analysis. The original analysis assumed few high value crops (fruit and vegetables together account for only about 4% of the area at full development). This assumption was maintained in the revised analysis because of the spreading of water over a large area. However, it would not be justified with a smaller command area particularly with the industrialization of Gujarat and its likely orientation toward export markets in the future. Furthermore, the original analysis allowed for little increased cropping intensity to use the large surplus quantities of water that would be available for irrigation in the early years before the irrigated command area is fully developed. This assumption was also maintained because it may be preferable not to create water rights in the upstream areas of the command area which would be difficult to withdraw at a later stage of development. It was assumed that excess water will be used mostly for power generation which in any case gives a better return than irrigation. No assumption of improved efficiency of water use over time was made, although in reality it is likely that drip and sprinkle irrigation will gradually increase provided water is appropriately priced.

19. **Build-up of Irrigation Benefits.** Due to the delays in project implementation, irrigation benefits are assumed to start in 1995, three years later than the SAR estimate. An 11-year command area (CCA) development period is assumed compared to 10 years estimated by the Sardar Sarovar Nigam Ltd.(SSNNL) and 12 years estimated in the SAR. Groundwater development was also postponed by three years. The build-up pattern for each annual irrigation block remains unchanged. The way this is handled within the model, i.e., adding one phased build-up into another effectively, results in an irrigation development over about 15 years. To derive the overall benefit pattern, analyses were carried out separately for the with and without project cases, and are further divided to reflect the irrigated and rainfed conditions. Full project completion is assumed by 2008/2009 as against 2003/2004 foreseen by the Borrower.

20. Delays in the whole irrigation component would not reduce the overall economic rate of return; in fact, it would raise it by allowing more water for a longer period to be used for high value power generation. The irrigation outcome that would affect the economic rate of return more would be if investments in irrigation command area development at the lower end of the system were to lag significantly behind the expenditure on the main canal, branch canals and distributaries at the upper end and the middle of the system, since under those circumstances the benefits would be delayed in relation to the main investments. The prices used for the irrigation benefits are updated to 1992 prices with grains priced at a neutral import/export parity price and cotton at export parity. Non-traded commodity prices such as vegetables and legumes are at estimated 1992 prices.

21. **Municipal and Industrial (M&I) Water Benefits:** It had been appreciated at the time of the earlier analysis that the value of M&I water was considerably underestimated. Following further study and discussions with consultants there remains a methodological difficulty which has significant implications (on the positive side) for the economics of the project. The difficulty is that on the scale proposed for M&I water there simply are no practical and reliable water supply

alternatives to the project which would be valid for a least-cost alternative calculation. A smaller open canal conveyance for M&I water alone from the Narmada River would appear, in theory, to be the lowest cost alternative. However, in practice it is considered unworkable since the water would get diverted en route by farmers. It is also extremely costly. Piping water is even more costly. Desalinization would appear to be the only practical alternative, but this is also very costly. The lack of viable alternatives suggests a high value for M&I water.

22. The valuation of domestic water in the original analysis appears low in relation to likely willingness-to-pay criteria and the social adjustment alternatives in its absence which presumably would require at least a portion of the people to move out of the area. (The original valuation in 1992 prices at the point of intake into the local system was only Rs. 0.96 per m³ at the start of the project period (i.e., less than three-hundredths of a US cent per m³ rising over 30 years with increasing water scarcity to Rs. 3.68 per m³ (about one-tenth of a US cent per m³. This appears to be a substantial underestimate given the severe impacts of recent droughts on these areas which required trucking of water to villages and serious losses of livestock).

23. For the purposes of this analysis, the original SAR methodology was adopted but the cost was escalated by assuming one-third of the water would come from desalinization. The present value of the M&I water is thus raised by about 60% in real terms over the SAR estimate. The M&I water benefits stream is given in Table 15. Further work on this valuation is needed. This is a case where there are no alternatives on the same scale.

24. **Fuelwood Benefits:** Benefits from fuelwood production from canal-side and on-farm trees were omitted in the original analysis. It is estimated that there will be about 36,000 ha of canal-side plantations and a substantial incremental number of on-farm trees per hectare growing at a faster rate than in the "without project" drylands situation due to the irrigation. Fuelwood is valued at Rs. 500 per ton and poles at Rs. 30 per piece. Average net revenue from the canal-side plantations with 50% of production going for poles and 50% for fuelwood is estimated at Rs. 4,132 per ha. Average incremental net benefits from fuelwood/pole production from on-farm trees is estimated at Rs. 150 per hectare per year for the 1.8 million ha command area. Benefits would reach their maximum level in the year 2010. Costs have been deducted to derive net benefits.

25. **Fisheries Benefits:** Fisheries benefits and costs were omitted in the original analysis. Costs of possible fisheries losses in the estuary are included in the Environment Costs column (Table 21). Potentially, fisheries net benefits are significant due to the large volume of water and the water control available from the project and due to the high and rising value of fish, with pond-grown prawns as a high value export product. The projected benefits would come from the following sources: (a) the reservoir itself, (b) canals, (c) the development of fish and prawn ponds within the command area, (d) possibly the development of shrimp production using drainage water to regulate the salinity in brackish water ponds near the sea, and (e) cage fisheries in both reservoir and canals. Assumptions are from the analyses done for the fisheries component of the earlier proposed Narmada Basin Development Project: reservoir yield to stabilize at 50 kg per hectare after an initial trophic burst and subsequent trophic depression phase; 2000 ha of fish ponds and 1000 ha of prawn ponds by Year 21 with net benefits rising thereafter at 4% annually; associated fish production at 30% of the net benefit level of prawns; a small canal cage and capture fishery; and, development costs (plans are already quite far advanced) of Rs. 150 million over 8 years with continued operating costs thereafter.

Economic Rate of Return

26. The Economic Rate of Return (ERR) is estimated at 12.4% (Table 22) which, as noted earlier, falls within the acceptable range for a large multi-purpose regional project of this type. In a recent study on India (Hazell and Haggblade 1990) the multiplier effect was estimated at Rs. 0.66

value added in non-farm activities in rural areas and rural towns for every Rs. 1.00 value added in agriculture and Rs. 0.86 value added in the national non-farm economy. Furthermore, the multiplier was found to be higher in irrigation than rainfed agriculture and to rise over time with increasing development (e.g., the multiplier was Rs. 1.06 in Punjab). With respect to a decision about whether to continue the projects (dam and irrigation) beyond this point in time, assuming costs already expended are sunk costs, the ERR of the project is about 17.4%. As a power project alone, the ERR of SSP is 14.2%. Tables 30, 31, and 32 give results of sensitivity analyses. As indicated by the tables, because of the multi-purpose nature, the project is relatively stable to changed assumptions.

27. The ERR of SSP without the Narmada Sagar Dam would depend on what other related changes occur above Sardar Sarovar Dam and in the command area development in response to an indefinite delay in constructing Narmada Sagar. There are many different scenarios, most of which would require further water modelling to define. No modelling of a "Sardar Sarovar Dam only" scenario was run since it was part of an integrated package of developments. However, assuming delays in Narmada Sagar, approximations can be made. Assuming that, without Narmada Sagar, the irrigation benefits at Sardar Sarovar would be reduced by a flat rate of 30% and power by a flat rate of 25% for the full 50-year analysis period (these are somewhat greater reductions than the modelling actually indicated), assuming that the projected water use upstream would develop as originally modelled in accordance with the NWDT water allocations to the participating states, and assuming that the command area investments would be adjusted in the following way: by lowering main canal expenditure by 0% (i.e., assuming the whole canal would be completed), branch canals by 15%, and all investments below that by 25%, the ERR for the Sardar Sarovar Projects would fall by a little over 1%. Note that reductions in the size of the command area have a positive impact on the ERR since they release water for the higher value power benefit⁵.

Discussion

28. Economic analysis needs to be tempered with sensible judgment. Do these results appear sensible given the changes since the original analysis? Yes, they appear to be. Costs have not escalated dramatically in real terms, as many critics have suggested. The original analysis allowed for quite substantial physical contingencies despite the advanced state of design of the dam. Those items such as resettlement (R&R) and environmental costs, which are now valued at considerably higher levels, are not large relative to the substantial scale of the overall project cost and benefit streams; R&R, for example, represents even now less than 5% of the total project cost and environmental costs are less. Increased land values for R&R, one of the main escalation items usually quoted as being damaging to the economics, do not in fact affect the economics at all since these are simply transfer costs within the economy. Catchment treatment costs, often said to be an environmental cost to the dam, are not a valid economic cost because such catchment treatment carries its own benefit stream in terms of increased agricultural production from moisture conservation and reduced on-site erosion and adequate economic rates of return are anticipated from such projects elsewhere in India.

29. With respect to sensitivity to environmental parameters, if higher than projected environmental costs in and around the submergence zone or in the estuary were to have a significant effect on lowering the ERR, they would have to be orders of magnitude higher than they appear to be. This would only appear to be conceivable if there was a very rare plant or animal species threatened with extinction and accorded a very high value.

5

The Borrower notes that the NWDT had estimated a reduction of 17.8% in the SSP benefits without the regulated releases from the Narmada Sagar Reservoir. The Borrower further indicates that there is no possibility for reducing the size of the command area.

30. Table 22 gives results of sensitivity tests to implementation delays. Any future delays in the development of the irrigation command area will not affect the ERR much unless they are delays in the final stage of developing the distributary and on-farm elements relative to the investments on the main and branch canals. This is a scheduling issue which project management is aware of and which management information systems are designed to deal with. The multi-purpose characteristics of the project give considerable economic stability because any delays in development of the irrigation system, which in a pure irrigation project would have a serious impact on the economics, would in this project leave more water for the higher value power component.

31. With respect to alternatives, a number of alternative dam sizes, dam numbers and locations were considered by the Narmada Tribunal, which sat for ten years. The small dam alternative often suggested is not an alternative in the sense that small dams could replace the Sardar Sarovar Dam. The typical technical and economic characteristics of small dams are well known (economic rates of return have often in fact been marginal; for example the Karnataka Tanks Project gave an ERR of at most 4%). They cannot in this part of India provide the scale of benefits sought because the number of efficient dam sites do not exist, nor could small dams provide water from the Narmada Basin to Gujarat on any scale. Furthermore, their biggest drawback is that it is in precisely those years which both people and governments are currently most concerned about -- the dry years -- when the value of production and domestic water is at a premium, that the small dams fail because they do not fill and cannot carry water across years. They are a useful complement but they cannot deal with the scale of India's needs. Groundwater is also not an alternative; it is a complement which has in fact been designed into the project to establish a conjunctive use strategy⁶.

6

Conjunctive use can be defined as the optimum use of surface water, groundwater and rainfall under conditions where the only significant practical public intervention is the way that water is distributed in time and space in the surface system.

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Derivation of Economic Prices of Tradable Crops and Fertilizers

		Paddy	Wheat	Cotton (medium)	Cotton (short)	Groundnut	Nitrogen	Phos-	Potash
Worldmarket price 1995 a/	\$/ton	276	157	1484	1,484	297	162	127	114
Quality adjustment	%	90	100	90	54	100	100	100	100
Worldmarket equivalent	\$/ton	248	157	1,336	801	297	162	127	114
International shipping	\$/ton	0	0	(140)	(130)	0	50	65	65
CIF/FOB price, Bombay	\$/ton	248	157	1,196	671	297	212	192	179
CIF/FOB price, Bombay b/	Rs/ton	6,499	4,110	31,325	17,590	7,781	5,559	5,036	4,702
Domestic handling/transpt.	Rs/ton	671	567	(464)	(438)	(1,032)	774	774	774
Processing ratio c/	%	66	100	35	33	68	46	48	60
Value of by-product d/	Rs/ton	0	0	2,200	2,200	0	0	0	0
Processing ratio by-product	%	0	0	65	67	0	0	0	0
Processing cost	Rs/ton	(284)	0	(1,032)	(1,032)	(1,135)	0	0	0
Wholesale price raw product	Rs/ton	4,448	4,678	11,200	6,102	3,455	13,767	12,103	9,127
Transport from farmgate	Rs/ton	(129)	(129)	(335)	(335)	(181)	0	0	0
Farmgate price	Rs/ton	4,319	4,549	10,864	5,767	3,274	13,767	12,103	9,127
say	Rs/ton	4,320	4,550	10,860	5,770	3,270	13,770	12,100	9,130

a/ IBRD commodity price forecasts, November 1992, in constant 1992 US\$.

Wheat: Canadian No. 1, Western Red Spring, FOB Thunder Bay

Rice: Thai, milled, 5% broken, FOB Bangkok

Cotton: (outlook "A" Index), Middling (1-3/32"), CIF Europe

Groundnuts: any origin, shelled, CIF Europe

Nitrogen: Urea, bagged, FOB N.W. Europe

Phosphate: Triple Super Phosphate, bulk, FOB US Gulf

Potash: Muriate of Potash, bulk, FOB Vancouver

b/ At RS per US\$

c/ Nutrient content for fertilizers

d/ Cotton seeds for cotton, domestic wholesale price estimate, in economic terms

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Summary of Prices for Economic and Financial Analysis
(in constant 1992 rupees)

			Seeds	
	Economic (Rs/ton)	Financial (Rs/ton)	Economic (Rs/kg)	Financial (Rs/kg)
Crops				
Paddy	4,320	4,164	6.68	4.52
Wheat	4,550	4,620	5.68	4.73
Sorghum (local)	3,550	3,548	4.52	4.52
Sorghum (hybrid)	3,335	3,333	14.62	18.28
Pearl Millet	4,469	4,466	14.62	18.28
Pigeon Pea	9,722	9,715	7.96	7.96
Gram	9,917	9,910	6.89	6.88
Mung Beans	9,006	9,000	12.28	9.03
Cluster Beans	7,850	9,715	6.36	7.96
Groundnut	3,270	11,186	14.84	16.13
Mustard	8,382	9,111	14.84	16.13
Castor Beans	7,930	6,908	13.11	11.40
Cotton (short staple)	5770	12,141	2.46	4.73
Cotton (medium Staple)	10,860	14,474	146.22	182.77
Tobacco ('Bidi')	8,146	10,183	0.034	0.04
Sugarcane	404	505	0.24	0.30
Bananas	1,290	1,613	0.28	0.34
Chillies	28,800	36,000	189.22	236.53
Onions	1,290	1,613	94.61	118.27
Potatoes	1,634	2,043	3.61	4.52
Fodder sorghum	215	269	4.52	4.52
Fodder Lucerne	378	473	27.52	34.40
Inputs				
Nitrogen	13,770	7,642		
Phosphate	12,100	7,642		
Potash	9,130	6,209		
Compost	34	43		
Labor (person-day)	16.8	25.0		
Bullocks (pair/day)	52	65		

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Crop Input and Output Data: Present Situation
(per hectare)

Crop	Season	Yield (tons)	By- product (Rs)	Seeds (kg)	N	P	K	Compost (tons)	Chemical (Rs)	Labor (mandays(pairday)	Bullocks	Misc. (Rs)
Paddy rainfed a/	Kharif	0.9	320	50	20	0	0	3	0	75	12	20
Paddy rainfed b/	Kharif	1.35	490	50	40	0	0	5	0	91	12	25
Paddy irrigated a/	Kharif	1.8	320	60	60	0	0	5	0	110	13	200
Paddy irrigated b/	Kharif	2.5	450	60	80	20	0	6	30	140	14	250
Wheat rainfed	Rabi	0.55	90	70	10	0	0	0	0	44	9	25
Wheat irrigated	Rabi	2.2	330	110	60	35	10	1	10	70	10	240
Sorghum rainfed a/	Kharif	0.75	150	25	10	0	0	2	0	60	8	80
Sorghum rainfed b/	Kharif	0.4	80	25	10	0	0	1	0	50	8	30
Sorghum rfd.HYV	Rabi	1.5	220	10	30	20	0	2	50	70	10	120
Sorghum irrigated	Kharif	1.1	220	25	20	0	0	2	30	75	9	120
Pearlmillet rfd.a/	Kharif	0.65	130	5	15	0	0	2	0	55	10	80
Pearlmillet rfd.b/	Kharif	0.7	140	5	20	0	0	2	0	58	10	90
Pearlmillet irr.	Kharif	2	390	5	60	30	15	3	100	80	12	110
Pearlmillet irr.	Hot	2.5	490	5	90	50	20	3	75	95	13	140
Pigeon pea rainfed	2-seasn	0.6	190	15	10	0	0	3	120	75	10	50
Pigeon pea irrig.	2-seasn	1	240	15	20	20	0	3	160	85	12	60
Gram rainfed	Rabi	0.65	35	60	5	10	0	0	0	60	10	25
Mung rainfed	Rabi	0.35	20	18	18	0	0	2	0	55	10	30
Cluster bean rfd.	Kharif	0.45	100	20	0	0	0	1	0	35	9	35
Groundnut rfd.	Kharif	0.85	0	100	15	35	10	8	50	60	12	120
Mustard rainfed	Rabi	0.5	0	3	10	5	0	0	0	50	10	35
Mustard irrigated	Rabi	0.8	0	3	25	10	0	0	50	54	11	50
Castor bean rfd.	2-seasn	1.1	0	10	20	10	0	2	50	70	12	50
Cotton rainfed c/	2-seasn	0.4	0	14	10	0	0	2	0	43	10	45
Cotton irrig. d/	2-seasn	1.1	0	3	80	40	0	4	1400	135	12	100
Tobacco rainfed	2-seasn	0.8	0	15000	100	0	0	4	0	125	10	150
Tobacco irrigated	2-seasn	2	0	15000	200	0	0	8	0	220	15	400
Fodder sorghum rfd.	Kharif	15	0	30	30	15	0	2	0	70	8	60
Fodder sorghum irr.	Kharif	30	0	30	60	30	0	3	0	100	9	100

Note: Byproduct value and chemical cost are in 1984 prices.

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Crop Input and Output Data: Future with Project
(per hectare, irrigated crops only)

Crop	Season	Yield (tons)	By- product (Rs)	Seeds (kg)	N (..... kg	P (..... kg	K (..... kg	Compost (tons)	Chemical (Rs)	Labor (mandays/pair/day)	Bullocks (Rs)	Misc. (Rs)
Irrigated Crops												
Paddy HYV	Kharif	4.00	650	60	125	40	0	8	50	200	15	300
Wheat HYV	Rabi	3.50	500	120	90	50	15	1	20	100	12	300
Sorghum HYV	Kharif	2.60	260	15	65	35	0	2	150	90	10	150
Sorghum HYV	Rabi	3.10	310	15	70	40	0	2	70	95	10	150
Pearl Millet HYV	Kharif	2.70	530	5	70	35	20	3	120	95	12	140
Pearl Millet HYV	Hot-seas	3.10	600	5	90	50	20	3	75	100	13	140
Pigeon pea	2-seasons	1.60	300	20	40	40	0	3	200	100	13	120
Gram	Rabi	1.60	85	60	25	50	0	0	200	70	12	175
Groundnut	Kharif	2.00	440	100	20	40	20	8	350	90	14	150
Groundnut	Hot seas	2.30	510	100	25	50	25	8	80	100	14	180
Mustard	Rabi	1.50	0	3	45	20	0	0	125	65	12	120
Castor bean	2-seasons	2.00	0	10	55	20	0	4	125	95	14	130
Cotton med.staple	2-seasons	2.40	0	3	125	65	20	6	2,000	200	13	250
Tobacco	2-seasons	2.40	0	15,000	200	0	0	10	0	250	15	300
Sugarcane	Perennia	90.00	400	10,000	300	120	50	20	90	290	25	3,000
Bananas	Perennia	30.00	0	3,600	360	145	720	50	200	250	22	1,200
Chillies	2-seasons	1.30	0	2	50	50	40	15	800	225	10	600
Vegetable (onions)	Rabi	20.00	0	10	100	60	60	25	220	265	20	800
Vegetable (potato)	Rabi	30.00	0	2,200	170	120	120	15	215	230	24	650
Fodder sorghum	Kharif	40.00	0	30	80	40	0	4	0	120	16	120
Lucerne	2-seasons	40.00	0	25	30	80	0	0	270	195	20	210
Rainfed Crops												
Paddy rainfed a/	Kharif	1.125	400	62.5	25	0	0	3.75	0	93.75	15	25
Paddy rainfed b/	Kharif	1.6875	612.5	62.5	50	0	0	6.25	0	113.75	15	31.25
Wheat rainfed	Rabi	0.6875	112.5	87.5	12.5	0	0	0	0	55	11.25	31.25
Sorghum rainfed a/	Kharif	0.9375	187.5	31.25	12.5	0	0	2.5	0	75	10	100
Sorghum rainfed b/	Kharif	0.5	100	31.25	12.5	0	0	1.25	0	62.5	10	37.5
Sorghum rfd.HYV	Rabi	1.875	275	12.5	37.5	25	0	2.5	62.5	87.5	12.5	150
Pearlmillet rfd.a/	Kharif	0.8125	162.5	6.25	18.75	0	0	2.5	0	68.75	12.5	100
Pearlmillet rfd.b/	Kharif	0.875	175	6.25	25	0	0	2.5	0	72.5	12.5	112.5
Pigeon pea rainfed	2-seasons	0.75	237.5	18.75	12.5	0	0	3.75	150	93.75	12.5	62.5
Gram rainfed	Rabi	0.8125	43.75	75	6.25	12.5	0	0	0	75	12.5	31.25
Mung rainfed	Rabi	0.4375	25	22.5	22.5	0	0	2.5	0	68.75	12.5	37.5
Cluster bean rfd.	Kharif	0.5625	125	25	0	0	0	1.25	0	43.75	11.25	43.75
Groundnut rfd.	Kharif	1.0625	0	125	18.75	43.75	12.5	10	62.5	75	15	150
Mustard rainfed	Rabi	0.625	0	3.75	12.5	6.25	0	0	0	62.5	12.5	43.75
Castor bean rfd.	2-seasons	1.375	0	12.5	25	12.5	0	2.5	62.5	87.5	15	62.5
Cotton rainfed c/	2-seasons	0.5	0	17.5	12.5	0	0	2.5	0	53.75	12.5	56.25
Tobacco rainfed	2-seasons	1	0	18750	125	0	0	5	0	156.25	12.5	187.5
Fodder sorghum rfd.	Kharif	18.75	0	37.5	37.5	18.75	0	2.5	0	87.5	10	75

Note: Byproduct value and chemical cost are in 1984 prices.

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Economic Crop Budgets: Present Situation
(per hectare)

Crop	Season	Gross Return	Inputs								Total	Labor	Net Income	Net Return
			Seeds	N	P	K	Compost	Chemical	Bullock	Misc.				
Irrigated														
Paddy irrigated a/	Kharif	8,032	401	826	0	0	172	0	671	160	2,230	1,843	5,802	3,960
Paddy irrigated b/	Kharif	11,160	401	1,102	242	0	206	24	722	200	2,897	2,345	8,263	5,918
Wheat irrigated	Rabi	10,274	624	826	424	91	34	8	516	192	2,716	1,173	7,558	6,386
Sorghum irrigated	Kharif	4,082	113	275	0	0	69	24	464	96	1,042	1,256	3,040	1,784
Pearlmillet irr.	Kharif	9,250	73	826	363	137	103	80	619	88	2,290	1,340	6,961	5,621
Pearlmillet irr.	Hot	11,565	73	1,239	605	183	103	60	671	112	3,046	1,591	8,519	6,928
Pigeon pea irrig.	2-season	9,914	119	275	242	0	103	128	619	48	1,535	1,424	8,379	6,955
Mustard irrigated	Rabi	6,706	45	344	121	0	0	40	568	40	1,157	905	5,548	4,644
Cotton irrig. d/	2-season	11,946	439	1,102	484	0	138	1,120	619	80	3,981	2,261	7,965	5,704
Tobacco irrigated	2-season	16,293	516	2,754	0	0	275	0	774	320	4,639	3,685	11,654	7,969
Fodder sorghum irr.	Kharif	6,450	136	826	363	0	103	0	464	80	1,972	1,675	4,478	2,803
Rainfed														
Paddy rainfed a/	Kharif	4,144	334	275	0	0	103	0	619	16	1,348	1,256	2,796	1,540
Paddy rainfed b/	Kharif	6,224	334	551	0	0	172	0	619	20	1,696	1,524	4,528	3,004
Wheat rainfed	Rabi	2,575	397	138	0	0	0	0	464	20	1,019	737	1,555	818
Sorghum rainfed a/	Kharif	2,783	113	138	0	0	69	0	413	64	796	1,005	1,987	982
Sorghum rainfed b/	Kharif	1,484	113	138	0	0	34	0	413	24	722	838	762	(75)
Sorghum rfd.HYV	Rabi	5,179	146	413	242	0	69	40	516	96	1,522	1,173	3,657	2,484
Pearlmillet rfd.a/	Kharif	3,009	73	207	0	0	69	0	516	64	928	921	2,080	1,159
Pearlmillet rfd.b/	Kharif	3,240	73	275	0	0	69	0	516	72	1,005	972	2,235	1,264
Pigeon pea rainfed	2-season	5,985	119	138	0	0	103	96	516	40	1,012	1,256	4,973	3,716
Gram rainfed	Rabi	6,474	413	69	121	0	0	0	516	20	1,139	1,005	5,335	4,330
Mung rainfed	Rabi	3,168	221	248	0	0	69	0	516	24	1,078	921	2,090	1,169
Cluster bean rfd.	Kharif	3,612	127	0	0	0	34	0	464	28	654	586	2,958	2,372
Groundnut rfd.	Kharif	2,780	1,484	207	424	91	275	40	619	96	3,235	1,005	(456)	(1,461)
Mustard rainfed	Rabi	4,191	45	138	61	0	0	0	516	28	787	838	3,404	2,567
Castor bean rfd.	2-season	8,723	131	275	121	0	69	40	619	40	1,295	1,173	7,428	6,255
Cotton rainfed c/	2-season	2,308	34	138	0	0	69	0	516	36	793	720	1,515	795
Tobacco rainfed	2-season	6,517	516	1,377	0	0	138	0	516	120	2,667	2,094	3,850	1,757
Fodder sorghum rfd.	Kharif	3,225	136	413	182	0	69	0	413	48	1,260	1,173	1,965	793

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Economic Crop Budgets: Future with Project (per hectare)

Crop	Season	Gross Return	Inputs								Total	Labor	Net Income	Net Return
			Seeds	N	P	K	Compost	Chemical	Bullock	Misc.				
Irrigated Crops														
Paddy HYV	Kharif	17,800	401	1,721	484	0	275	40	774	240	3,935	3,350	13,865	10,515
Wheat HYV	Rabi	16,325	681	1,239	605	137	34	16	619	240	3,572	1,675	12,753	11,078
Sorghum HYV	Kharif	8,880	219	895	424	0	69	120	516	120	2,363	1,508	6,517	5,010
Sorghum HYV	Rabi	10,588	219	964	484	0	69	56	516	120	2,428	1,591	8,159	6,568
Pearl Millet HYV	Kharif	12,491	73	964	424	183	103	96	619	112	2,574	1,591	9,917	8,326
Pearl Millet HYV	Hot-seas	14,334	73	1,239	605	183	103	60	671	112	3,046	1,675	11,288	9,613
Pigeon pea	2-seasons	15,795	159	551	484	0	103	160	671	96	2,224	1,675	13,571	11,896
Gram	Rabi	15,935	413	344	605	0	0	160	619	140	2,282	1,173	13,653	12,481
Groundnut	Kharif	6,892	1,484	275	484	183	275	280	722	120	3,823	1,508	3,069	1,561
Groundnut	Hot seas	7,929	1,484	344	605	228	275	64	722	144	3,867	1,675	4,062	2,387
Mustard	Rabi	12,573	45	620	242	0	0	100	619	96	1,721	1,089	10,852	9,763
Castor bean	2-season	15,861	131	757	242	0	138	100	722	104	2,194	1,591	13,666	12,075
Cotton med.staple	2-season	26,064	439	1,721	787	183	206	1,600	671	200	5,806	3,350	20,258	16,908
Tobacco	2-season	19,551	516	2,754	0	0	344	0	774	240	4,628	4,188	14,923	10,736
Sugarcane	Perennia	36,680	2,408	4,131	1,452	457	688	72	1,290	2,400	12,898	4,858	23,782	18,925
Bananas	Perennia	38,700	991	4,957	1,755	6,574	1,720	160	1,135	960	18,251	4,188	20,449	16,261
Chillies	2-season	37,440	378	689	605	365	516	640	516	480	4,189	3,769	33,251	29,482
Vegetable (onions)	Rabi	25,800	946	1,377	726	548	860	176	1,032	640	6,305	4,439	19,495	15,056
Vegetable (potato)	Rabi	49,020	7,947	2,341	1,452	1,096	516	172	1,238	520	15,282	3,853	33,738	29,885
Fodder sorghum	Kharif	8,600	136	1,102	484	0	138	0	826	96	2,780	2,010	5,820	3,810
Lucerne	2-season	15,136	688	413	968	0	0	216	1,032	168	3,485	3,266	11,651	8,385
Rainfed Crops														
Paddy rainfed a/	Kharif	5,180	418	344	0	0	129	0	774	20	1,685	1,570	3,495	1,925
Paddy rainfed b/	Kharif	7,780	418	689	0	0	215	0	774	25	2,120	1,905	5,660	3,754
Wheat rainfed	Rabi	3,218	497	172	0	0	0	0	581	25	1,274	921	1,944	1,023
Sorghum rainfed a/	Kharif	3,479	141	172	0	0	86	0	516	80	995	1,256	2,483	1,227
Sorghum rainfed b/	Kharif	1,855	141	172	0	0	43	0	516	30	902	1,047	953	(94)
Sorghum rfd,HYV	Rabi	6,474	183	516	303	0	86	50	645	120	1,903	1,466	4,571	3,105
Pearlmillet rfd.a/	Kharif	3,761	91	258	0	0	86	0	645	80	1,161	1,152	2,601	1,449
Pearlmillet rfd.b/	Kharif	4,050	91	344	0	0	86	0	645	90	1,257	1,214	2,794	1,579
Pigeon pea rainfed	2-season	7,481	149	172	0	0	129	120	645	50	1,265	1,570	6,216	4,646
Gram rainfed	Rabi	8,092	516	86	151	0	0	0	645	25	1,424	1,256	6,669	5,412
Mung rainfed	Rabi	3,960	276	310	0	0	86	0	645	30	1,347	1,152	2,613	1,462
Cluster bean rfd.	Kharif	4,515	159	0	0	0	43	0	581	35	818	733	3,698	2,965
Groundnut rfd.	Kharif	3,474	1,855	258	529	114	344	50	774	120	4,044	1,256	(570)	(1,826)
Mustard rainfed	Rabi	5,239	56	172	76	0	0	0	645	35	983	1,047	4,255	3,209
Castor bean rfd.	2-season	10,904	164	344	151	0	86	50	774	50	1,619	1,466	9,285	7,819
Cotton rainfed c/	2-season	2,885	43	172	0	0	86	0	645	45	991	900	1,894	994
Tobacco rainfed	2-season	8,146	645	1,721	0	0	172	0	645	150	3,333	2,617	4,813	2,196
Fodder sorghum rfd.	Kharif	4,031	169	516	227	0	86	0	516	60	1,575	1,466	2,457	991

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Financial Crop Budgets: Present Situation
(per hectare)

Crop	Season	Gross Return	Inputs								Total	Labor	Net Income	Net Return
			Seeds	N	P	K	Compost	Chemical	Bullock	Misc.				
Irrigated														
Paddy irrigated a/	Kharif	7,815	271	458	0	0	215	0	839	200	1,983	2,750	5,832	3,082
Paddy irrigated b/	Kharif	10,860	271	611	153	0	258	30	903	250	2,476	3,500	8,384	4,884
Wheat irrigated	Rabi	10,494	520	458	267	62	43	10	645	240	2,246	1,750	8,248	6,498
Sorghum irrigated	Kharif	4,123	113	153	0	0	86	30	581	120	1,082	1,875	3,041	1,166
Pearlmillet irr.	Kharif	9,322	91	458	229	93	129	100	774	110	1,985	2,000	7,337	5,337
Pearlmillet irr.	Hot	11,655	91	688	382	124	129	75	839	140	2,468	2,375	9,187	6,812
Pigeon pea irrig.	2-season	9,955	119	153	153	0	129	160	774	60	1,548	2,125	8,407	6,282
Mustard irrigated	Rabi	7,289	48	191	76	0	0	50	710	50	1,125	1,350	6,163	4,813
Cotton irrig. d/	2-season	15,921	548	611	306	0	172	1,400	774	100	3,911	3,375	12,010	8,635
Tobacco irrigated	2-season	20,366	645	1,528	0	0	344	0	968	400	3,885	5,500	16,481	10,981
Fodder sorghum irr.	Kharif	8,063	135	458	229	0	129	0	581	100	1,633	2,500	6,430	3,930
Rainfed														
Paddy rainfed a/	Kharif	4,068	226	153	0	0	129	0	774	20	1,302	1,875	2,766	891
Paddy rainfed b/	Kharif	6,111	226	306	0	0	215	0	774	25	1,545	2,275	4,566	2,291
Wheat rainfed	Rabi	2,631	331	76	0	0	0	0	581	25	1,013	1,100	1,618	518
Sorghum rainfed a/	Kharif	2,811	113	76	0	0	86	0	516	80	871	1,500	1,940	440
Sorghum rainfed b/	Kharif	1,499	113	76	0	0	43	0	516	30	778	1,250	721	(529)
Sorghum rfd.HV	Rabi	5,220	183	229	153	0	86	50	645	120	1,466	1,750	3,754	2,004
Pearlmillet rfd.a/	Kharif	3,033	91	115	0	0	86	0	645	80	1,017	1,375	2,016	641
Pearlmillet rfd.b/	Kharif	3,266	91	153	0	0	86	0	645	90	1,065	1,450	2,201	751
Pigeon pea rainfed	2-season	6,019	119	76	0	0	129	120	645	50	1,140	1,875	4,879	3,004
Gram rainfed	Rabi	6,477	413	38	76	0	0	0	645	25	1,197	1,500	5,279	3,779
Mung rainfed	Rabi	3,170	163	138	0	0	86	0	645	30	1,061	1,375	2,109	734
Cluster bean rfd.	Kharif	4,472	159	0	0	0	43	0	581	35	818	875	3,654	2,779
Groundnut rfd.	Kharif	9,508	1,613	115	267	62	344	50	774	120	3,345	1,500	6,163	4,663
Mustard rainfed	Rabi	4,556	48	76	38	0	0	0	645	35	843	1,250	3,712	2,462
Castor bean rfd.	2-season	7,599	114	153	76	0	86	50	774	50	1,303	1,750	6,296	4,546
Cotton rainfed c/	2-season	4,856	66	76	0	0	86	0	645	45	919	1,075	3,938	2,863
Tobacco rainfed	2-season	8,146	645	764	0	0	172	0	645	150	2,376	3,125	5,770	2,645
Fodder sorghum rfd.	Kharif	4,031	135	229	115	0	86	0	516	60	1,141	1,750	2,890	1,140

HARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Financial Crop Budgets: Future with Project
(per hectare)

Crop	Season	Gross Return	Inputs								Total	Labor	Net Income	Net Return
			Seeds	N	P	K	Compost	Chemical	Bullock	Misc.				
Irrigated Crops														
Paddy HYV	Kharif	17,306	271	955	306	0	344	50	968	300	3,193	5,000	14,113	9,113
Wheat HYV	Rabi	16,670	568	688	382	93	43	20	774	300	2,868	2,500	13,802	11,302
Sorghum HYV	Kharif	8,926	274	497	267	0	86	150	645	150	2,069	2,250	6,856	4,606
Sorghum HYV	Rabi	10,642	274	535	306	0	86	70	645	150	2,066	2,375	8,577	6,202
Pearl Millet HYV	Kharif	12,588	91	535	267	124	129	120	774	140	2,181	2,375	10,407	8,032
Pearl Millet HYV	Hot-seas	14,445	91	688	382	124	129	75	839	140	2,468	2,500	11,977	9,477
Pigeon pea	2-seasns	15,844	159	306	306	0	129	200	839	120	2,058	2,500	13,786	11,286
Gram	Rabi	15,941	413	191	382	0	0	200	774	175	2,135	1,750	13,806	12,056
Groundnut	Kharif	22,812	1,613	153	306	124	344	350	903	150	3,942	2,250	18,870	16,620
Groundnut	Hot seas	26,238	1,613	191	382	155	344	80	903	180	3,848	2,500	22,390	19,890
Mustard	Rabi	13,667	48	344	153	0	0	125	774	120	1,564	1,625	12,102	10,477
Castor bean	2-seasn	13,816	114	420	153	0	172	125	903	130	2,017	2,375	11,799	9,424
Cotton med.staple	2-seasn	34,738	548	955	497	124	258	2,000	839	250	5,471	5,000	29,267	24,267
Tobacco	2-seasn	24,439	645	1,528	0	0	430	0	968	300	3,871	6,250	20,568	14,318
Sugarcane	Perennia	45,850	3,010	2,292	917	310	860	90	1,613	3,000	12,093	7,250	33,757	26,507
Bananas	Perennia	48,375	1,239	2,751	1,108	4,470	2,150	200	1,419	1,200	14,537	6,250	33,838	27,588
Chillies	2-seasn	46,800	473	382	382	248	645	800	645	600	4,176	5,625	42,624	36,999
Vegetable (onions)	Rabi	32,250	1,183	764	458	373	1,075	220	1,290	800	6,163	6,625	26,087	19,462
Vegetable (potato)	Rabi	61,275	9,934	1,299	917	745	645	215	1,548	650	15,953	5,750	45,322	39,572
Fodder sorghum	Kharif	10,750	135	611	306	0	172	0	1,032	120	2,376	3,000	8,374	5,374
Lucerne	2-seasn	18,920	860	229	611	0	0	270	1,290	210	3,471	4,875	15,449	10,574
Rainfed Crops														
Paddy rainfed a/	Kharif	5,085	282	191	0	0	161	0	968	25	1,627	2,344	3,457	1,114
Paddy rainfed b/	Kharif	7,639	282	382	0	0	269	0	968	31	1,932	2,844	5,707	2,864
Wheat rainfed	Rabi	3,289	414	96	0	0	0	0	726	31	1,266	1,375	2,022	647
Sorghum rainfed a/	Kharif	3,514	141	96	0	0	108	0	645	100	1,089	1,875	2,425	550
Sorghum rainfed b/	Kharif	1,874	141	96	0	0	54	0	645	38	973	1,563	901	(661)
Sorghum rfd.HYV	Rabi	6,524	228	287	191	0	108	63	806	150	1,832	2,188	4,692	2,505
Pearlmillet rfd.a/	Kharif	3,791	114	143	0	0	108	0	806	100	1,271	1,719	2,520	801
Pearlmillet rfd.b/	Kharif	4,083	114	191	0	0	108	0	806	113	1,332	1,813	2,751	939
Pigeon pea rainfed	2-seasn	7,524	149	96	0	0	161	150	806	63	1,425	2,344	6,099	3,755
Gram rainfed	Rabi	8,096	516	48	96	0	0	0	806	31	1,497	1,875	6,599	4,724
Mung rainfed	Rabi	3,963	203	172	0	0	108	0	806	38	1,326	1,719	2,636	917
Cluster bean rfd.	Kharif	5,590	199	0	0	0	54	0	726	44	1,022	1,094	4,568	3,474
Groundnut rfd.	Kharif	11,885	2,016	143	334	78	430	63	968	150	4,181	1,875	7,704	5,829
Mustard rainfed	Rabi	5,694	60	96	48	0	0	0	806	44	1,054	1,563	4,641	3,078
Castor bean rfd.	2-seasn	9,499	142	191	96	0	108	63	968	63	1,629	2,188	7,869	5,682
Cotton rainfed c/	2-seasn	6,071	83	96	0	0	108	0	806	56	1,148	1,344	4,922	3,578
Tobacco rainfed	2-seasn	10,183	806	955	0	0	215	0	806	188	2,970	3,906	7,213	3,306
Fodder sorghum rfd.	Kharif	5,039	169	287	143	0	108	0	645	75	1,427	2,188	3,612	1,425

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Regional Cropping Patterns - Present Situation
(in percent of net CCA)

Crop	Region 1			Region 2			Region 3			Region 4			Region 5		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Rice	1.0	9.0	10.0	1.0	9.0	10.0	0.0	2.0	2.0	0.0	2.0	2.0	3.0	6.0	9.0
Wheat	3.0	1.0	4.0	5.0	0.0	5.0	1.0	6.0	7.0	0.0	13.0	13.0	11.0	1.0	12.0
Sorghum	0.0	13.0	13.0	0.0	11.0	11.0	0.0	14.0	14.0	0.0	12.0	12.0	1.0	7.0	8.0
Pearlmillet	0.0	3.0	3.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	4.0	29.0	33.0
Pulses & Oilseeds	0.0	5.0	5.0	1.0	10.0	11.0	1.0	20.0	21.0	0.0	14.0	14.0	0.0	10.0	10.0
Groundnut	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tobacco	0.0	5.0	5.0	4.0	3.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	8.0
Cotton	5.0	38.0	43.0	22.0	18.0	40.0	7.0	36.0	43.0	4.0	45.0	49.0	7.0	8.0	15.0
Fodder Crops	0.0	7.0	7.0	2.0	10.0	12.0	0.0	7.0	7.0	0.0	7.0	7.0	2.0	14.0	16.0
Other Crops	0.0	11.0	11.0	0.0	10.0	10.0	0.0	5.0	5.0	0.0	1.0	1.0	0.0	6.0	6.0
All Crops	9.0	94.0	103.0	35.0	73.0	108.0	9.0	92.0	101.0	4.0	96.0	100.0	32.0	85.0	117.0

Crop	Region 6			Region 7			Region 8			Region 9			Region 10		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Rice	3.0	4.0	7.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wheat	7.0	7.0	14.0	1.0	16.0	17.0	1.0	0.0	1.0	2.0	0.0	2.0	0.0	4.0	4.0
Sorghum	2.0	8.0	10.0	0.0	16.0	16.0	0.0	15.0	15.0	0.0	13.0	13.0	0.0	15.0	15.0
Pearl millet	2.0	15.0	17.0	0.0	7.0	7.0	0.0	15.0	15.0	0.0	14.0	14.0	0.0	5.0	5.0
Pulses & Oilseeds	0.0	8.0	8.0	0.0	6.0	6.0	0.0	4.0	4.0	0.0	4.0	4.0	0.0	4.0	4.0
Groundnut	0.0	0.0	0.0	0.0	2.0	2.0	0.0	18.0	18.0	0.0	14.0	14.0	0.0	1.0	1.0
Tobacco	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cotton	6.0	27.0	33.0	7.0	36.0	43.0	7.0	39.0	46.0	8.0	43.0	51.0	5.0	58.0	63.0
Fodder Crops	2.0	12.0	14.0	0.0	6.0	6.0	0.0	2.0	2.0	0.0	1.0	1.0	0.0	8.0	8.0
Other Crops	0.0	6.0	6.0	0.0	3.0	3.0	0.0	2.0	2.0	0.0	4.0	4.0	0.0	4.0	4.0
All Crops	22.0	88.0	110.0	8.0	94.0	102.0	8.0	95.0	103.0	10.0	93.0	103.0	5.0	99.0	104.0

Continued

Crop	Region 11			Region 12			Region 13			Total CCA		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0
Wheat	2.0	16.0	18.0	5.0	2.0	7.0	0.0	0.0	0.0	3.0	5.0	8.0
Sorghum	0.0	16.0	16.0	0.0	9.0	9.0	0.0	12.0	12.0	0.0	12.0	12.0
Pearlmillet	0.0	12.0	12.0	1.0	49.0	50.0	1.0	5.0	6.0	1.0	15.0	16.0
Pulses & Oilseeds	0.0	12.0	12.0	4.0	18.0	22.0	0.0	21.0	21.0	1.0	9.0	10.0
Groundnut	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	4.0	4.0
Tobacco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0
Cotton	3.0	37.0	40.0	0.0	2.0	2.0	5.0	34.0	39.0	7.0	30.0	37.0
Fodder Crops	0.0	6.0	6.0	0.0	12.0	12.0	0.0	20.0	20.0	0.0	8.0	8.0
Other Crops	1.0	3.0	4.0	0.0	4.0	4.0	0.0	1.0	1.0	0.0	5.0	5.0
All Crops	6.0	102.0	108.0	10.0	96.0	106.0	6.0	95.0	101.0	13.0	92.0	105.0

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Regional Cropping Patterns - Future without Project
(in percent of net CCA)

Crop	Region 1			Region 2			Region 3			Region 4			Region 5		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Rice	2.0	9.0	11.0	1.0	7.0	8.0	0.0	2.0	2.0	0.0	2.0	2.0	4.0	6.0	10.0
Wheat	4.5	1.0	5.5	7.0	0.0	7.0	2.0	6.0	8.0	0.0	13.0	13.0	13.0	1.0	14.0
Sorghum	0.0	11.5	11.5	0.0	8.0	8.0	0.0	13.0	13.0	0.0	12.0	12.0	1.0	6.0	7.0
Pearlmillet	0.0	3.0	3.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	5.0	27.0	32.0
Pulses & Oilseeds	0.0	5.0	5.0	1.0	8.0	9.0	2.0	19.0	21.0	0.0	14.0	14.0	0.0	9.0	9.0
Groundnut	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tobacco	0.0	5.0	5.0	6.0	2.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	4.0	9.0
Cotton	7.5	35.5	43.0	33.0	14.0	47.0	11.0	34.0	45.0	4.0	45.0	49.0	8.0	7.0	15.0
Fodder Crops	0.0	7.0	7.0	3.0	8.0	11.0	0.0	7.0	7.0	0.0	7.0	7.0	2.0	16.0	18.0
Other Crops	0.0	10.0	10.0	0.0	8.0	8.0	0.0	5.0	5.0	0.0	1.0	1.0	0.0	6.0	6.0
All Crops	14.0	89.0	103.0	51.0	57.0	108.0	15.0	88.0	103.0	4.0	96.0	100.0	38.0	82.0	120.0

Crop	Region 6			Region 7			Region 8			Region 9			Region 10		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Rice	4.0	4.0	8.0	0.0	8.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wheat	10.0	6.0	16.0	1.0	16.0	17.0	1.0	0.0	1.0	2.0	0.0	2.0	0.0	4.0	4.0
Sorghum	3.0	7.0	10.0	0.0	16.0	16.0	0.0	15.0	15.0	0.0	13.0	13.0	0.0	15.0	15.0
Pearlmillet	3.0	13.0	16.0	0.0	7.0	7.0	0.0	15.0	15.0	0.0	14.0	14.0	0.0	5.0	5.0
Pulses & Oilseeds	0.0	7.0	7.0	0.0	6.0	6.0	0.0	4.0	4.0	0.0	4.0	4.0	0.0	4.0	4.0
Groundnut	0.0	0.0	0.0	0.0	2.0	2.0	0.0	18.0	18.0	0.0	14.0	14.0	0.0	1.0	1.0
Tobacco	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cotton	9.0	24.0	33.0	7.0	36.0	43.0	7.0	39.0	46.0	8.0	43.0	51.0	5.0	58.0	63.0
Fodder Crops	3.0	11.0	14.0	0.0	6.0	6.0	0.0	2.0	2.0	0.0	1.0	1.0	0.0	8.0	8.0
Other Crops	0.0	5.0	5.0	0.0	3.0	3.0	0.0	2.0	2.0	0.0	4.0	4.0	0.0	4.0	4.0
All Crops	32.0	78.0	110.0	8.0	100.0	108.0	8.0	95.0	103.0	10.0	93.0	103.0	5.0	99.0	104.0

Continued

Crop	Region 11			Region 12			Region 13			Total CCA		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0
Wheat	3.0	16.0	19.0	5.0	2.0	7.0	0.0	0.0	0.0	4.0	5.0	9.0
Sorghum	0.0	16.0	16.0	0.0	9.0	9.0	0.0	12.0	12.0	0.0	12.0	12.0
Pearlmillet	0.0	12.0	12.0	1.0	49.0	50.0	1.0	5.0	6.0	1.0	15.0	16.0
Pulses & Oilseeds	0.0	12.0	12.0	4.0	18.0	22.0	0.0	21.0	21.0	1.0	9.0	10.0
Groundnut	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	4.0	4.0
Tobacco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0
Cotton	5.0	36.0	41.0	0.0	2.0	2.0	5.0	34.0	39.0	8.0	30.0	38.0
Fodder Crops	0.0	6.0	6.0	0.0	12.0	12.0	0.0	20.0	20.0	1.0	8.0	9.0
Other Crops	2.0	3.0	5.0	0.0	4.0	4.0	0.0	1.0	1.0	0.0	4.0	4.0
All Crops	10.0	101.0	111.0	10.0	96.0	106.0	6.0	95.0	101.0	16.0	89.0	107.0

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Regional Cropping Patterns - Future with Project
(in percent of net CCA)

Crop	Region 1			Region 2			Region 3			Region 4			Region 5		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Paddy HYV	22.0	0.0	22.0	23.0	0.0	23.0	11.0	0.0	11.0	15.0	0.0	15.0	27.0	0.0	27.0
Wheat HYV	18.0	0.0	18.0	22.0	0.0	22.0	15.0	0.0	15.0	10.0	2.0	12.0	29.0	0.0	29.0
Sorghum (Kharif)	1.0	3.0	4.0	2.0	3.0	5.0	3.0	8.0	11.0	0.0	12.0	12.0	4.0	4.0	8.0
Sorghum (Rabi)	3.0	1.0	4.0	2.0	0.0	2.0	6.0	0.0	6.0	2.0	0.0	2.0	0.0	0.0	0.0
Pearl Millet (Khar	2.0	2.0	4.0	1.0	1.0	2.0	4.0	3.0	7.0	2.0	6.0	8.0	7.0	7.0	14.0
Pearl Millet (Rabi)	5.0	0.0	5.0	5.0	0.0	5.0	5.0	0.0	5.0	0.0	0.0	0.0	7.0	0.0	7.0
Pigeon pea	5.0	1.0	6.0	6.0	0.0	6.0	10.0	5.0	15.0	2.0	8.0	10.0	2.0	0.0	2.0
Gram	3.0	2.0	5.0	1.0	0.0	1.0	3.0	0.0	3.0	3.0	1.0	4.0	4.0	4.0	8.0
Groundnut (kharif)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	4.0
Groundnut (Rabi)	5.0	0.0	5.0	5.0	0.0	5.0	5.0	0.0	5.0	0.0	0.0	0.0	3.0	0.0	3.0
Mustard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
Castor bean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	3.0
Cotton med.staple	41.0	0.0	41.0	37.0	0.0	37.0	42.0	0.0	42.0	11.0	0.0	11.0	14.0	0.0	14.0
Cotton short stapl	0.0	2.0	2.0	0.0	1.0	1.0	0.0	3.0	3.0	0.0	28.0	28.0	0.0	2.0	2.0
Tobacco	10.0	0.0	10.0	12.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	6.0
Sugarcane	3.0	0.0	3.0	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bananas	4.0	0.0	4.0	4.0	0.0	4.0	4.0	0.0	4.0	0.0	0.0	0.0	6.0	0.0	6.0
Chillies	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
Vegetable (onions)	2.0	0.0	2.0	4.0	0.0	4.0	2.5	0.0	2.5	0.5	0.0	0.5	4.0	0.0	4.0
Vegetable (potato)	2.0	0.0	2.0	4.0	0.0	4.0	2.5	0.0	2.5	0.5	0.0	0.5	4.0	0.0	4.0
Fodder sorghum	1.5	1.5	3.0	1.5	2.0	3.5	2.0	2.5	4.5	0.0	2.0	2.0	4.0	3.0	7.0
Lucerne	1.5	1.5	3.0	1.5	2.0	3.5	2.0	2.5	4.5	0.0	2.0	2.0	4.0	3.0	7.0
All Crops	129.0	14.0	143.0	135.0	9.0	144.0	117.0	24.0	141.0	46.0	61.0	107.0	131.0	26.0	157.0

Crop	Region 6			Region 7			Region 8			Region 9			Region 10		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Paddy HYV	23.0	0.0	23.0	12.0	0.0	12.0	6.0	0.0	6.0	7.0	0.0	7.0	4.0	0.0	4.0
Wheat HYV	34.0	0.0	34.0	25.0	4.0	29.0	25.0	0.0	25.0	18.0	0.0	18.0	16.0	2.0	18.0
Sorghum (Kharif)	5.0	6.0	11.0	1.0	8.0	9.0	9.0	8.0	17.0	11.0	2.0	13.0	8.0	9.0	17.0
Sorghum (Rabi)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pearl Millet (Khar)	3.0	10.0	13.0	4.0	5.0	9.0	5.0	8.0	13.0	5.0	4.0	9.0	6.0	6.0	12.0
Pearl Millet (Rabi)	7.0	0.0	7.0	3.0	0.0	3.0	0.0	0.0	0.0	3.0	0.0	3.0	4.0	0.0	4.0
Pigeon pea	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gram	4.0	4.0	8.0	4.0	3.0	7.0	3.0	2.0	5.0	2.0	0.0	2.0	3.0	4.0	7.0
Groundnut (kharif)	3.0	3.0	6.0	4.0	2.0	6.0	12.0	2.0	14.0	16.0	0.0	16.0	1.0	0.0	1.0
Groundnut (Rabi)	5.0	0.0	5.0	0.0	0.0	0.0	8.0	0.0	8.0	5.0	0.0	5.0	0.0	0.0	0.0
Mustard	4.0	0.0	4.0	2.0	2.0	4.0	0.0	0.0	0.0	3.0	0.0	3.0	3.0	0.0	3.0
Castor bean	4.0	0.0	4.0	2.0	1.0	3.0	0.0	0.0	0.0	2.0	0.0	2.0	3.0	2.0	5.0
Cotton med. staple	20.0	0.0	20.0	17.0	0.0	17.0	28.0	0.0	28.0	30.0	0.0	30.0	35.0	0.0	35.0
Cotton short staple	0.0	3.0	3.0	0.0	20.0	20.0	0.0	4.0	4.0	0.0	5.0	5.0	0.0	4.0	4.0
Tobacco	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bananas	5.0	0.0	5.0	1.0	0.0	1.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0
Chillies	1.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	1.0
Vegetable (onions)	4.0	0.0	4.0	0.5	0.0	0.5	1.0	0.0	1.0	1.0	0.0	1.0	1.5	0.0	1.5
Vegetable (potato)	4.0	0.0	4.0	0.5	0.0	0.5	1.0	0.0	1.0	1.0	0.0	1.0	1.5	0.0	1.5
Fodder sorghum	2.0	2.5	4.5	1.5	2.5	4.0	2.0	1.0	3.0	2.5	1.5	4.0	1.5	3.0	4.5
Lucerne	2.0	2.5	4.5	1.5	2.5	4.0	2.0	1.0	3.0	2.5	1.5	4.0	1.5	3.0	4.5
All Crops	134.0	32.0	166.0	79.0	50.0	129.0	105.0	26.0	131.0	112.0	14.0	126.0	92.0	33.0	125.0

Table 11

Continued

Crop	Region 11			Region 12			Region 13			Total CCA		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Paddy HYV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	0.0	10.9
Wheat HYV	15.0	12.0	27.0	29.0	0.0	29.0	16.0	0.0	16.0	22.3	1.0	23.3
Sorghum (Kharif)	5.0	10.0	15.0	9.0	6.0	15.0	6.0	8.0	14.0	5.4	6.0	11.4
Sorghum (Rabi)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.7
Pearl Millet (Khar)	10.0	2.0	12.0	25.0	10.0	35.0	10.0	3.0	13.0	7.6	6.0	13.6
Pearl Millet (Rabi)	2.0	0.0	2.0	3.0	0.0	3.0	1.0	0.0	1.0	3.5	0.0	3.5
Pigeon pea	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.0	2.6
Gram	2.0	0.0	2.0	7.0	11.0	18.0	7.0	5.0	12.0	3.6	3.0	6.6
Groundnut (kharif)	0.0	0.0	0.0	4.0	0.0	4.0	9.0	1.0	10.0	4.2	1.0	5.2
Groundnut (Rabi)	0.0	0.0	0.0	3.0	0.0	3.0	3.0	0.0	3.0	3.2	0.0	3.2
Mustard	7.0	2.0	9.0	8.0	0.0	8.0	4.0	0.0	4.0	2.7	0.0	2.7
Castor bean	3.0	2.0	5.0	5.0	0.0	5.0	4.0	0.0	4.0	2.1	1.0	3.1
Cotton med. staple	13.0	0.0	13.0	11.0	0.0	11.0	25.0	0.0	25.0	24.4	0.0	24.4
Cotton short staple	0.0	26.0	26.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	7.0	7.0
Tobacco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	2.4
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5
Bananas	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	2.3	0.0	2.3
Chillies	1.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	1.0	0.4	0.0	0.4
Vegetable (onions)	1.0	0.0	1.0	2.5	0.0	2.5	1.5	0.0	1.5	2.0	0.0	2.0
Vegetable (potato)	1.0	0.0	1.0	2.5	0.0	2.5	1.5	0.0	1.5	2.0	0.0	2.0
Fodder sorghum	0.5	2.5	3.0	3.0	3.5	6.5	3.0	7.5	10.5	2.0	2.5	4.5
Lucerne	0.5	2.5	3.0	3.0	3.5	6.5	3.0	7.5	10.5	2.0	2.5	4.5
All Crops	61.0	61.0	122.0	115.0	34.0	149.0	96.0	33.0	129.0	106.0	31.0	137.0

INDIA

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Estimated Average EWater Balance
(Ru(Million m3))

	Region 1			Region 2			Region 3			Region 4			Region 5		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Present															
Gross return	10,954	3,491	4,267	11,720	3,820	6,891	11,534	3,266	4,043	11,946	2,913	3,275	11,204	3,546	6,599
Input cost	5,217	2,129	2,471	5,840	2,174	3,631	5,616	1,873	2,228	6,242	1,806	1,984	4,941	2,215	3,464
Net return	5,737	1,362	1,796	5,880	1,646	3,260	5,918	1,393	1,814	5,704	1,107	1,291	6,263	1,331	3,136
Labor	1,852	1,706	1,770	2,199	1,590	1,930	2,047	1,605	1,661	2,261	1,774	1,794	1,858	1,072	1,506
Crop Intensity	9	94	103	35	73	108	9	92	101	4	96	100	32	85	117
Future WOP															
Gross return	13,145	4,189	5,568	14,064	4,584	9,786	13,841	3,919	5,525	14,335	3,496	3,930	13,445	4,255	8,598
Input cost	6,521	2,662	3,282	7,300	2,718	5,272	7,020	2,341	3,113	7,803	2,258	2,479	6,176	2,768	4,617
Net return	6,624	1,528	2,287	6,764	1,866	4,514	6,821	1,578	2,412	6,532	1,238	1,450	7,269	1,487	3,981
Labor	2,222	1,202	1,381	2,658	1,251	2,069	2,364	1,073	1,299	2,714	1,016	1,084	2,308	1,200	1,861
Crop Intensity	14	89	103	51	57	108	15	88	103	4	96	100	38	82	120
Future WP															
Gross return	20,957	4,712	27,694	21,314	3,690	29,106	20,358	4,389	24,872	14,346	3,862	8,955	19,088	4,460	26,165
Input cost	8,092	2,560	10,797	8,321	2,569	11,464	7,555	2,500	9,440	5,086	2,226	3,697	7,444	2,708	10,456
Net return	12,865	2,151	16,897	12,993	1,121	17,642	12,802	1,889	15,432	9,260	1,636	5,258	11,644	1,752	15,709
Labor	2,798	1,083	3,760	2,803	1,256	3,898	2,463	1,309	3,196	2,536	813	1,662	2,360	1,115	3,381
Crop Intensity	129	14	143	135	9	144	117	24	141	46	61	107	131	26	157

	Region 6			Region 7			Region 8			Region 9			Region 10		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Present															
Gross return	10,058	3,054	4,900	11,737	2,623	3,405	11,737	2,558	3,369	11,612	2,561	3,543	11,946	2,458	3,031
Input cost	4,617	1,955	2,736	5,948	1,805	2,172	5,948	2,166	2,534	5,772	2,067	2,499	6,242	1,709	2,004
Net return	5,441	1,099	2,165	5,789	819	1,233	5,789	392	836	5,840	494	1,044	5,704	750	1,027
Labor	1,721	942	1,207	2,125	844	963	2,125	862	989	2,044	852	997	2,261	819	924
Crop intensity	22	88	110	8	94	102	8	95	103	10	93	103	5	99	104
Future WOP															
Gross return	12,069	3,665	6,721	14,084	3,148	4,275	14,084	3,070	4,043	13,934	3,073	4,252	14,335	2,950	3,637
Input cost	5,771	2,443	3,752	7,435	2,256	2,851	7,435	2,707	3,167	7,214	2,583	3,124	7,803	2,136	2,504
Net return	6,298	1,222	2,968	6,649	892	1,424	6,649	363	876	6,720	490	1,128	6,532	814	1,132
Labor	4,684	996	2,276	1,457	1,193	1,309	1,457	1,104	1,165	1,752	1,068	1,169	969	1,093	1,131
Crop intensity	32	78	110	8	100	108	8	95	103	10	93	103	5	99	104
Future WP															
Gross return	19,117	4,085	26,924	13,543	3,569	12,483	17,316	3,461	19,081	16,838	3,317	19,323	20,116	4,162	19,880
Input cost	7,283	2,661	10,610	4,860	2,295	4,987	6,775	2,450	7,751	6,641	2,266	7,778	7,161	2,379	7,373
Net return	11,834	1,424	16,313	8,683	1,274	7,496	10,541	1,011	11,331	10,177	1,050	11,545	12,954	1,783	12,506
Labor	2,319	1,167	3,481	2,198	794	2,133	2,190	1,192	2,610	2,189	969	2,588	2,363	1,117	2,543
Crop intensity	134	32	166	79	50	129	105	26	131	112	14	126	92	33	125

Table 12

Continued												
	Region 11			Region 12			Region 13			Total CCA		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Present												
Gross return	11,325	2,706	3,439	9,617	3,334	4,163	11,882	3,019	3,581	11,193	2,984	4,200
Input cost	4,417	1,741	2,041	3,412	1,987	2,249	5,975	1,892	2,156	5,231	1,968	2,494
Net return	6,908	964	1,398	6,205	1,347	1,913	5,908	1,126	1,424	5,962	1,016	1,706
Labor	1,521	839	947	1,211	981	1,063	2,150	908	992	1,918	1,064	1,231
Crop Intensity	6	102	108	10	96	106	6	95	101	13	93	105
Future WOP												
Gross return	13,590	3,247	4,638	11,541	4,001	4,995	14,259	3,622	4,297	13,441	3,559	5,379
Input cost	5,522	2,177	2,751	4,265	2,484	2,811	7,468	2,365	2,695	6,554	2,454	3,274
Net return	8,069	1,070	1,888	7,276	1,517	2,184	6,790	1,257	1,602	6,888	1,105	2,105
Labor	1,271	1,145	1,283	1,027	1,269	1,321	1,095	1,163	1,171	2,305	1,153	1,414
Crop Intensity	10	101	111	10	96	106	6	95	101	16	91	107
Future WP												
Gross return	13,196	3,405	10,126	15,621	4,967	19,652	17,458	4,069	18,103	17,933	4,029	20,265
Input cost	4,300	2,143	3,930	5,381	2,517	7,044	6,328	2,689	6,962	6,713	2,430	7,872
Net return	8,896	1,261	6,196	10,239	2,450	12,608	11,131	1,381	11,141	11,220	1,599	12,394
Labor	1,929	873	1,709	1,638	976	2,215	1,952	1,048	2,220	2,267	1,005	2,715
Crop Intensity	61	61	122	115	34	149	96	33	129	106	31	137

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Estimated Average FWater Balance
(Ru(Million m3))

	Region 1			Region 2			Region 3			Region 4			Region 5		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Present															
Gross return	13,212	4,823	5,722	14,803	4,656	8,580	14,655	4,386	5,354	15,921	4,214	4,682	12,744	4,081	7,547
Input cost	5,906	2,655	3,027	6,700	2,704	4,319	6,519	2,374	2,771	7,286	2,289	2,489	5,487	2,736	4,081
Net return	7,306	2,168	2,695	8,103	1,953	4,262	8,136	2,013	2,584	8,635	1,925	2,193	7,257	1,345	3,466
Labor	2,764	2,547	2,643	3,282	2,373	2,881	3,056	2,395	2,479	3,375	2,648	2,678	2,773	1,600	2,248
Crop Intensity	9	94	103	35	73	108	9	92	101	4	96	100	32	85	117
Future WOP															
Gross return	15,854	5,787	7,370	17,763	5,588	12,244	17,587	5,264	7,270	19,106	5,056	5,618	15,292	4,898	9,827
Input cost	7,382	3,318	3,987	8,375	3,379	6,197	8,149	2,967	3,833	9,108	2,861	3,111	6,859	3,420	5,411
Net return	8,471	2,469	3,383	9,389	2,208	6,047	9,437	2,296	3,437	9,998	2,195	2,507	8,434	1,478	4,417
Labor	3,316	1,794	2,061	3,967	1,867	3,087	3,528	1,602	1,939	4,050	1,516	1,618	3,444	1,791	2,778
Crop Intensity	14	89	103	51	57	108	15	88	103	4	96	100	38	82	120
Future WP															
Gross return	25,647	5,402	33,841	25,963	4,507	35,455	25,100	5,021	30,572	15,997	5,408	10,658	22,134	5,542	30,436
Input cost	8,961	3,231	12,011	9,218	3,203	12,732	8,366	3,211	10,560	5,670	2,894	4,374	8,119	3,352	11,507
Net return	16,687	2,171	21,830	16,745	1,303	22,724	16,734	1,810	20,013	10,327	2,514	6,284	14,015	2,190	18,929
Labor	4,175	1,616	5,613	4,184	1,875	5,818	3,676	1,953	4,770	3,785	1,213	2,481	3,522	1,664	5,046
Crop Intensity	129	14	143	135	9	144	117	24	141	46	61	107	131	26	157

	Region 6			Region 7			Region 8			Region 9			Region 10		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Present															
Gross return	11,329	4,045	6,052	15,243	3,846	4,834	15,243	4,929	5,902	14,836	4,811	5,958	15,921	4,132	4,886
Input cost	5,158	2,444	3,286	6,875	2,274	2,688	6,875	2,679	3,095	6,628	2,575	3,057	7,286	2,187	2,529
Net return	6,171	1,601	2,766	8,368	1,572	2,147	8,368	2,250	2,807	8,208	2,237	2,901	8,635	1,945	2,357
Labor	2,568	1,406	1,802	3,172	1,259	1,438	3,172	1,286	1,476	3,050	1,272	1,468	3,375	1,222	1,379
Crop Intensity	22	88	110	8	94	102	8	95	103	10	93	103	5	99	104
Future WOP															
Gross return	13,595	4,854	8,137	18,292	4,615	6,078	18,292	5,915	7,083	17,803	5,774	7,150	19,106	4,958	5,864
Input cost	6,448	3,055	4,446	8,594	2,842	3,530	8,594	3,349	3,869	8,285	3,218	3,821	9,108	2,733	3,161
Net return	7,147	1,799	3,690	9,698	1,772	2,548	9,698	2,566	3,214	9,518	2,555	3,328	9,998	2,225	2,702
Labor	6,991	1,487	3,397	2,175	1,780	1,954	2,175	1,647	1,739	2,614	1,595	1,745	1,446	1,631	1,687
Crop Intensity	32	78	110	8	100	108	8	95	103	10	93	103	5	99	104
Future WP															
Gross return	22,659	5,345	32,073	15,828	5,282	15,145	23,470	4,691	25,864	22,798	4,682	26,189	24,325	4,662	23,917
Input cost	7,957	3,315	11,723	5,336	2,900	5,665	7,507	3,087	8,685	7,417	2,881	8,711	7,948	2,994	8,300
Net return	14,702	2,030	20,350	10,492	2,382	9,480	15,963	1,605	17,179	15,381	1,801	17,479	16,377	1,667	15,617
Labor	3,461	1,742	5,195	3,280	1,185	3,184	3,269	1,779	3,895	3,268	1,446	3,863	3,527	1,667	3,795
Crop Intensity	134	32	166	79	50	129	105	26	131	112	14	126	92	33	125

Continued												
	Region 11			Region 12			Region 13			Total CCA		
	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT	IR	RF	TOT
Present												
Gross return	13,401	3,742	4,621	9,861	3,579	4,422	15,210	4,303	5,001	13,523	4,226	5,649
Input cost	4,975	2,213	2,556	3,712	2,503	2,774	6,879	2,387	2,680	5,937	2,468	3,048
Net return	8,426	1,528	2,065	6,149	1,077	1,649	8,331	1,916	2,320	7,586	1,758	2,601
Labor	2,271	1,253	1,414	1,808	1,464	1,586	3,208	1,355	1,480	2,863	1,588	1,838
Crop Intensity	6	102	108	10	96	106	6	95	101	13	93	105
Future WOP												
Gross return	16,081	4,490	6,143	11,834	4,295	5,307	18,252	5,164	6,001	16,247	5,060	7,189
Input cost	6,219	2,767	3,416	4,640	3,128	3,467	8,599	2,984	3,351	7,440	3,078	3,982
Net return	9,862	1,723	2,727	7,193	1,167	1,840	9,654	2,180	2,651	8,807	1,981	3,206
Labor	1,896	1,708	1,915	1,533	1,895	1,972	1,634	1,736	1,747	3,441	1,720	2,111
Crop Intensity	10	101	111	10	96	106	6	95	101	16	91	107
Future WP												1
Gross return	15,064	4,833	12,137	18,145	5,188	22,631	22,490	4,887	23,203	21,920	5,108	24,828
Input cost	4,772	2,726	4,574	5,951	3,162	7,919	7,082	3,299	7,888	7,417	3,063	8,814
Net return	10,292	2,107	7,563	12,194	2,026	14,712	15,408	1,587	15,316	14,504	2,044	16,013
Labor	2,879	1,303	2,551	2,445	1,456	3,306	2,914	1,565	3,314	3,383	1,500	4,053
Crop Intensity	61	61	122	115	34	149	96	33	129	106	31	137

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Estimate of Economic Value of energy from Hydropower Component

1. Economic tariff based on willingness to pay (Rs/kWh) = 2.134

2. Adjustment for System Losses and Auxiliary Consumption

System losses 18.00% of energy sent out
 Auxiliary consumption 0.50% of energy generated
 Adjustment factor: 0.816

Average financial value at busbar (Rs/kWh): 1.741

3. Economic Value

Rs 1.741 x standard conversion factor (.8) = Rs 1.39 0.00

4. Midnight power cost (Rs/kWh) 0.384

a/ Average value of benefits for the western region program analysis,
 Second Maharashtra Power Project, adjusted for inflation.

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BARMUDA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Economic Power Benefits (Rs. M)

Table 15

Economic Power Benefits:

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
River Bed Powerhouse															
Annual water releases (Mm3)	0	0	0	19404	18677	17730	16358	15082	18178	16444	14964	13740	12802	12120	11667
Annual energy generated (MkWh)			0	3976	4764	4528	4185	3846	4637	4206	3836	3530	3295	3125	3012
Gross value (Rs millions)	0	0	0	5539	6637	6307	5829	5357	6460	5859	5344	4917	4591	4353	4195
Carmelhead Powerhouse															
Annual water releases (Mm3)	0	51	443	962	1835	3076	5024	6946	8899	10719	12231	13423	14257	14771	15000
Average water head		35	35	34	34	33	33	32	31	31	30	29	29	28	28
Annual energy generated (MkWh)		3	36	77	144	236	379	514	645	762	851	915	951	964	957
Gross value (Rs millions)	0	5	50	107	200	329	528	716	899	1061	1186	1274	1325	1343	1333
RBPB Pumpback															
Plant factor	0.00%	0.00%	0.00%	2.00%	3.07%	5.45%	7.44%	9.25%	11.01%	12.00%	14.58%	16.37%	18.15%	19.94%	25.00%
Annual energy generated (MkWh)	0	0	0	65	121	177	233	288	344	400	456	512	567	623	781
Gross value (Rs millions)	0	0	0	91	168	246	326	402	479	557	635	713	790	868	1080
Energy cost	0	0	0	28	52	76	100	124	148	172	196	220	244	268	336
Net value	0	0	0	63	116	170	224	278	331	385	439	493	546	600	752
Total Value	0	5	50	5708	6954	6807	6581	6358	7691	7305	6969	6684	6462	6296	6281

Economic M & I Benefits (Gross)

Water supply (Mm3)		0.0	133.6	141.8	150.8	160.2	483.1	583.6	525.2	547.9	572.4	591.5	610.6	632.2	657.4
Gross value (Rs millions)	0	559	607	1884	1881	1962	2879	2167	2240	2342	2401	2496	2606	2744	2910

Economic Power Benefits

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
River Bed Powerhouse															
Annual water releases (Mm3)	11324	10659	10338	10032	9748	9463	9137	8893	8608	8322	8036	7749	7479	7208	6938
Annual energy generated (MWh)	2926	2768	2680	2603	2532	2461	2379	2318	2247	2176	2104	2032	1965	1897	1829
Gross value (Rs millions)	4076	3845	3733	3626	3527	3428	3315	3238	3138	3031	2931	2831	2737	2643	2549
Canalhead Powerhouse															
Annual water releases (Mm3)	15091	15583	15646	15691	15708	15726	15795	15762	15781	15808	15819	15839	15839	15839	15839
Average water head	27	26	26	25	25	25	25	25	25	25	25	25	25	25	25
Annual energy generated (MWh)	941	949	930	910	911	912	916	916	915	916	917	919	919	919	919
Gross value (Rs millions)	1311	1322	1296	1268	1269	1271	1276	1274	1275	1277	1278	1280	1280	1280	1280
RBPB Pumpback															
Plant factor	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Annual energy generated (MWh)	781	781	781	781	781	781	781	781	781	781	781	781	781	781	781
Gross value (Rs millions)	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088	1088
Energy cost	336	336	336	336	336	336	336	336	336	336	336	336	336	336	336
Net value	752	752	752	752	752	752	752	752	752	752	752	752	752	752	752
Total Value	6139	5919	5781	5646	5549	5451	5343	5256	5158	5060	4962	4863	4769	4675	4581

Economic M & I Benefits (Gross)

Water supply (Mm3)	686.5	723.2	767.2	798.5	818.7	823.8	871.6	848.2	861.5	874.8	888.1	902.5	902.5	902.5	902.5
Gross value (Rs millions)	3029	3078	3127	3177	3226	3276	3327	3377	3432	3433	3435	3436	3436	3436	3436

Table 15

Continued

Economic Power Benefits

Year	2024	2025	2026-33
River Bed Powerhouse			
Annual water releases (Mm ³)	6668	6397	6127
Annual energy generated (MkWh)	1762	1694	1627
Gross value (Rs millions)	2454	2368	2266
Canalhead Powerhouse			
Annual water releases (Mm ³)	15839	15839	15839
Average water head	25	25	25
Annual energy generated (MkWh)	919	919	919
Gross value (Rs millions)	1280	1280	1280
BSPM Pumpback			
Plant factor	25.00%	25.00%	25.00%
Annual energy generated (MkWh)	781	781	781
Gross value (Rs millions)	1068	1068	1068
Energy cost	336	336	336
Net value	752	752	752
Total Value	4487	4392	4298

Economic M & I Benefits (Gross)

Water supply (Mm ³)	902.5	902.5	902.5
Gross value (Rs millions)	3436	3436	3436

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Financial Investment Cost by Components by Year
(Rs Million)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
A. Main dam	783	160	144	150	249	196	428	789	1294	1528	1790	1361	1029
B. Rockfill dykes & link channels													
C. Riverbed powerhouse	16	26	64	34	299	100	82	164	293	735	4470	3341	978
D. Main canal	828	247	144	135	338	585	913	1514	2331	2218	4722	5376	5305
E. Garudeshwar weir *										202	172	127	
F. Canalhead powerhouse	8	27	35	20	85	251	24	175	160	326	353	374	300
G. Transmission system *								27	46	57	55	43	
H. Branches	110	35	47	63	156	148	304	622	808	1122	2104	3549	7236
I. Distribution & drainage system	90	17	17	26	25	50	114	273	269	824	968	3694	4992
Drainage & ground water deve.										405	405	405	608
J. En route storage													
K. Command area development										16	323	588	850
L. Hydrometeorological network *										48	50	40	38
M. Training and TA - dam & canal *	4	9	10	9	6	5	5	4	4	4	2	1	1
N. Land acquisition & rehabilitatio	137	101	532	563	147	126	75						
Total baseline costs	1974	622	992	1000	1304	1461	1945	3569	5204	7485	15413	18897	21337

Note: at current prices before 1992, constant 1992 prices afterwards.

Table 16

	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total	
										Rs	US\$
A. Main dam	632	592	176	20						11320	432
B. Rockfill dykes & link channels										0	0
C. Riverbed powerhouse	536	511	59							11706	447
D. Main canal	3685	2518	1599	649						33109	1264
E. Garudeshwar weir *										501	19
F. Canalhead powerhouse	162	5	4							2309	88
G. Transmission system *										227	9
H. Branches	8886	8213	6214	3133	479	461				43687	1667
I. Distribution & drainage system	5273	5078	3032	1608	718	58				27125	1033
Drainage & ground water deve.	608	608	608	405						4054	155
J. En route storage	48	80	96	64	32					320	12
K. Command area development	946	1302	1364	1173	816	786	496	361	0	9020	344
L. Hydrometeorological network *										175	7
M. Training and TA - dam & canal *	1	1	1	1	1	1	1	1	1	74	3
N. Land acquisition & rehabilitatio										1681	64
Total baseline costs	20777	18908	13152	7053	2046	1306	497	362	1	145307	5546

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Economic Investment Cost by Components by Year
(Rs Million)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
A. Main dam	1,650	305	244	226	345	250	504	709	1,057	1,248	1,462	1,111	841	516	484
B. Rockfill dykes & link channels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Riverbed powerhouse	33	50	108	52	415	128	97	148	239	630	3,833	2,865	838	459	438
D. Main canal	1,744	469	244	205	469	748	1,075	1,360	1,904	1,993	4,242	4,830	4,766	3,311	2,262
E. Garudeshwar weir	0	0	0	0	0	0	0	0	0	468	399	294	0	0	0
F. Canalhead powerhouse	16	52	59	30	117	321	29	157	130	280	302	320	258	139	5
G. Transmission system	0	0	0	0	0	0	0	60	101	126	121	96	0	0	0
H. Branches	232	66	80	96	216	189	358	559	660	1,008	1,890	3,188	6,501	7,983	7,378
I. Distribution & drainage system	189	33	28	39	35	64	134	245	219	740	870	3,318	4,484	4,738	4,562
Drainage & ground water deve.	0	0	0	0	0	0	0	0	0	364	364	364	546	546	546
J. En route storage	0	0	0	0	0	0	0	0	0	0	0	0	0	43	72
K. Command area development	0	0	0	0	0	0	0	0	0	15	290	528	764	850	1,170
L. Hydrometeorological network *	0	0	0	0	0	0	0	0	0	111	115	92	89	0	0
M. Training and TA - dam & canal *	8	20	24	20	14	11	11	10	10	10	6	3	3	3	3
N. Land acquisition & rehabilitation															
O. Rajasthan branch & distribution															
Total Project Costs	3,871	994	787	668	1,610	1,711	2,207	3,248	4,320	6,992	13,894	17,009	19,090	18,588	16,920

	1999	2000	2001	2002	2003	2004	2005	Total		Coversto Factor	Phys. Cont.	Update/ SAR
								Rs	US\$			
A. Main dam	144	17	0	0	0	0	0	11,111	424	0.8	1	0.97
B. Rockfill dykes & link channels	0	0	0	0	0	0	0	0	0	0.8	1	0.00
C. Riverbed powerhouse	50	0	0	0	0	0	0	10,382	396	0.8	1.05	0.93
D. Main canal	1,437	583	0	0	0	0	0	31,642	1,208	0.8	1.1	1.15
E. Garudeshwar weir *	0	0	0	0	0	0	0	1,161	44	0.8	1.1	1.02
F. Canalhead powerhouse	4	0	0	0	0	0	0	2,220	85	0.8	1.05	0.97
G. Transmission system *	0	0	0	0	0	0	0	503	19	0.8	1.05	1.02
H. Branches	5,582	2,814	430	414	0	0	0	39,644	1,513	0.8	1.1	1.86
I. Distribution & drainage system	2,724	1,444	645	52	0	0	0	24,565	938	0.8	1.1	1.03
Drainage & ground water deve.	546	364	0	0	0	0	0	0	0	0.8	1.1	
J. En route storage	86	57	29	0	0	0	0	287	11	0.8	1.1	
K. Command area development	1,225	1,054	733	706	446	324	0	8,104	309	0.8	1.1	0.66
L. Hydrometeorological network *	0	0	0	0	0	0	0	406	15	0.8	1.1	1.02
M. Training and TA - dam & canal *	3	3	3	3	3	3	3	172	7	0.8	1.1	1.02
N. Land acquisition & rehabilitatio												
O. Rajasthan branch & distribution	270	541	676	676	541	0		2,704	103			
Total Project Costs	12,071	6,877	2,516	1,851	989	327	3	136,543	5,212			1.00

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Sardar Sarovar Dam and Power Component
 Estimated Recurrent Operation and Maintenance Costs
 (Rs Million)

	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Investment Schedule (with price Contign.)	2,578	1,010	2,097	1,929	1,843	1,534	1,339	1,624	2,088	3,592	7,560	5,933	3,170	2,182	2,012	1,092	604
Accumulative Investment	2,578	3,588	5,684	7,613	9,457	10,990	12,329	13,953	16,041	19,633	27,193	33,126	36,296	38,478	40,490	41,582	42,186
Operation & Maintenance Rate/factor a/								0.000	0.000	0.001	0.002	0.003	0.004	0.005	0.005	0.005	0.005
Distribution costs b/														462.8	476.5	474.9	472.4
Total Estimated Annual O&M Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.6	54.4	99.4	145.2	655.2	678.9	682.8	683.3

a/ Based on a rate of the cumulative investment at initial operation in 1993 and increasing to 0.51 development in 1997.

b/ Including annualital costs and O&M costs.

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NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Water Delivery and Drainage
Estimated Recurrent Operation and maintenance Costs
(Rs Million)

Table 19

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Financial															
Establishment Costs	0.0	0.3	3.3	27.5	49.5	89.3	133.5	178.1	223.3	268.7	319.7	370.1	414.7	453.9	509.3
Communications/Control costs	1.9	2.2	2.5	2.3	5.4	4.9	7.5	9.7	11.2	11.2	14.9	17.5	20.1	20.1	22.4
Well Maintenance Costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.0	1.7	2.9	4.5	6.5
Total O&M Costs	1.9	2.5	5.8	29.8	54.9	94.2	141.0	187.8	234.6	280.2	335.6	389.3	437.7	478.5	538.2
Energy Costs	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.6	1.7	5.6	15.2	27.8	178.8	274.4	347.5
Total Annual Costs	1.9	2.5	5.8	29.8	55.1	94.4	141.4	188.4	236.3	285.8	350.8	417.1	616.5	752.9	885.7
Economic															
Establishment Costs	0.0	0.6	5.5	40.8	67.3	111.8	153.9	156.7	178.6	215.0	255.8	296.1	331.8	363.1	407.4
Communications/Control costs	3.8	4.1	4.2	3.4	7.3	6.1	8.6	8.5	9.0	9.0	11.9	14.0	16.1	16.1	17.9
Well Maintenance Costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.8	1.4	2.3	3.6	5.2
Total O&M Costs	3.8	4.7	9.6	44.2	74.6	117.9	162.5	165.3	187.7	224.2	268.5	311.4	350.2	382.8	430.6
Energy Costs	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.5	1.4	4.5	12.1	22.3	143.0	219.5	278.0
Total Annual Costs	3.8	4.7	9.6	44.2	74.8	118.1	162.9	165.7	189.1	228.6	280.6	333.7	493.2	602.3	708.6

	2006	2007	2008	2009	2010
Financial					
Establishment Costs	544.6	553.2	554.5	554.5	554.6
Communications/Control costs	22.4	22.4	22.4	22.4	22.4
Well Maintenance Costs	8.6	10.9	12.9	14.2	15.2
Total O&M Costs	575.6	586.5	589.8	591.1	592.2
Energy Costs	408.2	441.6	470.6	490.4	506.5
Total Annual Costs	983.8	1028.1	1060.4	1081.5	1098.7
Economic					
Establishment Costs	435.7	442.6	443.6	443.6	443.7
Communications/Control costs	17.9	17.9	17.9	17.9	17.9
Well Maintenance Costs	6.9	8.7	10.3	11.4	12.2
Total O&M Costs	460.5	469.2	471.8	472.9	473.8
Energy Costs	326.6	353.3	376.5	392.3	405.2
Total Annual Costs	787.0	822.5	848.3	865.2	879.0

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NARMADA RIVER DEVELOPMENT-GUJARAT

Table 20

Update of Economic Analysis

Other Benefits and Costs

(Rs. Million)

Other Benefits and Costs (M Rs)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Land Acquisition															
Dam and reservoir															
Agriculture	3.4	5.9	19.4	34.0	38.2	41.9	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4
Forestry-cost	2.4	4.2	13.7	23.7	26.4	28.6	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
Forestry harvesting	(11.1)	(8.2)	(43.1)	(45.6)	(11.9)	(10.2)	(6.1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Resettlement Cost	50.5	50.5	50.5	50.5	50.5	200.0	250.0	330.0	330.0	350.0	400.0	340.0	340.0	237.5	0.0
Total reservoir	45.2	52.5	40.5	62.6	103.1	260.3	318.2	404.3	404.3	424.3	474.3	414.3	414.3	311.8	74.3
Command control area											0.0	0.0	0.0	12.0	32.8
Total land	79.0	55.0	313.0	335.0	82.0	260.3	318.2	404.3	404.3	424.3	474.3	414.3	414.3	323.8	107.1
Narmada Sagar dam cost allocation	0.1	0.1	0.3	0.3	0.1	0.1	0.0	1.0		18.6	26.7	40.0	50.0	50.0	50.0
Environmental															
Benefit															
Costs															
Net				1.8	3.5	7.9	67.8	67.8	92.6	92.5	92.4	58.9	64.1	59.6	56.6
Fuelwood (net)													27.5	55.0	82.5
Fishery benefit (net)									(7.9)	(8.2)	(1.8)	(3.1)	(1.2)	14.4	27.7

Other Benefits and Costs (M Rs)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Land Acquisition															
Dam and reservoir															
Agriculture	44.4	44.4	44.4	44.4	44.4	44.4									
Forestry-cost	29.9	29.9	29.9	29.9	29.9	29.9									
Forestry harvesting	0.0	0.0	0.0	0.0	0.0	0.0									
Resettlement Cost	0.0	0.0	0.0	0.0	0.0	0.0									
Total reservoir	74.3	74.3	74.3	74.3	74.3	74.3	74.3	74.3	74.3						
Command control area	62.9	96.3	143.6	194.2	238.7	270.6	300.7	318.3	331.1						
Total land	137.2	170.6	217.9	268.5	313.0	344.9	375.0	392.6	405.3						
Narmada Sagar dam cost allocation	40.0	25.0	12.0	10.0	6.2										
Environmental															
Benefit															
Costs															
Net	56.5	89.1	86.3	86.2	86.1	86.0	50.6	49.6	49.5	49.4	49.3	71.0	70.9	70.8	70.9
Fuelwood (net)	110.0	137.5	165.0	192.5	220.0	247.5	275.0	302.5	330.0	357.5	385.0	410.3	410.3	410.3	410.3
Fishery benefit (net)	44.6	55.2	60.8	61.1	61.8	66.0	66.0	64.3	64.9	65.9	66.0	65.0	67.1	65.7	65.7

Table 20

Other Benefits and Costs (M Rs)													
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026-33
Land Acquisition													
Dam and reservoir													
Agriculture													
Forestry-cost													
Forestry harvesting													
Resettlement Cost													
Total reservoir													
Command control area													
Total land													
Narmada Sagar dam cost allocation													
Environmental													
Benefit													
Costs													
Net	71.0	71.0	71.1	71.3	71.3	71.3	71.4	72.6	72.6	72.6	72.6	72.6	72.6
Fuelwood (net)	410.3	410.3	410.3	410.3	410.3	410.3	410.3	410.3	410.3	410.3	410.3	410.3	410.3
Fishery benefit (net)	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7

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NARMADA RIVER DEVELOPMENT-GUJARAT

Table 21

Update of Economic Analysis

Economic Cost and Benefit
(Rs Million)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Incremental Benefits															
Net irrigation benefit	0	0	0	0	0	0	0	0	0	0	0	404	1,184	2,462	4,091
Power benefit	0	0	0	0	0	0	0	0	0	0	0	5	50	5,708	6,954
N & I benefit	0	0	0	0	0	0	0	0	0	0	0	559	687	1,804	1,881
Others	0	0	0	0	0	0	0	0	(8)	(8)	(2)	(3)	26	49	118
Total benefits	0	0	0	0	0	0	0	0	(8)	(8)	(2)	965	1,868	10,044	13,036
Incremental Costs															
Investment costs															
Dam and reservoir	1,699	368	297	300	456	517	828	1,119	1,466	1,477	1,939	1,527	1,257	873	631
Power facilities	49	182	167	82	532	449	125	365	470	1,523	4,682	3,615	1,146	648	493
Irrigation facilities	2,168	577	362	348	726	1,005	1,571	2,168	2,788	4,235	7,774	12,321	17,152	17,441	15,953
Total investment costs	3,916	1,047	827	730	1,713	1,971	2,523	3,652	4,723	7,435	14,395	17,463	19,554	18,962	17,077
Incremental working capital															
Operation & maintenance cost															
Dam and power	0	0	0	0	0	0	0	0	0	20	54	99	145	655	679
Irrigation system	0	0	0	0	0	0	0	4	5	18	44	75	118	163	166
Total operation costs	0	0	0	0	0	0	0	4	5	29	99	174	263	818	845
Environmental cost	0	0	0	2	4	8	68	68	93	93	92	59	64	60	57
Total costs	3,916	1,047	827	732	1,717	1,979	2,593	3,724	4,822	7,557	14,585	17,696	19,882	19,840	17,978
Net Cash Flow	(3,916)	(1,047)	(827)	(732)	(1,717)	(1,979)	(2,593)	(3,724)	(4,830)	(7,565)	(14,587)	(16,732)	(18,014)	(9,796)	(4,942)
EIRR:															
NPV (at 12%):															

Note: Other benefits include fuel wood and fishery benefits. Investment costs for dam and irrigation system include the opportunity costs.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Incremental Benefits															
Net Irrigation benefit	6,397	9,030	11,114	12,586	13,949	15,326	16,615	17,426	18,043	18,587	18,811	18,754	18,685	18,637	18,618
Power benefit	6,807	6,581	6,358	7,691	7,305	6,969	6,684	6,462	6,296	6,281	6,139	5,919	5,781	5,646	5,549
M & I benefit	1,962	2,079	2,167	2,248	2,342	2,401	2,496	2,606	2,744	2,910	3,029	3,078	3,127	3,177	3,226
Others	155	193	226	254	282	313	341	367	395	423	451	475	477	476	476
Total benefits	15,321	17,883	19,857	22,778	23,878	25,009	26,137	26,861	27,478	28,121	28,429	28,226	28,071	27,936	27,868
Incremental Costs															
Investment costs															
Dam and reservoir	386	150	105	78	76	76	76	76	76	76	76	76	76	76	76
Power facilities	94	25	12	10	6	0	0	0	0	0	0	0	0	0	0
Irrigation facilities	11,849	6,898	2,629	2,044	1,227	596	302	302	302	302	302	302	302	302	302
Total investment costs	12,248	7,073	2,746	2,130	1,309	672	378	378	378	378	378	378	378	378	378
Incremental working capital															
Operation & maintenance cost															
Dam and power	683	683	683	683	683	683	683	683	683	683	683	683	683	683	683
Irrigation system	189	229	281	334	493	602	709	787	822	848	865	879	879	879	879
Total operation costs	872	912	964	1,017	1,176	1,286	1,392	1,470	1,506	1,532	1,548	1,562	1,562	1,562	1,562
Environmental cost	57	89	86	86	86	86	51	58	50	49	49	71	71	71	71
Total costs	13,177	8,074	3,796	3,233	2,571	2,043	1,820	1,898	1,933	1,959	1,976	2,011	2,011	2,011	2,011
Net Cash Flow	2,144	9,809	16,061	19,537	21,307	22,966	24,316	24,963	25,545	26,162	26,454	26,215	26,060	25,926	25,857
EIRR:															
NPV (at 12%)															

Table 21

Continued

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026-33
Incremental Benefits													
Net Irrigation benefit	18,599	18,523	18,560	18,539	18,518	18,497	18,475	18,475	18,475	18,475	18,475	18,475	18,475
Power benefit	5,451	5,343	5,256	5,158	5,060	4,962	4,863	4,769	4,675	4,581	4,487	4,392	4,298
M & I benefit	3,276	3,327	3,377	3,432	3,433	3,435	3,436	3,436	3,436	3,436	3,436	3,436	3,436
Others	476	476	476	476	476	476	476	476	476	476	476	476	476
Total benefits	27,802	27,669	27,668	27,604	27,487	27,370	27,251	27,156	27,062	26,968	26,874	26,780	26,685
Incremental Costs													
Investment costs													
Dam and reservoir	76	76	76	76	76	76	76	76	76	76	76	76	76
Power facilities	0	0	0	0	0	0	0	0	0	0	0	0	0
Irrigation facilities	302	302	302	302	302	302	302	302	302	302	302	302	302
Total investment costs	378	378	378	378	378	378	378	378	378	378	378	378	378
Incremental working capital													
Operation & maintenance cost													
Dam and power	683	683	683	683	683	683	683	683	683	683	683	683	683
Irrigation system	879	879	879	879	879	879	879	879	879	879	879	879	879
Total operation costs	1,562	1,562	1,562	1,562	1,562	1,562	1,562	1,562	1,562	1,562	1,562	1,562	1,562
Environmental cost	71	71	71	71	71	71	71	73	73	73	73	73	73
Total costs	2,011	2,011	2,011	2,011	2,011	2,011	2,012	2,013	2,013	2,013	2,013	2,013	2,013
Net Cash Flow	25,791	25,658	25,657	25,593	25,476	25,358	25,239	25,144	25,050	24,955	24,861	24,767	24,673
EIRR:													
NPV (at 12%)													

Table 22

INDIA

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Sensitivity Analysis

	EIRR (%)	NPV Min Rs	Switching Value (%)
Base case: Irrigation, Power and R&I	11.9	(360)	
Alternatives			
Power only	14.2	4,208	
Irrigation only	10.8	(3,627)	
Irrigation and R&I only	12.4	1,257	
Base case Excluding sunk costs	17.4	14,196	
Sensitivity			
M & I price down			> 100
Power price down			70.0
Fm prod. price down			22.8
Total costs up			23.5
Total benefit down			19.0
CCA development delayed by a/			
1 year	11.5	(1,925)	
2 year	11.2	(3,271)	
3 year	10.8	(4,569)	
4 year	10.5	(5,683)	
5 year	10.2	(6,677)	
6 year	9.9	(7,565)	
7 year	9.7	(8,358)	
8 year	9.4	(9,066)	
9 year	9.1	(9,697)	
10 year	8.9	(10,262)	
CCA reduced by /b			
20%	12.4	1,943	
30%	12.4	1,642	
40%	12.3	1,342	
R&PIH commissioning delayed by c/			
1 year	11.7	(1,281)	
2 year	11.5	(2,103)	
3 year	11.4	(2,837)	
4 year	11.2	(3,493)	

- a/ Development of CAA, branch canal and distribution system delayed simultaneously but not main canal.
b/ Investments for branch canal, distribution system and CAA development reduced by same proportion. More water for R&PIH power generation.
c/ Investments for R&PIH and transmission system delayed simultaneously.

INDIA

Table 23

INDIA

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Phasing of CCA Development
(Rs. Million)

Phasing of CCA
Devel. ('000 ha)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Gujarat															
Annual									0	0	0	70	122	176	196
Accum.								0	0	0	0	70	192	368	565
Rajasthan															
Annual														0	0
Accum.														0	0
Total															
Annual	0	0	0	0	0	0	0	0	0	0	0	70	122	176	196
Accum.	0	0	0	0	0	0	0	0	0	0	0	70	192	368	565

Table 24

Phasing of CCA
Devel. ('000 ha)

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Gujarat															
Annual	270	283	243	169	163	103	75								
Accum.	834	1,117	1,360	1,529	1,692	1,795	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870
Rajasthan															
Annual	7	14	18	18	14	0									
Accum.	7	21	39	56	70	70	70	70	70	70	70	70	70	70	70
Total															
Annual	277	297	261	187	177	103	75	0	0	0	0	0	0	0	0
Accum.	841	1,138	1,399	1,585	1,762	1,865	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940

Phasing of CCA
Devel. ('000 ha)

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
Gujarat									
Annual									
Accum.	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870
Rajasthan									
Annual									
Accum.	70	70	70	70	70	70	70	70	70
Total									
Annual	0	0	0	0	0	0	0	0	0
Accum.	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940

Table 25

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Water Balance
(Million m3)

Water Balance (Mm3)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Mean Utilizable Flow(1/)	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900
En route rivers	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Public ground water (new)															
Private G. water (exist)									1,250	1,250	1,250	1,250	1,250	1,250	1,250
Private G. water (new)															
Total source	43,300	43,300	43,300	43,300	43,300	43,300	43,300	43,300	44,550	44,550	44,550	44,550	44,698	44,846	44,994
Upstream diversion(2/)	1,800	2,138	2,476	2,814	3,152	3,490	3,829	4,167	4,505	4,843	5,181	5,519	5,857	6,195	6,533
Irrigation (div.)									0	0	0	51	252	759	1,620
Irrigation (well)									1,250	1,250	1,250	1,250	1,398	1,546	1,694
M&I												0	191	203	215
RBPH water realises													0	19,404	18,677
Others (3/)	41,500	41,162	40,824	40,486	40,148	39,810	39,471	39,133	38,795	38,457	38,119	37,730	37,000	16,739	16,254
Total use	43,300	43,300	43,300	43,300	43,300	43,300	43,300	43,300	44,550	44,550	44,550	44,550	44,698	44,846	44,994

1/ CWC 1891-1990 Series - Virgin Flows (50% dependable) 40,755 Mm3
 Return flow+carry over - evaporation (+5.3%) 2,145
 Utilization Flow (50% dependable) 42,900 Mm3

2/ Limited to 16,000 Mm3 as per H.R. Wallingford's estimates

3/ Spills and Operational losses

Table 25															
Continued															
Water Balance (Mm3)															
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mean Utilizable Flow(1/)	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900
En route rivers	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Public ground water (new)	592	740	888	1,036	1,184	1,332	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Private G. water (exist)	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Private G. water (new)		220	440	660	880	1,100	1,320	1,540	1,760	1,980	2,200	2,200	2,200	2,200	2,200
Total source	45,142	45,510	45,878	46,246	46,614	46,982	47,350	47,570	47,790	48,010	48,230	48,230	48,230	48,230	48,230
Upstream diversion(2/)	6,871	7,210	7,548	7,886	8,224	8,562	8,900	9,238	9,576	9,914	10,252	10,590	10,929	11,267	11,605
Irrigation (div.)	2,847	4,334	6,227	8,149	9,936	11,413	12,578	13,385	13,868	14,061	14,110	14,550	14,550	14,550	14,550
Irrigation (well)	1,842	2,210	2,578	2,946	3,314	3,682	4,050	4,270	4,490	4,710	4,930	4,930	4,930	4,930	4,930
M&I	229	690	719	750	783	818	845	872	903	939	981	1,033	1,096	1,141	1,158
RBPH water realises	17,730	16,358	15,002	18,170	16,444	14,964	13,740	12,802	12,120	11,667	11,324	10,659	10,338	10,032	9,748
Others (3/)	15,623	14,708	13,804	8,345	7,913	7,543	7,237	7,003	6,833	6,719	6,633	6,467	6,387	6,311	6,239
Total use	45,142	45,510	45,878	46,246	46,614	46,982	47,350	47,570	47,790	48,010	48,230	48,230	48,230	48,230	48,230

Water Balance (Mm3)

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026-33
Mean Utilizable Flow(1/)	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900	42,900
En route rivers	400	400	400	400	400	400	400	400	400	400	400	400	400
Public ground water (new)	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
Private G. water (exist)	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Private G. water (new)	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200
Total source	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230
Upstream diversion(2/)	11,943	12,281	12,619	12,957	13,295	13,633	13,971	14,310	14,648	14,986	15,324	15,662	16,000
Irrigation (div.)	14,550	14,550	14,550	14,550	14,550	14,550	14,550	14,550	14,550	14,550	14,550	14,550	14,550
Irrigation (well)	4,930	4,930	4,930	4,930	4,930	4,930	4,930	4,930	4,930	4,930	4,930	4,930	4,930
M&I	1,176	1,245	1,212	1,231	1,250	1,269	1,289	1,289	1,289	1,289	1,289	1,289	1,289
RBPH water realises	9,463	9,137	8,893	8,608	8,322	8,036	7,749	7,479	7,208	6,938	6,668	6,397	6,127
Others (3/)	6,168	6,087	6,026	5,954	5,883	5,812	5,740	5,672	5,605	5,537	5,469	5,402	5,334
Total use	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230	48,230

Table 25

NARMADA RIVER DEVELOPMENT-GUJARAT

Update of Economic Analysis

Buildup of Land Productivity
(Rs. Million)Buildup of land
productivity(net return)

Without project -- Irrigated	1.0621	1.0699	1.0776	1.0854	1.0932	1.1009	1.1087	1.1164	1.1242	1.1320	1.1397	1.1475	1.1553		
Without project -- rainfed	1.0349	1.0393	1.0437	1.0481	1.0524	1.0568	1.0612	1.0655	1.0699	1.0743	1.0786	1.0830	1.0874		
Without project average	1.0933	1.1050	1.1166	1.1283	1.1400	1.1516	1.1633	1.1750	1.1866	1.1983	1.2099	1.2216	1.2333		
	0.8276														
With project -- Irrigated	1.0621	1.0699	1.0776	1.1581	1.2228	1.3056	1.3951	1.4518	1.5046	1.5699	1.6460	1.7011	1.7543	1.7946	1.8406
With project -- rainfed	1.0349	1.0393	1.0437	1.0967	1.1496	1.2026	1.2556	1.3086	1.3615	1.4145	1.4675	1.5205	1.5734	1.5734	1.5734

Annual block buildup

		1	2	3	4	5										
Adoption curve		0.1	0.22	0.36	0.23	0.09										
Accum.		0.1	0.32	0.68	0.91	1										
Year		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Weighted buildup		0.00	0.00	0.00	0.10	0.18	0.28	0.39	0.47	0.53	0.61	0.71	0.78	0.84	0.89	0.95
Year	Ann.Inten															
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1995	70.26				7.03	22.48	47.78	63.94	70.26	70.26	70.26	70.26	70.26	70.26	70.26	70.26
1996	121.86					12.19	39.00	82.87	110.89	121.86	121.86	121.86	121.86	121.86	121.86	121.86
1997	176.28						17.63	56.41	119.87	160.42	176.28	176.28	176.28	176.28	176.28	176.28
1998	196.12							19.61	62.76	133.36	178.47	196.12	196.12	196.12	196.12	196.12
1999	276.91								27.69	88.61	188.30	251.99	276.91	276.91	276.91	276.91
2000	296.72									29.67	94.95	201.77	270.02	296.72	296.72	296.72
2001	260.67										26.07	83.41	177.25	237.21	260.67	260.67
2002	186.65											18.67	59.73	126.92	169.85	186.65
2003	176.87												17.69	56.60	120.27	160.95
2004	102.85													10.29	32.91	69.94
2005	74.80														7.48	23.94
Total	1940.00	0.00	0.00	0.00	7.03	34.67	104.40	222.83	391.48	604.19	856.20	1120.37	1366.13	1569.18	1729.35	1840.31

Buildup of land
productivity(net return)

Without project -- irrigated
Without project -- rainfed
Without project average

With project -- irrigated	1.8682	1.8819	1.8819
With project -- rainfed	1.5734	1.5734	1.5734

Annual block buildup

Adoption curve				
Accum.		1	1	
Year		2007	2008	2009
Weighted buildup		0.98	1.00	1.00
Year	Ann.Inten			
1992	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00
1994	0.00	0.00	0.00	0.00
1995	70.26	70.26	70.26	70.26
1996	121.86	121.86	121.86	121.86
1997	176.28	176.28	176.28	176.28
1998	196.12	196.12	196.12	196.12
1999	276.91	276.91	276.91	276.91
2000	296.72	296.72	296.72	296.72
2001	260.67	260.67	260.67	260.67
2002	186.65	186.65	186.65	186.65
2003	176.87	176.87	176.87	176.87
2004	102.85	93.59	102.85	102.85
2005	74.80	50.86	68.07	74.80
Total	1940.00	1906.81	1933.27	1940.00

INDIA
NARMADA RIVER DEVELOPMENT - GUJARAT

UPDATE OF ECONOMIC ANALYSIS

UPDATE OF ECONOMIC ANALYSIS

Investment in Adjustments (Cost/Benefits)

(REG. MAIL)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80																				

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[illegible]

Footnotes to Table 27- Environmental Adjustment

Column B: Possible estuary losses of hilsa assumed to be 33% of the mean annual 1986-1989 catch of 3400 tons from Year 15 increasing to 50% by Year 25. Net value after fishing expenses is assumed to be Rs 10 per kg. Water volume passing down to the estuary in the early stages will still be substantial but silt load will be reduced. Hilsa do not migrate up past the dam site, but there is likely to be some effect on the downstream hilsa fishery. Strictly speaking, the loss of water volume is attributable to all dams to be developed, not simply to SSP, the loss of silt in the estuary is attributable predominantly to SSP in the early years but later again to all dams as they develop upstream. Possible estuary losses of prawn assumed to be 33% of the mean annual 1986-1989 catch of 3400 tons with the loss starting in Year 15 increasing to 50% by Year 25. Net value after fishing expenses is assumed to be Rs 30 per kg. Losses throughout the river and estuary of other types of fish are assumed to be 30% of the hilsa loss figures.

Column C: Wildlife losses assumed to be equal to 50% of the forest losses on the 11,600 ha of forest area, but with the quantity of wildlife falling by 1.5% over a 20-year period in line with the present trend of loss of habitat. However, against this trend, the per unit value of forest is assumed to rise by 1% per year in real terms for the first 20 years, i.e. somewhat lower than the physical rate of loss, and then by 2% per year thereafter i.e. somewhat higher than the physical rate of loss to allow for increased real amenity value/appreciation of wildlife over time.

Column D: Wildlife benefits, excluding benefits to parks receiving water which are treated separately, are assumed to be the benefits of the improved lakeshore environment at the reservoir boundary and the benefits to waterfowl. The assumption is a Rs 2 m per year benefit rising by 1% per year for the increasing amenity value.

Column E: The net of the above wildlife costs and benefits.

Column F: The estimated costs to parks and nature reserves. This is set at zero since no parks or reserves are inundated in the submergence area and elsewhere the increased productivity from the command area development should decrease rather than increase the pressure on parks.

Column G: The estimated park benefits. Four parks/reserves are expected to benefit from the irrigation water or from the proximity of the reservoir. Rs 1m benefit each per year is estimated.

Column H: The net of the parks costs and benefits.

Column I: Compensatory afforestation costs. This is set at zero to flag its presence as an activity but to indicate that this is not treated as an economic cost because the value of the lost forest has already been accounted for in the Dam costs land loss calculation. To value this as an economic cost would be double counting.

Column J: Minor forest product cost (gums, dyes, fermented liquors, medicines, "smokes" leaves, etc), which are small due to the advanced state of degradation in the submergence zone, are assumed to be 20% of the value of the forest loss. In the "without project" situation one would expect these to fall over time but they have been left at a constant value here.

Column K: Minor forest product benefits. This is set at zero since, although the command area will have very much greater annual incremental biomass production than the submergence area, it is assumed that mostly this will not be the "minor forest product" type of species.

Column L: The net of the minor forest product costs and benefits.

Column M: Public Health costs are based on estimates of Rs 380 m for surveillance and control of water related diseases in 1989 prices over a period of 5 years. Thereafter, the operating costs are assumed to be 50% of that.

Column N: Public Health benefits are expected to be very substantial due to the supply of reliable drinking and washing water to 30 million people and to the large increase in food production and income increases. It is difficult to estimate the value of those benefits but they are assumed here to be equal to the costs per annum but not starting until Year 20. This may be a substantial underestimate.

Column O: The net of the public health costs and benefits.

Column P: Navigation costs in the estuary, if there are any, would not start until about Year 35 when non-monsoon flows reach lower levels. Given return flows from water use and environmentally sound reservoir operation the lowest river flow is not expected to be lower than the present lowest flow, it therefore seems probable that there will be no navigation costs but Rs 2 m per year starting after 35 years has been assumed.

Column Q: There are possibilities of navigation benefits. Benefits from using the canal have been studied, but found too costly for large boat navigation. However, there may be benefits to estuary navigation from the evening out of the water flow and there may be benefits from reservoir navigation because of its long narrow shape. The reservoir will also, by collecting silt reduce sand bar build up in the estuary. A notional Rs 1 m navigation benefit is assumed. (Note that local transport benefits on roads associated with canals have not been included, although the roads are part of the canal development cost.)

Column R: The net of the navigation costs and the navigation benefits.

Column S: The cost of moving minor village shrines has been included in the R&R costs. The costs given here are for the three larger temples which will be moved. The total estimated cost is less than Rs 2 m. Rs 3 m over three years is allowed for to include some contingency.

Column T: No benefits to monuments are expected, so this is set at zero.

Column U: The net of monument costs and benefits.

Column V: Rare plant losses costs. Investigations have found no rare plant species likely to be lost to mankind in the submergence area due to the degraded nature of the area, but to be conservative we put a cost on the reduction in the number of individuals equal to 50% of the value of the loss of forest to inundation and treat the changes over time in quantity and value in the same way as wildlife were treated under the wildlife column.

Column W: Rare plant benefits are not expected, except possibly for some lakeshore species and some benefits to certain plants from an improved micro-climate in the vicinity of the reservoir and the command area. The positive value to rare plants is set at zero.

Column X: The net of the costs and benefits to rare plants.

Column Y: The carbon/oxygen balance costs due to inundation are related to the loss of oxygen output from the inundated vegetation currently growing in the inundation area and the storage of carbon by the stock of vegetation in that area. This is expected to be vastly outweighed by the enormous incremental production of oxygen from the irrigation command area and the enormously greater incremental volume of carbon storage from the trees in the command area. (The canal side trees alone will have far greater carbon storage capacity than the trees lost to inundation.) No

attempt has been made to claim this benefit for the project by placing a value on it. However, to indicate its presence we put a notional Rs 1m on the cost side in this column and a notional Rs 2m on the benefit side in the next column.

Column Z: See explanation above.

Column AA: The net of the carbon/oxygen balance columns.

Column AB: The micro-climate is defined here as the contribution to greater moisture in the atmosphere. There is no cost to the project since the evaporation from the open water surface of the reservoir is expected to be about equal to, or greater than, the evapo-transpiration from the degraded dry deciduous woodland and the rainfed cropland to be inundated.

Column AC: There is expected to be a substantial micro-climate benefit from the very high levels of total evapo-transpiration from the crops and canals in the irrigation area. The value of this has not been calculated but a notional Rs 1 m per year is assumed.

Column AD: The net of the micro-climate costs and benefits.

Column AE: The cost of induced pressure on neighbouring areas due to the loss of land to inundation is a difficult calculation. There is considerable danger of double counting since costs of compensating Project Affected Persons have already been included and because the lake and lakeshore environment can probably locally increase human and animal carrying capacity substantially, although care has to be taken in the management of that environment to avoid erosion. A substantial portion of the so-called inundated area is not actually lost to production; it will change from a poor soil rainfed site to a good soil irrigated site on which annually, as the reservoir water retreats, there will be very productive "draw-down" farming on the excellent soils (due to the siltation) using residual moisture plus pumped irrigation on both the draw-down area and in certain locations away from the reservoir edge. These two activities together seem likely to give at least 10,000 ha of irrigated land, which, at a ratio of 3:1 in terms of irrigated to rainfed production per hectare would more than match the lost productivity of the predominantly rainfed submergence area production and provide substantial quantities of by-products. Furthermore, catchment treatment will have productive benefits as well as sedimentation reducing effects. Notwithstanding the above points, in order to be conservative, the assumption has been made that there would still be an induced pressure cost on one third of the equivalent of the inundated area to the extent of reducing its annual productivity by Rs 500 per ha.

Column AF: The benefits from changes in induced pressure arise from the capacity of the irrigated command area to provide an improved livelihood to large numbers of families who would otherwise be forced to exploit rapidly degrading grazing and forest land. The irrigated area will support very large numbers of livestock on by-products. The value of this decreased pressure is difficult to calculate. It is certainly substantially greater than the increased costs around the submergence area estimated above. However, it is assumed for the purposes of this analysis to be equal to the costs of the increased submergence area pressure as estimated above, but starting after 15 years. To put the pressure issue in perspective, it is worth noting that with rural populations rising at a rate of at least 1.5% per year the annual pressure equivalent in the command area is about 27,000 ha (1,800,000 has time 1.5%) thus in less than two years this pressure equivalent comes to more than the area lost to inundation.

Column AG: The net of the costs and benefits from changes in induced pressure.

Column AH: Costs of flood control provided by the dam are the losses of nutrients that may give some benefit following a flood. An annual mean benefit of Rs. 200 per ha on 5,000 ha downstream is assumed.

Column AI: Flood control benefits from the dam are expected to be substantial. In previous years a number of villages have been virtually destroyed, a considerable amount of farm equipment damaged and a number of lives lost. A mean annual cost of flood damage to land, property and human life downstream of the dam is estimated at Rs. 5m per year.

Column AJ: The net of flood control costs and flood control benefits.

Column AK: Salinisation costs are set at zero because a very substantial expenditure has been provided in the project costs for both horizontal and vertical drainage to ensure that salinisation does not have a significant impact and because in the benefit analysis those soil types most at risk have already been assumed to have a 25% lower yield than the anticipated average for that soil type to allow for the risk of waterlogging and salinisation.

Column AL: There will be some benefits in certain areas due to increased surface fresh water percolation pushing back the sub-surface salinity boundary somewhat. The extent of this benefit is uncertain so a notional Rs. 1m annually is put on this.

Column AM: The net of salinity costs and salinity benefits.

Column AN: There are not expected to be any costs in terms of reduced or salinised groundwater due to the project therefore this is set at zero.

Column AO: There are expected to be substantial groundwater recharge benefits from the project. Farmers pumping water will have reduced pumping depths due to the recharge from the surface irrigation. The annual benefit of this is uncertain but it is assumed that this would give a pumping cost reduction excluding subsidy of Rs.80 per annum (about 65 kwh) on 25,000 wells.

Column AP: The net of groundwater costs and benefits.

Column AQ: Tourism costs and benefits have not yet been calculated. They are expected to be substantial. The assumption has been made of Rs. 5m annual costs (in this column) and Rs. 10m annual benefits (in the next column).

Column AR: See above.

Column AS: The net of tourism costs and benefits.

Column AT: Totals the environmental net benefit columns in financial terms.

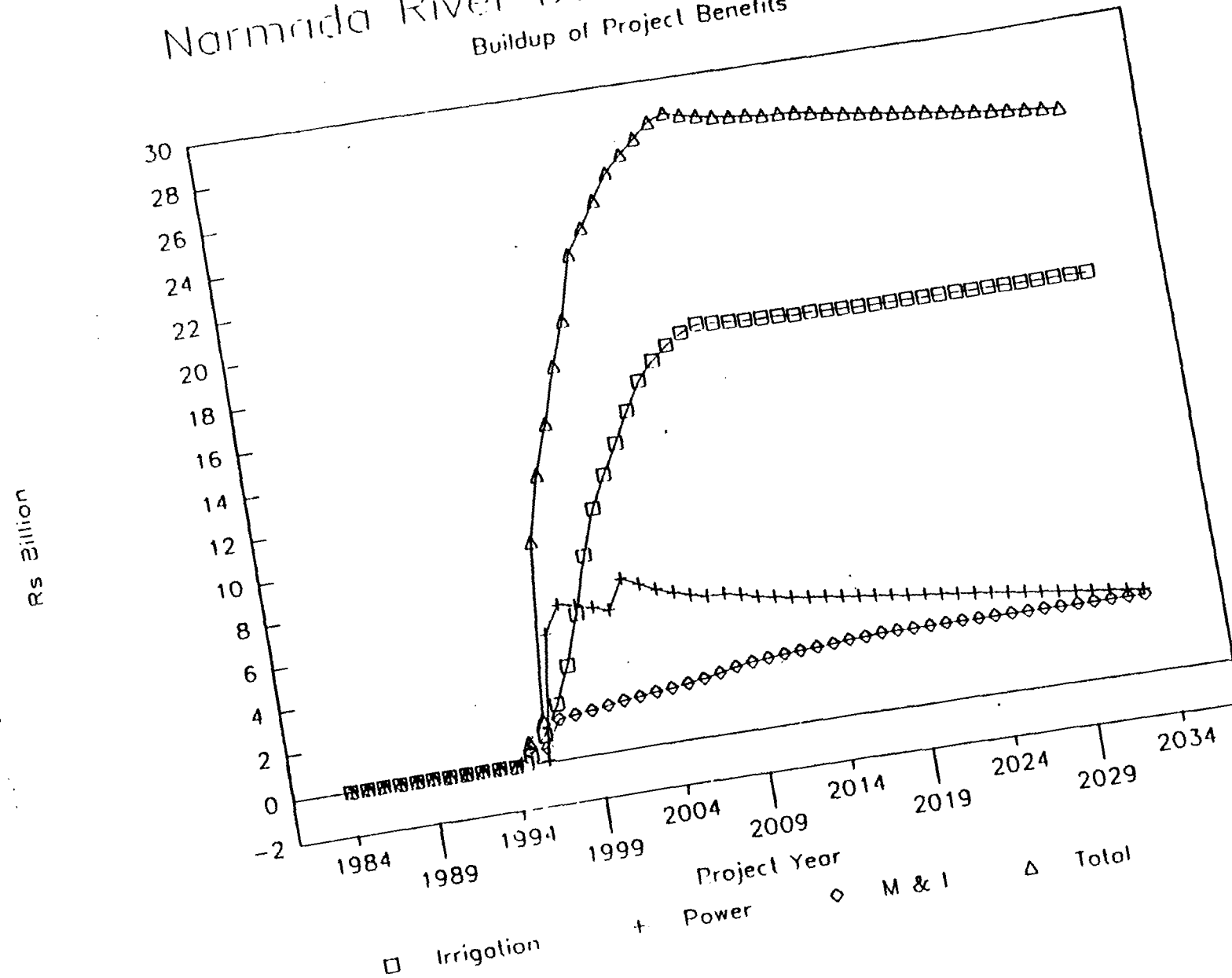
Column AU: Shows the previous column converted to economic prices at a factor of 0.8.

Note: The imputed forest value of Rs. 126 lakh per hectare for submerged land, i.e. about US\$700,000 per hectare, which has recently been quoted in newspapers in India warrants some comment here. It is based on a per tree valuation estimate which includes an estimate of the value of oxygen at a bottled oxygen price, an estimate of the cost of cleaning air artificially as an alternative to the role of trees in filtering out pollution, the value of the reduced erosion in terms of the cost of applying manure by hand to achieve the same effect, the cost pumping out of the ground the equivalent amount of water transpired by a tree, the cost of rearing, and looking after by hand, the animals and birds displaced by the loss of the tree and, finally, the protein conversion from green matter in terms of the value of goat meat. The problem with using this estimate, apart from the sheer magnitude of the figures, is that the methodology is faulty because it does not incorporate "with" and "without project" scenarios.

A correct analysis using the same figures and following the same logic, in fact, would find the Sardar Sarovar Projects to have a massive economic rate of return (equally misleading, of course) for the following reasons: (a) the irrigation in the 1.8 million hectare command area will result in very many more trees with much faster growth rate than in the dry degraded submergence zone with only a few thousand hectares of forest land; therefore, pollution reduction, if it occurs at all, will be much greater with the project than without it; (b) the photosynthetic output of oxygen from the actively growing crops in the command area will far outweigh that in the submergence zone, which is much smaller and large parts of which dry off for half the year (although the issue is, of course, net carbon storage not oxygen output); (c) the recycling of water from the ground to the air will be far greater from the open water surface of the reservoir plus the irrigated command area than from the dryland submergence zone (the area ratio being about 50 to 1); (d) no erosion will result underneath the reservoir surface due to the removal of the trees; and (e) there will be massively greater plant protein production for animals with the project than without it due to the irrigation by-products and field bund grazing in the command area. Coefficients of the sort quoted must be used for both the submergence and the command area and the methodology must incorporate both the "with" and "without" project situation.

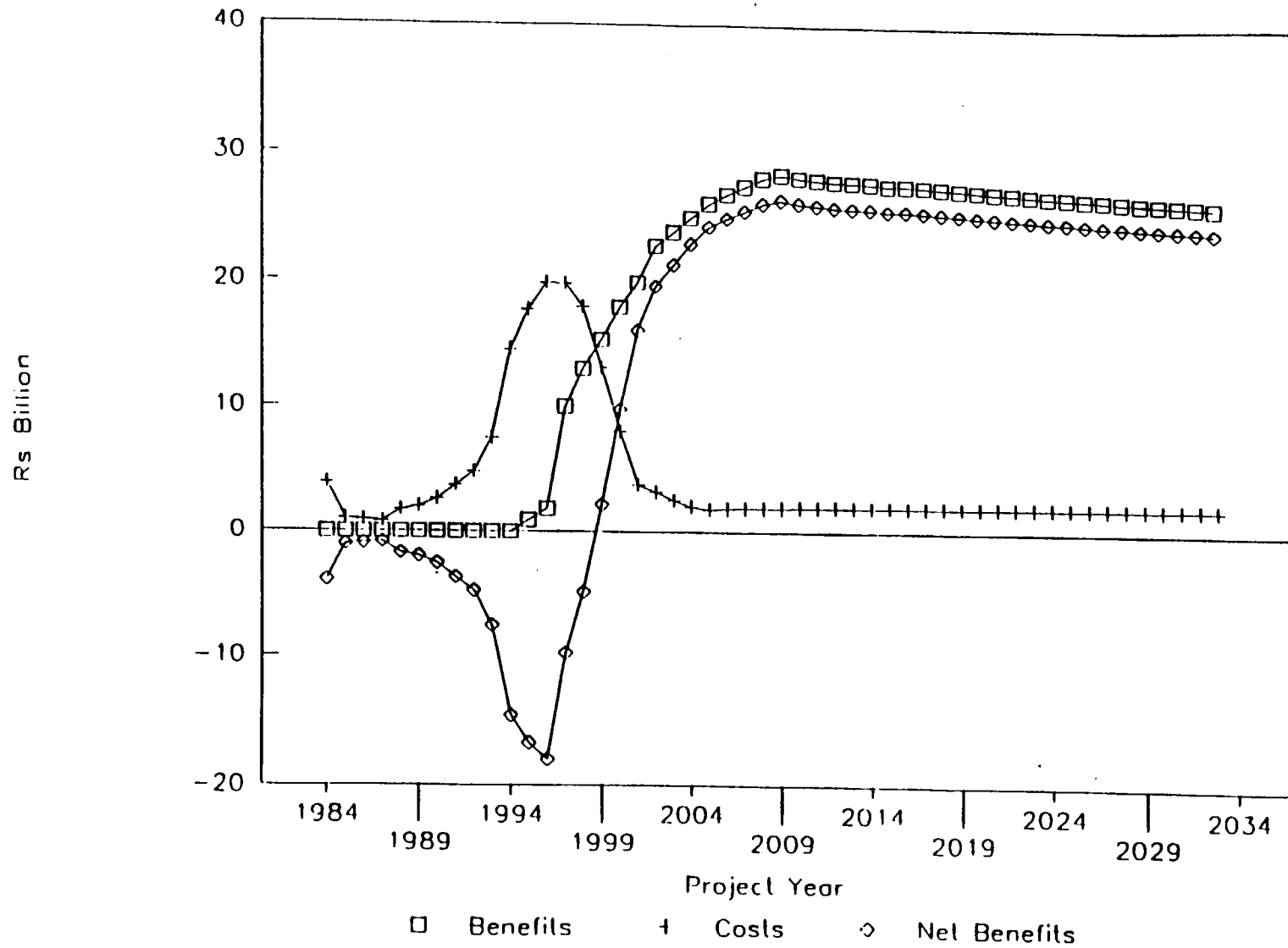
Narmada River Development – Gujarat

Buildup of Project Benefits



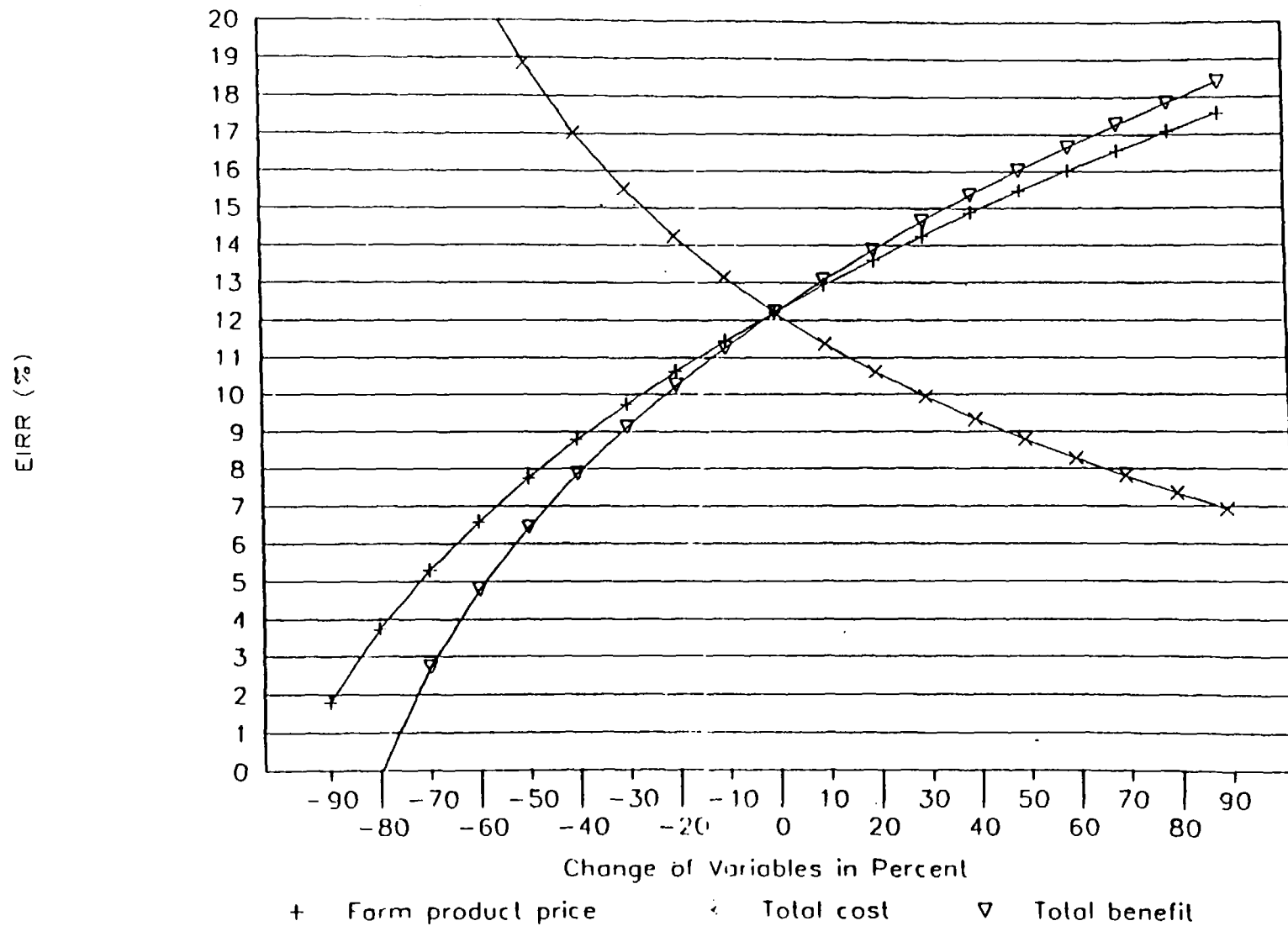
Narmada River Development – Gujarat

Total Benefits and Costs over Time



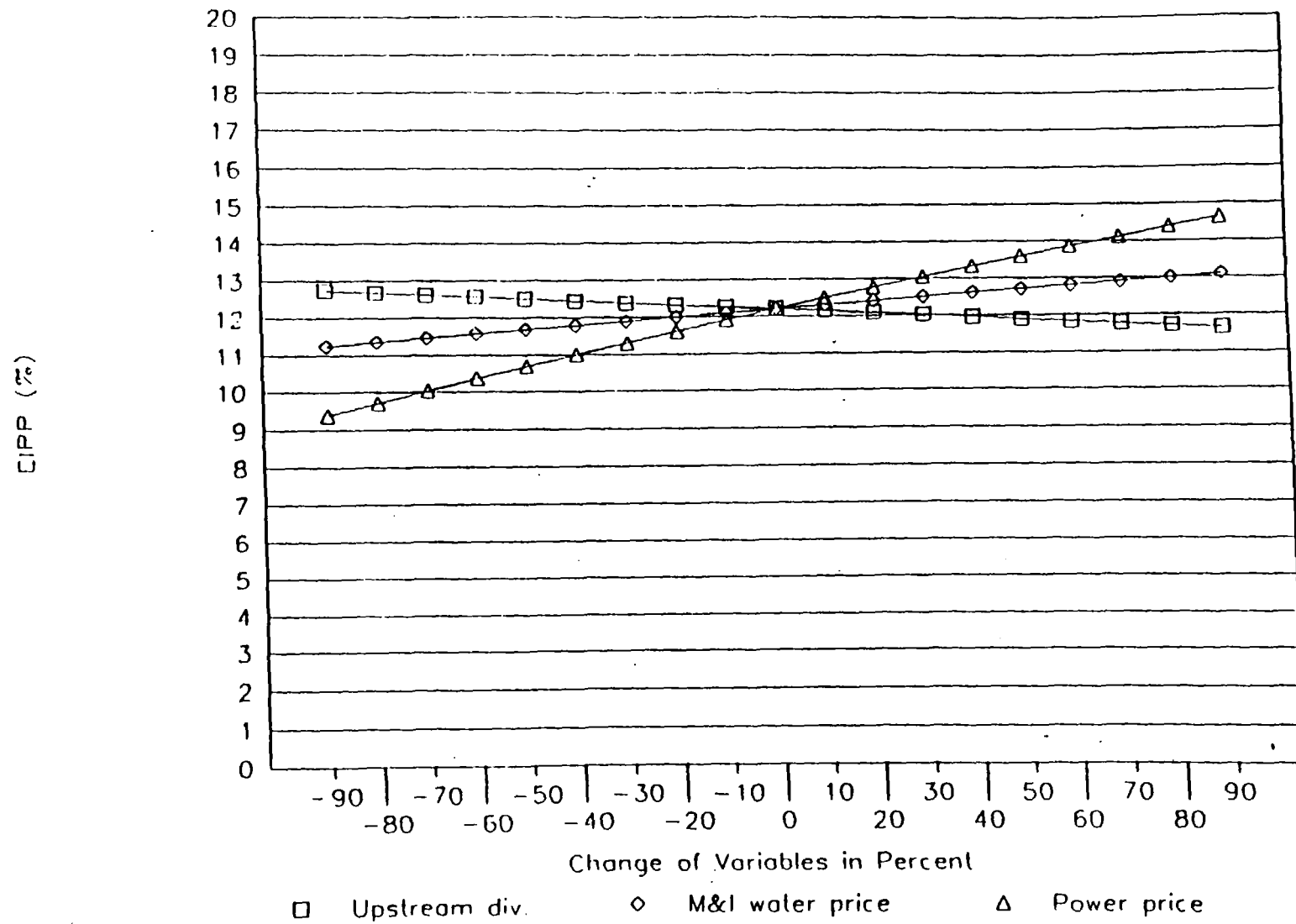
NARMADA RIVER DEVELOPMENT-GUJARAT

Sensitivity Analysis (1)



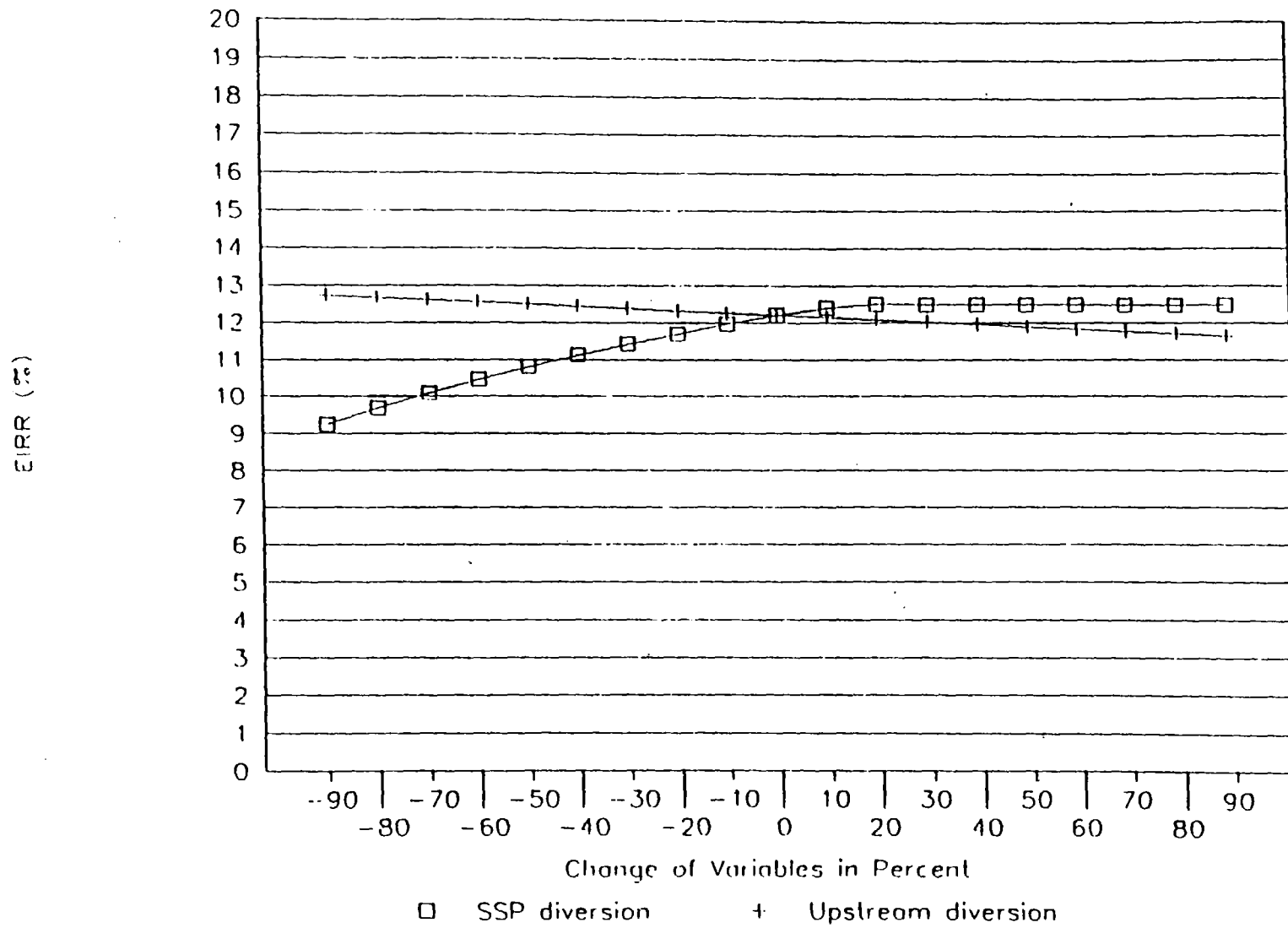
NARMADA RIVER DEVELOPMENT-GUJARAT

Sensitivity Analysis (11)



NARMADA RIVER DEVELOPMENT-GUJARAT

Sensilivity Analysis (111)



PROJECT COMPLETION REPORT

INDIA

**NARMADA RIVER DEVELOPMENT - GUJARAT
SARDAR SAROVAR DAM AND POWER PROJECT
(Credit 1552-IN/LOAN 2497-IN)**

PART III - STATISTICAL TABLES

INDIA

Narmada (Gujarat) Sardar Sarovar Dam and Power Project (Credit 1552-IN/Loan 2497-IN)

Related Bank Loans and Credits

Loan/Credit Title	Loan/Credit Amount	Purpose	Date of Approval	Status	Comments
1 Credit 13-IN Shetrunji Irrigation Project	US\$4.5 M	It was the Bank's first Credit for irrigation development in India which financed the construction of Shetrunji's canal system.	1961	Credit Closed	The project failed to achieve its agricultural objectives due to inadequate agricultural supporting services and lagging construction of field channels. Presently the distribution system is being modified in accordance with RWS principles and is expected to be completed by June 1993.
2 Credit 176-IN Kadana Irrigation Project	US\$35 M	To expand and stabilize agricultural production in rain-deficient areas; to complete irrigation facilities where past investments had brought only partial realization of agricultural potential and to complete an	Feb.1970	Project completed in 1979.	The lessons learned from Shetrunji project were taken into account in preparation of the Kadana project through due emphasis on on-farm development and the agricultural support program. There was a delay of

Loan/Credit Title	Loan/Credit Amount	Purpose	Date of Approval	Status	Comments
		<p>& Drainage Project consisted of financing a three-year time slice of the construction program in Phase I upto km 144 through partial implementation of main canal and major structures; 13 branch canals; and 12 distribution & drainage system development blocks.</p>			<p>structures; and 60% on branch canals. Construction of distribution and drainage development blocks was not undertaken though the planning and designs had been completed. SSNNL finalized the turnkey consultancy document and also finalized the technical evaluation of bids invited for the design, installation and commissioning of the remote control communication, monitoring and operation of the conveyance system. NPG also prepared 3-volume draft plans of operation and maintenance (POM) of the canal system and headworks, duly revised and updated from time to time.</p>

Loan/Credit Title	Loan/Credit Amount	Purpose	Date of Approval	Status	Comments
Credit 1553-IN Narmada (Gujarat) Water Delivery & Drainage Project	SDR 149.5M	This project which is interdependent with the Narmada (Gujarat) Dam and Power Project envisaged to achieve an efficient, reliable and equitable supply of irrigation water (coupled with effective drainage services) on RWS principles, and municipal, industrial and domestic water through storage and regulation of Narmada river flows at Sardar Sarovar Dam. The objective of the Water Delivery	March 1985	The Credit closed on July 1, 1992, 3 years and 3 months behind the original Closing Date of March 31, 1989, following 4 extensions including one of 3 months. With the cancellation of SDR 4.8 M in 12/91, the revised Credit amount of SDR 144.7 M was fully disbursed in 09/92.	<p>would almost achieve physical and financial completion level of about 95%. Progress on R&R is good and GOG has initiated implementation of time bound Action Plans for economic rehabilitation of below-poverty line oustees in 9 priority sub-projects and Action Plans for the remaining 13 sub-projects are also being prepared. NGOs have also been actively involved in economic rehabilitation.</p> <p>The project achieved SAR objective on the construction of main canal and structures and also set high quality standards of machine placed concrete lining, which is now being used as a model on other irrigation projects in India. In respect of other components, the achievements in terms of targets were: 80% on the construction of main canal head regulator and the gated cross regulators; 40% on seven major hydraulic</p>

Loan/Credit Title	Loan/Credit Amount	Purpose	Date of Approval	Status	Comments
		from Credit 1011-IN, which closed on April 30, 1989. The main objectives are to improve the standards of design and construction and to introduce an efficient, reliable and equitable water management system through RWS and farmer's participation through the creation of Water Users Association to enhance crop production.		March 31, 1994 through four extensions of one year each and one of 3 months. With the cancellation of SDR 15.0 M in 12/1991, and SDR 4.9 M in 05/93, the revised Credit amount is SDR 144.40 M against which SDR 129.5 M (US\$ 161.9 M) has been disbursed by June 30, 1993	(Cr.1011-IN), namely, WALMI, Saurashtra Coastal, Karjan, Machhu I and Machhu II. Overall, the restructured project has achieved a completion level of about 88%. Construction of dams and spillways is almost complete. Implementation of distribution network, hitherto lagging, has picked up momentum. A noteworthy feature of project implementation is the sustained effort of GOG in maximizing the introduction of RWS and its rapid acceptance by the farmers wherever irrigation has commenced. This has resulted in an increase in agricultural production. It is expected that at the extended Closing Date of March 31, 1994, RWS would be introduced in nearly 70% of CCA and the project.

Loan/Credit Title	Loan/Credit Amount	Purpose	Date of Approval	Status	Comments
		of Machhu I dam and introduction of operational and management improvements through rotational water supply (RWS) on existing and new schemes.			the Closing Date, thereby delaying or denying the benefits of irrigation deliveries to the farmers. Notwithstanding the lack of full accomplishment of project objectives, many positive results emanated from the project, particularly the planning and construction of distribution network in the subprojects in accordance with principles of Agreements on RWS concept (except for Damanganga sub-project) which started making an impact in a big way though late in the implementation period.
6 Credit 1496-IN Gujarat Medium Irrigation Project	SDR 164.3 M (US\$172 M equivalent)	To complete the construction of 22 on-going MIPs and 6 modernization schemes of the Closed Credit 808-IN as well as 3 major sub-projects and the WALMI as transferred	Jun-84	Project is under implementation with the Original Closing Date of December 31, 1989 having been extended to	The project was restructured in February 1991 to include the financing of civil works of additional components from the previous Gujarat Major Irrigation Project

Loan/Credit Title	Loan/Credit Amount	Purpose	Date of Approval	Status	Comments
		on-going irrigation scheme that had been under construction since 1948.			3 years in completion due to two extreme floods and some construction problems. Full Credit was disbursed. The project achieved its objectives and the Kadana area is now one of the most prosperous and productive areas in Gujarat.
3 Credit 191-IN Gujarat Agricultural Credit Project	US\$35 M	To support the development of ground water in the State through the construction of 41,000 wells and about 450 tubewells and installation of about 45,000 pump sets.	1970	Credit Closed	Objectives were largely achieved.
4 Credit 808-IN Gujarat Medium Irrigation Project	US\$85 M	It was a first timee-slice operation to support medium irrigation projects (MIPs) to promote investments in such projects (individually too small to justify Bank participation) through construction of 22 new MIPs; modernization of 6 projects	May-78	Closed on June 30, 1984. The project was fully disbursed.	Of the 22 new MIPs, only one sub-project (Panam) was operaitonal in 1984. The six modernization sub-projects were still in the various stages of construction at the Credit Closing Date. Hence the full benefits could only accrue under the follow-up project

Loan/Credit Title	Loan/Credit Amount	Purpose	Date of Approval	Status	Comments
		already in operation, establishment of a network of discharge measuring stations; providing technical services needed for monitoring and evaluation studies.			when completed.
5 Credit 1011-IN Gujarat Irrigation II Project	US\$175 M	To achieve an economic use of surface water resources and to ensure a reliable and equitable supply to individual farmers through construction of two new irrigation schemes (Damanganga and Karjan); modernization of Ukai-kakrapar irrigation system; development of Saurashtra coastal salinity ingress control scheme; establishment of a training institute for water and land management (WALMI); reconstruction of Machhu II dam; rehabilitation of Machhu II irrigation and water supply scheme, safety modifications	Apr-80	Closed on April 30, 1989. US\$15.7 M was cancelled at the Closing Date	Overall project implementation fell short of achieving the objectives due to persistent land acquisition problems; canal lining problems; severe drought conditions from 1985 to 1987 (leading to consecutive redesign of spillways at all dams); mid-term reductions in budgeted outlays and slippages in the construction of distribution networks in accordance with agreed RWS procedures. Whereas the sub-project dams and reservoirs were virtually completed, the conveyance system lagged substantially at

INDIANARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(Cr. 1552-IN/Ln.2497-IN)PROJECT TIME TABLE

Activities	Date Planned	Actual Date
1. IDENTIFICATION/ PREPARATION		August-December 1980/1980-83
2. APPRAISAL		March, June, September, 1983 and August 1984.
3. LOAN/CREDIT NEGOTIATIONS	November 1984	November 8-21, 1984
4. BOARD DATE	March 1985	March 7, 1985
5. SIGNING DATE	May 1985	May 10, 1985
6. EFFECTIVENESS	June 1985	January 6, 1986
7. COMPLETION	June 30, 1994	*Expected to be completed by January 23, 1998
8. CLOSING DATE	June 30, 1995	

* As per SSNNL's Revised Implementation Schedule of December 1989 (RIS 12/89).

Table 3
(Page 1 of 2)

INDIA

NARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(Cr.1552-IN/Ln.2497-IN) 1/

SCHEDULE OF CUMULATIVE DISBURSEMENTS

Bank FY	Semester Quarter	SAR Estimates		Revised Projection		Actual Disbursements		% Actual to SAR or Revised Projection
		Semester (US\$M)	Cumulative (US\$M)	SDR M/Credit	US\$M/Loan	SDR M/Credit	US\$M/Loan	
1985	1st							
	2nd	06.3	06.3					
1986	1st	10.0	16.3					
	2nd	18.2	34.5					
1987	1st							
	2nd	25.0	59.5					
	3rd							
	4th	25.1	84.6			14.7		17.3
1988	1st					17.2		
	2nd	27.0	111.6			17.2		15.3
	3rd					20.0		
	4th	30.0	141.6			20.0		14.1
1989	1st					20.0		
	2nd	25.0	166.6			24.3		14.5
	3rd							
	4th	25.2	191.8	29.5		28.7		97.0
1990	1st			30.5		28.7		94.0
	2nd	25.0	216.8	32.9		31.8		96.6
	3rd			35.9		34.9		97.4
	4th	25.9	242.7	37.8		37.9		100.0
1991	1st			37.8		37.9		100.0
	2nd	10.6	253.3	50.3		39.0		77.5
	3rd			62.8		57.5		91.5
	4th	10.0	263.3	70.0		62.7		89.6
1992	1st			74.0		74.1		100.0
	2nd	09.5	272.8	84.0		77.8		92.6
	3rd			88.0		91.9		104.4
	4th	09.0	281.8	91.0		91.9		100.9
1993	1st			93.5		99.7 2/ (US\$133.3M)	00.0	106.6
	2nd	06.1	287.9	99.7	00.0		0.26	
	3rd		290.9		12.0		34.46 3/	
	4th	06.0	293.9		24.0			

Table 3
(Page 2 of 2)

Bank FY	Semester Quarter	SAR Estimates		Revised Projection		Actual Disbursements		% Actual to SAR or Revised Projection
		Semester (US\$M)	Cumulative (US\$M)	SDR M/Credit	US\$M/Loan	SDR M/Credit	US\$M/Loan	
1994	1st				30.0		18.49 4/	
	2nd	03.1	297.0		42.0			
	3rd				60.0			
	4th	03.0	300.0		80.0			
	(Completion Date) 5/				86.0			
1995	1st				110.0			
	2nd				135.0			
	3rd				145.0			
	4th	(Closing Date)						

- 1/ Lending includes SDR 99.7 M under Cr.1552-IN and US\$ 200.0 M under Loan 2497-IN.
- 2/ SDR 99.7 M Credit fully disbursed on September 17, 1992.
- 3/ Remaining unwithdrawn amount of US\$ 165.54 M under Loan No. 2497-IN (US\$ 200 M) was cancelled with effect from March 29, 1993 consequent to GOI's request to the Board for cancellation.
- 4/ Total net amount disbursed after GOI refunded to the Bank on August 10, 1993 the unused balance of US\$ 15.96 M in the Special Account. Thus cumulative disbursements of US\$ 151.79 M were made under the total Credit/Loan amount of US\$ 300 M.
- 5/ Expected Completion Date is January 23, 1998, as per SSNNL's RIS (12/89).

Table 4

INDIA

NARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(Cr.1552-IN/Ln.2497-IN)

PROJECT IMPLEMENTATION
(Main Milestones)

	Component/Work	SAR Target	Implementation Status	Expected Schedule of Achievement of Target	Remarks
1.	<u>SARDAR SAROVAR DAM</u>				
(a)	Award of contract of Main Dam Civil Works.	Jun-85	* April 1987		* Delay in GOI clearance from environmental angle.
(b)	Completion of dam concrete placement above EL.91.46 m for commencement of irrigation diversion.	May-92	Work in progress	July 1995 1/	1/ As per SSNNL - RIS (12/89)
(c)	Completion of Dam & Spillway to top, EL 146.5m, with gates.	Jul-94	Work in progress	January 1998 2/	2/ As per SSNNL - RIS (12/89)
2.	<u>RIVERBED POWER HOUSE (RBPH)</u>				
(d)	Award of RBPH civil works.	Jun-85	** July 1987		** Delay in GOI clearance from environmental angle.
(e)	Completion of RBPH 1st stage concrete.	Apr-89	Concrete in Unit Bays not commenced	December 1995 3/	3/ Delays due to occurrence of fissures in cavern walls and time taken for their treatment, together with non-receipt of T/G sets due to non-resolution of Japanese funding of equipment.
(f)	Commissioning of first Unit at RBPH.	Oct.1992	- do -	Sept. 1997 3/	This schedule shall get further delayed if funding of T/G sets is not resolved promptly.
(g)	Commissioning of sixth Unit at RBPH.	Jul-94		May 1999 3/	

INDIA

NARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(CR.1552-IN/LN.2497-IN)PHYSICAL AND FINANCIAL IMPLEMENTATION OF PROJECT
(As of March 29, 1993)

Sl. No.	Component/Work	Tendered Cost (Rs.Million)	Unit	Estimated/ Revised Qty.	Actual Achievement	Completion Level
A.	<u>MAIN DAM</u>					
1.	<u>Main Dam Civil Works</u>	3,200.00				
(a) (i)	Excavation		Mm3	4.48/6.08	4.964	110.7/81.6%
(ii)	Concrete Placement		Mm3	6.820	3.455	50.6%
(iii)	Drilling and Grouting		Mm3	0.282	0.211	74.8%
(b)	Financial (expenditure incurred)		Rs.M		3,757.10	
2.	<u>Main Dam Instruments</u>	17.10				
(a) (i)	Procurement		No.	432	432	100.0%
(ii)	Installation		No.	432	300	69.4%
(b)	Financial (expenditure incurred)		Rs.M		19.8	
3.	<u>Seismic Instruments</u>	16.02				
(a) (i)	Procurement		No.	97	97	100.0%
(ii)	Installation		No.	97	69	71.1%
(b)	Financial (expenditure incurred)		Rs.M		27.1	
4.	<u>River Cluice Gates & Stoplogs</u> (8 Gates and 4 Stoplogs)	59.90				
(a) (i)	Fabrication		M.T.	1,510.00	1,284.55	85.1%
(ii)	Installation		M.T.	1,510.00	0.00	0.0%
(b)	Financial (expenditure incurred)		Rs.M		101.2	
5.	<u>Crest Radial Gates & Stoplogs</u> (30 gates & 3 sets of stoplogs)	405.50				
(a)	Fabrication		M.T.	13,452.00	5,750.81	42.7%
(b)	Financial (expenditure incurred)		Rs.M		253.00	
6.	<u>Penstock Gates & Stoplogs</u> (6 gates & 1 set of stoplogs)	78.20				
(a)	Fabrication		M.T.	2,247.00	2,003.00	89.1%
(b)	Financial (expenditure incurred)		Rs.M		84.10	

NOTE: Procurement action on pumps and elevators has not been completed so far.

Table 5
(Page 2 of 3)

Sl. No.	Component/Work	Tendered Cost (Rs.Million)	Unit	Estimated/ Revised Qty.	Actual Achievement	Completion Level
B.	RIVER BED POWER HOUSE					
1.	River Bed Power House Civil Works	404.20				
(a)	Underground Excavation					
(i)	Machine Hall; Control Room; Shafts & Bus Shaft; and Galleries		Th m3	229.90	200.74	87.30%
(ii)	Pressure Shafts (6 Nos.)		Th m3	53.00	53.00	100%
(iii)	Draft Tube Tunnels (6 Nos.)		Th m3	98.50	58.48	59.40%
(iv)	Exit Tunnels (3 Nos.)		Th m3	145.00	121.37	83.70%
(v)	Access Tunnel to Service Bay		Th m3	43.37	43.37	100%
Total Underground Works			Th m3	569.77	476.96	83.70%
(b)	Open Excavation					
(i)	Collection Pool		Th m3	595.00	525.00	88.20%
(ii)	Pressure Shafts		Th m3	32.00	32.00	100%
(iii)	Exit Tunnels & Tail Race		Th m3	846.00	777.56	92%
Total Open Excavation			Th m3	1473.00	1334.56	90.60%
(c)	Financial (expenditure incurred)		Rs.M		668.00	
2.	Steel Plates for Penstocks	38.24				71.20%
(a)	Supply of steel plates		M.T.	5171.00	5171.00	100%
(b)	Financial (expenditure incurred)		Rs.M		38.24	
3.	Hollow Core Rock Bolts	2.33				
(a)	Supply of rock bolts		No.	1800.00	1800.00	100%
(b)	Financial (expenditure incurred)		Rs.M		2.33	
4.	Ground Vibration Measuring Equipment	0.56				
(a)	Supply of equipment		Job		Completed	100%
(b)	Financial (expenditure incurred)		Rs.M		0.56	
5.	Penstock Liners	35.00				
(a) (i)	Fabrication of liners		M.T.	4711/4520	4422.00	97.80%
(ii)	Installation of liners		M.T.		695.00	15.40%
(b)	Financial (expenditure incurred)		Rs.M		28.30	
6.	Draft Tube Gates	63.90				
(a)	Fabrication		M.T.	1500.00	588.00	39.20%
(b)	Financial		Rs.M		12.40	

Table 5
(Page 3 of 3)

Sl. No.	Component/Work	Tendered Cost (Rs.Million)	Unit	Estimated/ Revised Qty.	Actual Achievement	Completion Level
7. (a)	<u>400 KV GIS Equipment</u> Advance payment made to M/s. GEC Alsthan, France	1,163.60	Rs.M		115.6	
(b)	Other Electric Equipment *				253.5	

Summary of Financial Progress
(on eligible items/works)

DAM

Expenditure incurred upto March 29, 1993 Rs. 4,158.20 M

POWER

Expenditure incurred upto March 29, 1993 Rs. 1,206.80 M

(i) Civil Works Rs. 837.7 M
(ii) Elec/Mech. Equipment Rs. 369.1 M
Rs. 1,206.8 M

TOTAL: Rs. 5,365.0 M

Hydromet. Trg. & T.A. Rs. 33.8 M

DISBURSEMENTS. Total disbursement (as of March 29, 1993) - US\$ 151.79 M.

* Financing of Electro-Mechanical Equipment for SDR 12.4 M (US\$ 17.6 M/Rs.517.7 M) agreed through June 6, 1991 Amendment to DCA.

Table 6

INDIA
NARMADA RIVER DEVELOPMENT - GUJARAT
TOTAL PROJECT COSTS

Sl. No.	Component/Work	Appraisal Estimate		Revised Cost (at 1992 Price Level)**	
		Rs.Million	US\$ M *	Rs.Million 1/	US\$ M 2/
A	Main Dam	5,469.2	455.8	11,320.0	432.0
B	Rock Fill Dykes & Link Channels	109.4	9.1	109.4	9.1
C	Riverbed Power House	5,152.4	429.4	11,706.0	447.0
D	Main Canal	12,175.6	1,014.6	33,109.0	1,264.0
E	Garudeshwar Weir	501.8	41.8	502.0	19.0
F	Canal Head Power House	1,060.2	88.3	2,309.0	88.0
G	Transmission System	227.4	18.9	227.4	9.0
H	Branches	9,401.0	783.4	43,687.0	1,667.0
I	Distribution & Drainage Systems	20,975.9	1,748.0	27,125.0	1,035.0
I-1	Ground Water Development	-	-	4,054.0	155.0
J	Vadgam Dam & Bye-pass Tunnel	257.1	21.4	566.0	21.4
J-1	En-route Storage	-	-	320.0	12.0
K	Command Area Development	5,379.4	448.3	9,020.0	344.0
L	Hydrometeorological Network	175.5	14.6	175.5	7.0
M	Training & Technical Assistance	74.0	6.2	74.0	3.0
N	Land Acquisition & Rehabilitation	1,680.8	140.1	1,680.8	64.0
	Total Baseline Costs	62,639.7	5,220.0	145,985.1	5,576.5 3/
	Physical Contingencies	8,029.1	669.1		
	Price Contingencies	65,738.2	5,478.2		
	TOTAL PROJECT COST	136,407.0	11,367.2		

* 1US\$ = RS.12.0

** At current prices before 1992, constant price afterwards.

1/ Total revised cost of SSP has increased to Rs. 145,985.1 M, compared to the Appraisal Cost of Rs.136,407.0 M (7% increase) and the project cost of Rs. 64060.4 M approved by Planning Commission at 1986-87 Price Level (128% increase).

2/ In terms of US\$, the Revised Cost has reduced by about 51% due to substantial devaluation of Rupee.

3/ Revised Project Cost of Dam & Power Project components (as per page 30 of SAR), viz. components at Serial Nos. A,B,C,E,F,G,J,L,M and N of the above table, is estimated to be Rs. 28,670.1 M at 1992 price level.

Table 7

INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
 (CR.1552-IN/LN.2497-IN)

PROJECT COST
 (Components/Items Eligible for Disbursement)

Sl. No.	Component	Appraisal Estimate		Tendered Cost Rs.M	Estimated Revised Cost (Rs.M) at 1992 Price Level	Actual Expenditure as of March 29, 1993 (Rs.M)	Balance Expenditure to Complete Spillover Works (Rs.M)
		US\$M	Rs.M				
		Base cost					
		Cost with contingency					
1	DAM (including instruments, gates, etc.)	390.7 635.3	4689.0 7623.9	3,698.5	5,688.2	4,158.2	1530
2	Irrigation By-pass Tunnel	9.6 14.3	115.0 171.9	193.5	283.2	0.0	283.2
3	POWER (Civil Works) (including steel plates, penstock liners and gates, etc.)	67.2 103.4	806.0 1241.0	626.1	1,281.0	837.7	443.3
4	POWER (Electric Equipment)	-	-		* US\$17.6M =Rs.517.7M] SDR 12.4M] **US\$39.6 =Rs.1163.6M]	369.1 (SDR8.87M)	1312.2
5	HYDROMET NETWO	12 16.7	144.1 201.2		Rs. 276.0 M	21.8 (US\$0.83M)	254.2
6	TRAINING & TECHN ASSISTANCE	2.5 3.4	29.6 41.2		Rs.86.7M	12 (US\$0.43M)	74.7
	TOTAL:	482.0 773.1	5783.7 9279.2	4,514.4	9,296.4	5,398.8	3897.6

NOTES:

- * Financing of Electro-Mechanical equipment for SDR 12.4 M agreed through the June 6,1991 amendment of DCA.
- ** Financing of 400 KV GIS equipment agreed through Bank letter of August 31, 1988.

At the current exchange rate of 1US\$ = Rs.30.7, the completion of balance works would require US\$ 126.9 M.

NARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(Cr.1552-IN/Ln.2497-IN)
PROJECT FINANCING

Category	Planned in Original Credit/Loan Agreement			Provided in Revised Credit/Loan Agreement			Actual Disbursements (as of March 29, 1993)	
	Amt.of Credit Allocated (SDRs '000)	Amt.of Loan Allocated (US\$ '000)	Disburse- ment %	Amt.of Credit Allocated (SDRs '000)	Amt.of Loan Allocated (US\$ '000)	Disburse- ment % 1/	Credit (SDRs '000)	Loan (US\$ '000)
A. (1) Civil Works	92,010	184,405	FY85-90: 45% FY91-95: 15%	79,610	184,405	90	87719.18	18479.76
(2) Training under Part K of the project	230	470	100%	230	470	100	19.95	3.42
(3) Technical Assistance: (a) Under Part M (vii) of the project	200	-	100%	200	-	100	50.28	-
(b) Under Parts M (i) through M (vi) of the project	700	1,800	100%	700	1,800	100	234.56	-
(4) Hydrometeorological Net- work under Part N of the project:								
(a) Civil works	735	1,499	70%	735	1,499	90	0.00	-
(b) Goods	4,165	8,491	100% of foreign expnd.; 100% of local expnds (ex-factory cost) & 70% of local expense for other items procured locally	4,165	8,491	100% of foreign expnd.; 100% of local expnds (ex-factory cost) & 80% of local expense for other items procured locally	585.29	-

Category	Planned in Original Credit/Loan Agreement			Provided in Revised Credit/Loan Agreement			Actual Disbursements (as of March 29, 1993)	
	Amt. of Credit Allocated (SDRs '000)	Amt. of Loan Allocated (US\$ '000)	Disbursement %	Amt. of Credit Allocated (SDRs '000)	Amt. of Loan Allocated (US\$ '000)	Disbursement % 1/	Credit (SDRs '000)	Loan (US\$ '000)
(5) Unallocated	1,660	3,335		(5) Goods under Parts B (ii) and G of the project 12,400 2/ (6) 1,660	3,335	100% of foreign expd., 100% of local expd., (ex-factory cost)	8,872.13 2218.60 3/	- 11.48 3/
TOTAL:	99,700	200,000		99,700	200,000		99,700.00 or US\$ 133.3 M	18,494.65 or 4/ US\$ 18.49 M

Total disbursements (Cr.+ Ln.):
US\$ 133.3 M + US\$ 18.49 M
= US\$ 151.79 M

B. Financing Plan

	Planned (US\$ M)	%	Final 6/ (US\$)	%
Credit & Loan (total)	300.00	18.00	151.79	13.80
Domestic (GOI & States)	1,374.00	82.00	947.71	86.20
Total Project Cost	1674.00 5/	100.00	1,099.50	100.00

Notes: 1/ Disbursement percentage increased with effect from September 1, 1990.

2/ DCA amended on June 6, 1991 to permit use of a portion of savings equivalent to SDR 12.4 M for financing additional Electro-Mechanical equipments.

3/ Differences due to cross exchange rates on special account transactions.

4/ Total disbursement under Loan is US\$ 18.49 M after cancellation of US\$ 165.54 M on March 29, 1993 and refund of US\$ 15.96 M by GOI on August 10, 1993.

5/ SAR Project Cost is US\$ 1933.5 M. Proposed project costing net of taxes and duties is US\$ 1674 M, as per page 32 of SAR.

6/ At 1992 price level.

INDIANARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(Cr.1552-IN/Ln.2497-IN)ECONOMIC IMPACT 1/

Indicator	Appraisal Estimate	PCR Estimate	Remarks
ERR Overall Project	13.20%		11.9%
Underlying Assumptions			
- Time period covered for evaluating economic viability	50 years	50 years	
- Estimation of economic and financial prices	1984 price level	1992 price level	
- Standard Conversion Factor (SCF)	0.8	0.8	
- Benefits included in economic evaluation	Irrigation; Power; and M&I benefits	Irrigation; Power; M&I; Fuelwood; and Fisheries Benefits	
- Commencement of benefits:			
o Commencement of first irrigation	May 1992	July 1995	
o Commencement of Hydro-Power through commissioning of first Unit of:			
(i) Canal Head Power House (CHPH)	August 1992	August 1995	All 5 units of CHPH are expected to be commissioned by 04/96.
(ii) Riverbed Power House (RBPH)	Oct. 1992	Sept. 1997	* Due to expected delays in resolution of funding of TG sets, power benefits from 1st Unit of RBPH shall commence from 09/97.

Table 9
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Indicator	Appraisal Estimate	PCR Estimate	Remarks
- Estimation of upstream diversions, at full development, for determining energy generation at RBPH	24,300 Mm3	* 16,000 Mm3	* By year 2024 due to expected delays in upstream water development
- Estimation of Narmada Sagar Dam being operational	1993/94	** 2001/02	** To account for the impact of delays in the construction of Narmada Sagar Dam, water released for power generation reduced by 25% during the first 5 years of operation.
- Economic value of energy from Hydro-Power Component	Rs.0.66/KWH	* Rs.1.39/KWH	* Based on Second Maharashtra Power Project, adjusted for inflation.

1/ Detailed Economic Analysis in Annex 1.

INDIANARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(Cr.1552-IN/Ln.2497-IN)PRIORITY STUDIES/WORK PLAN TOPICS OF NARMADA PLANNING GROUP

<u>Priority Number</u>	<u>Study Item or Topic 1/</u>	<u>Present Status</u>
1.	Resettlement and rehabilitation plans, including suitable financial and institutional arrangements.	<p>This topic is comprehensively included in Schedule 3 of DCA as well as the Project Agreements with Gujarat, Maharashtra and Madhya Pradesh under Schedule 2 and the relevant Sections of PA. Whereas, the progress had been generally satisfactory in Gujarat, there were severe problems with Maharashtra and M.P. in respect of institutional and implementation arrangements. Concerned at the unsatisfactory level of progress in implementing the R&R component, the Bank, in October 1992, agreed with GOI on a consolidated Action Plan including a detailed set of bench marks for implementation by the states within the prescribed period. The Action Plan comprised provisions for improvement in policies, organization and management, and implementation of R&R; tighter linkage between progress on R&R and dam construction; and strengthened environmental planning and monitoring of potential environmental impacts. Satisfactory implementation of the bench marks within the target period was made a condition for continuing disbursements beyond March 31, 1993. GOI, while assuring the Bank Executive Board on March 30, 1993 that Gujarat, Maharashtra and M.P. were achieving satisfactory progress in meeting the agreed benchmarks on R&R, decided to cancel further disbursements out of the outstanding portion of the Bank loan. The status of implementation (as of March 30, 1993) indicated an evidence of substantial progress towards several of the bench marks. However, on several important tasks relating to R&R, domestic difficulties unrelated to the project made adherence to the previously envisaged timetable difficult. The work on environmental</p>

Table 10
(Page 2 of 4)

amelioration and management was generally on course. In respect of R&R, substantial progress was made in improving planning and survey data. Perusal of the reports furnished recently by NCA indicates that (i) policies in M.P. and Maharashtra have been improved to close gaps between States; implementation has also improved through larger settlement of PAPs in Maharashtra and purchase of land in MP, grievances and appeals processes are now operating; staffing and administrative powers are now satisfactory; R&R staff is being trained; co-ordination of movements between MP and Gujarat PAPs has substantially improved; consultation with PAPs is being carried out; MIS to monitor R&R implementation is being set up; (ii) criteria to link dam construction to R&R implementation have been developed and the Bank-suggested "green light system" is being broadly implemented; (iii) dam construction program for 1992/93 was limited to ensure that R&R of affected villages was completed at least six months prior to submergence; and (iv) environmental overview and environmental work plans as well as the health management plans are reported to have been prepared by the party states.

2. Watershed management (with assistance of GOI, GOMP, GOG and GOM) including development of an "Afforestation Plan" for reservoir and adjacent area to achieve higher production base and improved environments (e.g., reduce sedimentation).

GOI's environmental clearance for the project imposed conditions for compensatory afforestation (CAF) and catchment area treatment (CAT). The environment issue is also appropriately covered in the Project Agreements with Gujarat, Maharashtra and M.P. Ministry of Environment and Forest, GOI has specified that the project will compensate for forest lands taken by SSP, as below:

	<u>Guj.</u> (ha)	<u>Mah.</u> (ha)	<u>MP</u> (ha)	<u>Total</u> (ha)
Forest area taken by the project	4,523	9,188	2,732	16,443
Degraded forest to be replanted	9,300	12,980	6,547	28,827
Non-forest land to be afforested	<u>4,650</u>	<u>2,190</u>	<u>2,190</u>	<u>16,030</u>
Total area for CAF	<u>13,950</u>	<u>22,170</u>	<u>8,737</u>	<u>44,857</u>

Table 10
(Page 3 of 4)

Each state has prepared an action plan for CAF within its boundaries and has initiated implementation as well. The total area afforested to-date is over 29,000 ha out of the planned total of 44,857 ha, viz. a progress of 65%. Progress is good in all three states: Gujarat (62%); Maharashtra (69%); and Madhya Pradesh (55%). The Regional Chief Conservator of Forests at Bhopal is monitoring CAF for the project on behalf of MOEF. In respect of catchment area treatment (CAT), each state has finalized an action plan for implementation. Gujarat has already treated 16,500 ha (55%) of the total area of 30,000 ha to be treated and the action plan envisages completion of treatment by 03/95. Maharashtra is to treat some 25,000 ha and a substantial part of CAT area has been encroached and used for agriculture by locals who are reluctant to allow forestry officers on to the land. Nevertheless, work has now commenced in the areas free from dispute and is scheduled to be completed by 03/96. MP has to treat 114,600 ha as per their detailed action plan. To date, 17,000 ha of land has been treated and the entire program is scheduled to be completed by 03/97.

The present schedules envisage completion of CAT programs in all three states by the end of 1996-97 financial year. Full impoundment of reservoir is not due until 1998; so these schedules are in accordance with the condition of the MOEF that the entire program of CAT should be completed before the reservoir filling.

3. Study of project-related computer needs for planning, design, project management, procurement, scheduling and other related needs.

Study has been completed by SSNNL and computers have also been installed and commissioned at 10 project sites where they have started functioning successfully. Five additional project locations have also been identified for installing computers and are expected to be commissioned within a year.

Table 10
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- | | | |
|----|---|---|
| 4. | Management information system requirements (with 3 above), administrative, planning, design, procurement, scheduling, and general engineering data retrieval systems. | Establishment of a fully computerized management information system (MIS), duly manned by trained engineers and staff, has been completed by SSNNL. It has developed into a dynamic management tool for all management levels, and besides preparing implementation schedules of the key project components, including master network schedule of SSP, it is also assisting in the programming, scheduling, and monitoring of contractor's performance. The Finance Wing has started receiving assistance from MIS. Process of computerization of designs of structures is also progressing well. Overall, project management, scheduling, implementation, reporting, accounting, budgetary controls, contractor's performance, etc. are all computerized and are starting to have a positive impact on timely implementation of works. A Computer Advisory Committee has also been formed under SSNNL Chairman to ensure sustainability of MIS and promoting innovations and forward thinking. |
| 5. | Communication and operational control systems plan (with 3 above). | This is in progress. The final feasibility report on the operation of Narmada Canal System, submitted by G.C.E.L., Vadodara, in 4/90 has been accepted by SSNNL. The Bank also assisted the Nigam in finalizing the TORs and bidding documents for the design, supply and commissioning of computerized remote control and monitoring system for the Narmada Main Canal and branch canals down to the 8.5 cumec level. |
| 6. | Project-wide manpower requirement and training programs plan. | This is a continuing study/exercise and is periodically updated/revised by SSNNL for the construction phases of the wide network of project activities. A study has also been recently completed to determine the manpower and training requirement of the O&M needs of headwork, power plants and canal system. O&M training program is still to be implemented. Core O&M groups have also to be appropriately established and strengthened. |

1/ Refer Table 22, page 102 of SAR No. 5107-IN.

INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
(CR.1552-IN/L.N.2497)

Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
GUJ 2.01a, PA	Carry out various parts of proj.as described in Sch.2 to DCA in conformity with appropriate adm., finan.,eng.,agr., env.,sociological &pub.utilities practices & with required funds, facilities,staff,services &resources,incl.3-State Hydromet (Part N).	ORG	2	//	//	Good progress achieved on execution of Parts A & B; Part H not undertaken due to non-resolution of invert level; implementation of Part K is still to be adequately initiated. Establishment of Hydromet (Part N) is substantially delayed.
GUJ 2.01b, PA	Provide facilities to NCA to enable it to carry on overall operation & maintenance of hydrometeorological network under Part N of the project.	ORG	4	//	//	N refers to hydromet. GOI has moved NCA to Indore, MP as a means of facilitating its responsibilities.
GUJ 2.01c, PA	Provide to NCA facilities & resources to enable it to assist the Borrower in carrying out M&E of R&R under Part P of the project with diligence & efficiency.	ORG	1	//	//	"P" refers to overall M&E of R&R.
GUJ 2.02a, PA	Carry out planning, design & construction of works under Parts A,B,D,E,G,H,I,J & N of the project and installation of equipment under Parts C,F & N of the project.	ORG	2	//	//	These activities span initiation through completion. Construction of works under Parts D,H & N not yet undertaken. Funding of T/G sets under Part C is still to be resolved. Part N is yet to take off.
GUJ 2.02b, PA	Furnish an O&M plan for dams, powerhouses, canals, structures & equipment (within State boundaries) under Parts A,B,C,D,E,F,G,H,I & J of the project and thereafter implement it.	ORG	1	//	12/31/87	The 3-volume O&M plans have been prepared by Nigam and reviewed by Bank.
GUJ 2.02c, PA	In coordination with MP,Maharashtra & NCA, furnish a final system design for hydrometeorological network under Part N of the project, including equipment specifications & construction schedules.	ORG	2	//	12/31/86	N refers to Hydromet implementation which has been initiated; however, implementation schedule by NCA to make it fully operational by June 1993 is now substantially delayed due to delay in finalizing telemetry procurement by NCA.
GUJ 2.02d, PA	In coordination with MP, Maharashtra & NCA, furnish an O&M plan for hydrometeorological network under Part N of the project, including provision of funds, staff & other resources.	ORG	4	//	12/31/87	Same as above in respect of Hydromet implementation schedule. O&M plan shall be prepared after installation of Hydromet starts.
GUJ 2.02e, PA	Maintain adequate supply of materials for construction works under Parts A,B,D,E,G,H,I,J & N of the project, including cement and steel.	ORG	1	//	//	
GUJ 2.02f, PA	Complete within State boundaries construction of transmission lines & substations required for full integration of power-related facilities with the Borrower's western region power grid.	ORG	2	//	12/31/91	Detailed survey for 400 kv transmission line, from SSP to Gujarat State border for M.P. and Maharashtra has been completed, implementation also initiated.
GUJ 2.02g, PA	Have such components of hydrometeorological network under Part N of the project located within State boundaries, installed and made operational.	ORG	3	//	06/30/88	Refer GUJ 2.02c, PA above.

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
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Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
GUJ 2.03a, PA	Carry out Tech.Assistance component of the project under Part M.Schedule 2, by employing consultants in accordance with World Bank Guidelines published in Aug. 1981.	MAN	1	//	//	
GUJ 2.03b, PA	Furnish a list of consultants in following areas: quality control,design of gates,valves & control equip.,steel fabrication & erection, tunnels,rock mechanics,design/installation of large rotating equipment,emergencies, etc.	ORG	1	//	04/01/85	
GUJ 2.03c, PA	In coordination with MP & Maharashtra, employ consultants (in accordance with World Bank Guidelines of Aug.1981) to carry out Hydromet under Part N of the project.	MAN	2	//	//	N refers to Hydromet. International Consultants recommendations on communication system, initially agreed by NCA, were later not implemented and procurement action re-initiated, causing heavy delays in establishment of Hydromet.
GUJ 2.04, PA	Procurement of goods & civil works required for Parts A,B,H,K&N of the proj.and to be financed out of credit proceeds shall be governed by provisions of Schedule 1 to this Agreement.	ORG	2	//	//	Civil works for Parts H&N not undertaken so far.
GUJ 2.06, PA	Gujarat to maintain at all times the Narmada Control Authority, Sardar Sarovar Construction Advisory Committee and the Narmada Review Committee, with staffing & funds as required.	ORG	1	//	//	
GUJ 2.07, PA	Maintain Narmada Dev. Dept. headed by a qualified officer, to enable it to undertake its responsibilities for overall implementation & management of Sardar Sarovar Project.	RPT	1	//	//	
GUJ 2.07a, PA	Undertake O&M of irrigation, municipal, industrial & domestic water facilities under Schedule 4, Part B of Sardar Sarovar Project.	ORG	4	//	//	Part B refers to the canal conveyance system and its operation by computerized remote control.
GUJ 2.07b, PA	O&M of Parts A,D,E,H & I of project described in Schedule 2 to DCA.	ORG	4	//	//	
GUJ 2.07c, PA	Undertake supply and distribution of irrigation, municipal, industrial & domestic water resulting from Sardar Sarovar Project (Schedule 4).	ORG	4	//	//	Nigam and GOG Water Supply Department have prepared preliminary plans for D.M.& I. water distribution. Detailed designs and estimates are under preparation.
GUJ 2.07d, PA	Through an appropriate agency establish by Dec.31,1988, (i) O&M of Parts B,C,F,G & J of project, and (ii) supply of hydroelectric power to Gujarat, MP & Maharashtra resulting from project described in Schedule 2 of DCA.	ORG	3	//	//	Though GOG has decided on the GEB as the O&M Agency the lease agreement between GOG/Nigam and GEB, has not been finalized so far.
GUJ 2.08a, PA	Maintain Narmada High Power Committee to adequately undertake its responsibilities for coordination and timely interaction among various departments and agencies of Gujarat.	ORG	1	//	//	

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
(CR.1552-IN/LN.2497)

Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
GUJ 2.08b, PA	Maintain Narmada Planning Group for carrying out planning studies of the Narmada River Dev. Program, including O&M of hydroelectric power & water delivery & drainage facilities.	ORG	1	//	//	O&M planning needs to be strengthened through expansion of core O&M units for dam & power and canals.
GUJ 2.09a, PA	Maintain within Narmada Development Dept., a Central Procurement Unit, headed by a qualified officer, for procurement of all goods & services required for implementation of Sardar Sarovar Project.	ORG	1	//	//	
GUJ 2.09b, PA	Maintain within NDD a Cell, headed by a qualified officer, for monitoring & evaluation of activities, e.g. Management Information System (MIS) Cell.	ORG	1	//	12/31/85	Compliance delayed till 1989; now under Director General (MIS), and his staff, MIS continues to make excellent progress towards the achievement of targetted objectives.
GUJ 2.10, PA	Implement a rehabilitation & resettlement plan for the oustees satisfactory to the Association.	ORG	2	//	//	Gujarat continues to give good performance in the resettlement of PAPs and has also involved NGO's support.
GUJ 2.11ai, PA	Furnish a work plan for environmental effects derived from implementation of Sardar Sarovar Proj., incl. suitable trng. programs for staff of Guj., MP & Mah. and studies & impl. schedules for fish & fisheries, forest & wildlife & public health aspects.	ORG	2	//	12/31/85	Important surveys & studies made; work plans on compen: afforestation, catchment treatment formulated & implementation initiated as well; environmental and health management plans have been prepared.
GUJ 2.11aii, PA	Furnish training program for O&M of facilities under Sardar Sarovar Project, including plans, schedules, syllabi & provision of funds.	ORG	2	//	06/30/89	Various plans prepared. Need to be coordinated and implemented.
GUJ 2.11aiii, PA	Training program on resettlement & rehabilitation of oustees for staff of Gujarat, MP & Maharashtra, including plans, schedules, syllabi & provision of funds.	ORG	2	//	12/31/85	Some training programs conducted but more need to be planned.
GUJ 2.12a-d, PA	Furnish plans, repts., schedules, maintain records for M&E, allow Bank access & visits, make available all data, docs. & records including Bank requested reports, contract data for publication by Bank & proj. completion report 6 months after Closing, et al.	ORG	1	//	//	
GUJ 2.13, PA	Furnish semi-annual & annual reports on progress of Parts A through O(i) of the project within 3 months after the end of each reporting period.	RPT	1	//	//	
GUJ 2.14a, PA	Exchange views with the Association regarding progress of Parts A through O(i) of the project and other matters relating to purposes of the Credit.	ORG	1	//	//	
GUJ 2.14b, PA	Inform the Association of any condition interfering with the progress of Parts A through O(i) of the project.	ORG	1	//	//	

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
(CR.1552-IN/L.N.2497)

Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
GUJ 2.15, PA	Take action to acquire, within State boundaries, all such land & rights in respect of land as shall be required for carrying out project & furnish evidence that such land & rights are available for purposes related to the project.	ORG	1	//	//	
GUJ 2.16, PA	Maintain efficiently the facilities provided under the project and necessary repairs and renewals made with sound engineering & financial practices.	ORG	4	//	//	
GUJ 2.17, PA	Take measures to minimize the risk of malaria, filaria, schistosomiasis and other water-related diseases that may result from implementation of the project.	ORG	2	//	//	A large number of studies carried out, the latest one in 12/92; work plan for control of malaria and other diseases finalized; intensified malaria control program is also initiated in areas impacted by the project.
GUJ 2.18a, PA	Maintain the Dam Safety Panel with TOR and membership satisfactory to the Association.	ORG	1	//	04/01/85	
GUJ 2.18b, PA	Cause the Dam Safety Panel to review the adequacy of the plans & designs of dams, spillways, by-pass tunnel, weir, powerhouses, channels, related structures & facilities included in the project.	ORG	1	//	//	
GUJ 2.18c, PA	Cause Dam Safety Panel to conduct semi-annual reviews during design & construction of dam and furnish to the Association & Gujarat its findings, conclusions & recommendations.	ORG	1	//	//	
GUJ 2.18d, PA	Cause dams, spillways, bypass tunnel, weir, related structures & facilities constructed to be periodically inspected in accordance with sound engineering practice.	ORG	4	//	//	
GUJ 3.01a, PA	Maintain separate records & accounts adequate to reflect its resources, expenditures & operations related to Parts A through O(i) of the project.	FIN	1	//	//	
GUJ 3.01b, PA	Furnish copies of their accounts & financial statements for each FY not later than 9 months after end of each such year, certified by an independent auditor acceptable to the Association.	ADT	1	//	//	
GUJ 3.02a-c, PA	Have their accounts and financial statements for each FY audited in accordance with appropriate auditing principles consistently applied, finalize & furnish immediately such other information the Bank shall reasonably request.	ADT	1	//	//	

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
(CR.1552-IN/L.N.2497)

Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
GUJ 3.03, PA	Enter into a bulk supply contract with appropriate electric utility organisation not later than 6 months before commissioning of the first turbine-generator unit under either Part C or F of the project.	ORG	4	//	//	C&F refer to RBPH and CHPH respectively. Refer Section 2.07d GUJ.
MAH 2.01a, PA	Maharashtra to provide to Gujarat, as needed, funds, facilities, services & other resources required to enable Gujarat to carry out Parts A through O(i) of the project described in Schedule 2.	ORG	1	//	//	
MAH 2.01b, PA	Maharashtra to carry out overall project M&E under Part L of the project described in Schedule 2 with diligence & efficiency and provide funds, facilities, staffing services and other resources required.	ORG	1	//	//	L refers to all parts of SSP other than R&R.
MAH 2.01c, PA	Maharashtra in coord. with Guj., MP & NCA and MP in coord. with Guj., Mah. & NCA, carry out proc., construction, install., O&M of such portions of hydrometeorological network under Part N of the proj. with efficiency & provide funds, staffing & resources reqd.	ORG	2	//	//	N refers to Hydromet implementation which has been initiated; however, implementation schedule by NCA to make it fully operational by 6/93 is now substantially delayed due to delay in finalizing telemetry procurement by NCA.
MAH 2.01d, PA	Maharashtra to provide to NCA facilities & services to enable it to carry out its responsibilities, inter alia, overall O&M of the hydrometeorological network under Part N of the project.	ORG	4	//	//	N refers to Hydromet. (Sec 2.01b GUJ)
MAH 2.01e, PA	Maharashtra to provide to NCA facilities and services to enable it to assist the Borrower in carrying out M&E of R&R under Part P of the project.	ORG	2	//	//	P refers to overall M&E of R&R.
MAH 2.02a, PA	Maharashtra to carry out planning, design and construction of works, and installation of Hydromet equipment under Part N of the project.	ORG	2	//	//	See Section 2.01c above.
MAH 2.02b, PA	Mah. in coord. with Guj., MP & NCA to prepare & furnish a final system design for hydrometeorological network under Part N of the proj., incl. equipment specifications & construction schedules.	ORG	2	//	12/31/86	See Section 2.01c above.
MAH 2.02c, PA	Maharashtra in coordination with Gujarat, MP & NCA to prepare & furnish an O&M plan for the hydrometeorological network under Part N of the project.	ORG	4	//	12/31/87	O&M plan shall be prepared when Hydromet installation is taken up.
MAH 2.02d, PA	Maharashtra to complete with State boundaries construction of transmission lines & substations required for full integration of power related facilities under the project.	ORG	2	//	12/31/91	

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
(CR.1552-IN/L.N.2497)

Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
MAH 2.03, PA	Maharashtra, in coordination with Gujarat & MP to employ consultants in accordance with the World Bank Guidelines published in August 1981.	MAN	1	//	//	See Section 2.03aGUJ and Section 2.18a-b,Gujarat PA
MAH 2.06, PA	Maharashtra to maintain at all times the Narmada Control Authority, Sardar Sarovar Construction Advisory Committee and the Narmada Review Committee, with staffing & funds as required.	ORG	1	//	//	
MAH 2.07, PA	Maharashtra to implement within their State boundaries, a resettlement & rehabilitation plan for the oustees.	ORG	2	//	//	Severe implementation problems had earlier persisted due to anti-dam agitation and inadequate R&R staffing, consultation & grievance procedures. Implementation has now significantly improved.
MAH 2.08ai, PA	Maharashtra to furnish a work plan for the environmental effects derived & derived from impl.of the Sardar Sarovar Proj., which will include (A)suitable trng.programs,(B)studies & impl.schedules for fish,forest,wildlife & pub.hlth.aspects.	ORG	2	//	12/31/85	Important surveys & studies made; work plans on compen. afforestation, catchment treatment formulated & implementation initiated as well; environmental and health management plans have also been prepared.
MAH 2.08aii, PA	Maharashtra with Gujarat and MP to furnish a suitable training program of O&M of facilities under Sardar Sarovar Project, including plans, schedules, syllabi & provision of funds.	ORG	3	//	06/30/89	
MAH 2.08aiii, PA	Maharashtra with Gujarat and MP to furnish a suitable training program on Resettlement & Rehabilitation of Ousteas for project staff of Guj.,MP & Maharashtra, including plans, schedules, syllabi & provision of funds.	ORG	2	//	12/31/85	Some training programs conducted but more requires to be planned.
MAH 2.08b, PA	Maharashtra in coordination with Gujarat & MP to implement the work plan & training programs referred to in para (a) above, as so approved.	ORG	2	//	//	See above.
MAH 2.09a-f, PA	Maharashtra to prepare, furnish reports,schedules and maintain records, allow Bank access to records & visitation and certain publication rights, expenditure & disb. data, progress & completion repts.on execution etc.for various parts of the proj.	ORG	1	//	//	
H 2.10, PA	Maharashtra to furnish semi-annual and annual reports on progress of Parts L,N & O respectively of the project within 3 months after the end of each reporting period.	RPT	2	//	//	NCA is reporting status on hydromet and Maharashtra on R&R regularly. However, M&E needs further improvement.
MAH 2.11a, PA	Maharashtra shall at the Association's request, exchange views with the Assoc. regarding progress of the project, performance of its obligations & other matters relating to the purposes of the Credit.	ORG	1	//	//	

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
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Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
MAH 2.11b, PA	Maharashtra to promptly inform the Association of any conditions interfering with the progress of the project, accomplishment of the purposes of the Credit, or performance by Maharashtra/MP of its obligations.	ORG	1	//	//	
MAH 2.12, PA	Maharashtra to furnish, after acquisition of land & rights in respect of land, evidence that such land & rights are available for purposes of the project.	ORG	1	//	//	
MAH 2.13, PA	Maharashtra to cause the facilities provided under the project to be efficiently maintained, vehicles & equipment provided and all necessary repairs & renewals to be made in accordance with sound engineering practices.	ORG	1	//	//	
MAH 2.14, PA	Measures to be taken by Maharashtra to minimize risk of malaria, filaria, schistosomiasis & other water-related diseases that may result from implementation of the project.	ORG	2	//	//	Maharashtra has finalized plans to strengthen state & district health facilities in villages and resettlement areas through additional public health units, mobile units and a floating dispensary as well for villages within 10 km of submergence zone.
MAH 2.14, PA (cont'd.)				//	//	Implementation initiated but needs to be accelerated.
MAH 2.15, PA	Maharashtra to enter into a bulk supply contract with appropriate electric utility organisations for sale of electricity not later than 6 months prior to commissioning of first turbine-generator unit under either Part C or F of the project.	ORG	4	//	//	C&F refer to RBPH and CHPH respectively.
MAH 3.01a, PA	Maharashtra to maintain separate records & accounts adequate to reflect its resources, expenditures & operations related to Parts L,N & O(iii)/Parts L,N & O(ii) respectively of the project.	FIN	1	//	//	N refers to Hydromet, O refers to M&E of R&R, L refers to M&E of activity other than R&R.
MAH 3.01b, PA	Maharashtra to furnish copies of their accounts & financial statements related to Parts L,N & O(iii)/Parts L,N & O(ii) respectively of the project for each FY not later than 9 months after end of each such year.	FIN	1	//	//	
MAH 3.02a-c, PA	Mah. to get their accounts & financial statements for Parts L,N & O(iii)/Parts L,N & O(ii) respectively audited by independent auditors acceptable to the Association, finalize & furnish immediately such other info. the Bank shall reasonably request.	FIN	1	//	//	As for 3.01 a GUJ.
MP 2.01a, PA	MP to provide to Gujarat, as needed, funds, facilities, services & other resources required to enable Gujarat to carry out Parts A through O(i) of the project described in Schedule 2.	ORG	2	//	//	MP is still to resolve the issue of invert level of irrigation bypass tunnel; non-resolution has delayed initiation of construction of Part H.

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
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Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
MP 2.01b, PA	MP to carry out overall project M&E under Part L of the project described in Schedule 2 with diligence & efficiency and provide funds, facilities, staffing services and other resources required.	ORG	1	//	//	L refers to all parts of SSP other than R&R.
MP 2.01c, PA	MP in coord. with Guj., Mah. & NCA carry out proc., construction, install. O&M of such portions of hydrometeorological network under Part N of the proj. with efficiency & provide funds, staffing & resources required.	ORG	2	//	//	Hydromet implementation, though initiated, has been substantially delayed due to delay in finalizing telemetry system by NCA. Earlier schedule of a fully operational Hydromet by 6/93 has suffered heavy slippage.
MP 2.01d, PA	MP to provide to NCA facilities & services to enable it to carry out its responsibilities, inter alia, overall O&M of the hydrometeorological network under Part N of the project.	ORG	4	//	//	N refers to Hydromet. (See 2.01b GUJ)
MP 2.01e, PA	MP to provide to NCA facilities and services to enable it to assist the Borrower in carrying out M&E of R&R under Part P of the project.	ORG	2	//	//	P refers to overall M&E of R&R. State M&E work is weak.
MP 2.02a, PA	MP to carry out planning, design and construction of works, and installation of Hydromet equipment under Part N of the project.	ORG	2	//	//	See Section 2.01c above.
MP 2.02b, PA	MP in coord. with Guj., Mah. & NCA to prepare and furnish a final system design for hydrometeorological network under Part N of the proj. incl. equipment specifications & construction schedules.	ORG	2	//	12/31/86	See Section 2.01c above.
MP 2.02c, PA	MP in coordination with Gujarat, Maharashtra & NCA prepare and furnish an O&M plan for the hydrometeorological network under Part N of the project.	ORG	4	//	12/31/87	O&M plan shall be prepared when installation of hydromet commences.
MP 2.02d, PA	MP to complete with State boundaries construction of transmission lines and substations required for full integration of power related facilities under the project.	ORG	2	//	12/31/91	
MP 2.03, PA	MP in coordination with Gujarat & Maharashtra, to employ consultants in accordance with the World Bank Guidelines published in August 1981.	MAN	1	//	//	See Section GUJ 2.03a and Section GUJ 2.18a-b, PA
MP 2.06, PA	MP to maintain at all times the Narmada Control Authority, Sardar Sarovar Construction Advisory Committee and the Narmada Review Committee, with staffing & funds as required.	ORG	1	//	//	
	MP to implement within their State boundaries, a resettlement & rehabilitation plan for the oustees.	ORG	2	//	//	R&R policy improved; implementation has also improved through: purchase of land in MP, streamlining grievance and appeals process, adequate staffing and consultation with PAPs.

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
 (CR 1552-IN/LN.2497)

Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
MP 2.08ai, PA	MP to furnish a work plan for the environmental effects derived and derived from implementation of the Sardar Sarovar Proj., which will include (A) suitable trng. programs, (B) studies & impl. schedules for fish, forest, wildlife & public health aspects.	ORG	2	//	12/31/85	Surveys & studies made; work plans on compen. afforestation & catchment treatment formulated and implementation initiated; studies & action plans on wild life and flora & fauna made; environmental and health management plans have been prepared.
MP 2.08aii, PA	MP with Gujarat & Maharashtra to furnish a suitable training program of O&M of facilities under Sardar Sarovar Project, including plans, schedules, syllabi & provision of funds.	ORG	3	//	06/30/89	
MP 2.08aiii, PA	MP with Gujarat & Maharashtra to furnish a suitable training program on Resettlement & Rehabilitation of Oustees for project staff of Guj. MP & Maharashtra, including plans, schedules, syllabi & provision of funds.	ORG	2	//	12/31/85	Some training programs conducted but more needs to be planned.
MP 2.08b, PA	MP in coordination with Gujarat & Maharashtra, to implement the work plan & training programs referred to in para (a) above, as so approved.	ORG	2	//	//	See above.
MP 2.09a-f, PA	MP to prepare, furnish reports, schedules & maintain records, allow Bank access to records & visitation & certain publication rights, expenditure & disb. data, progress & completion reports, on execution etc. for various parts of the project.	ORG	1	//	//	
MP 2.10, PA	MP to furnish semi-annual and annual reports on progress of Parts L, N & O respectively of the project within 3 months after the end of each reporting period.	RPT	2	//	//	NCA is reporting on status of R&R and hydromet. M&E reporting needs improvement.
MP 2.11a, PA	MP shall, at the Association's request, exchange views with the Assoc. regarding progress of the project, performance of its obligations & other matters relating to the purposes of the Credit.	ORG	1	//	//	
MP 2.11b, PA	MP to promptly inform the Association of any conditions interfering with the progress of the project, accomplishment of the purposes of the Credit, or performance by MP of its obligations.	ORG	1	//	//	
MP 2.12, PA	MP to furnish, after acquisition of land & rights in respect of land, evidence that such land & rights are available for purposes of the project.	ORG	1	//	//	
MP 2.13, PA	MP to cause the facilities provided under the project to be efficiently maintained, vehicles & equipment provided and all necessary repairs & renewals to be made in accordance with sound engineering practices.	ORG	1	//	//	

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NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
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Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
MP 2.14, PA	Measures to be taken by MP to minimize risk of malaria, filaria, schistosomiasis & other water-related diseases that may result from implementation of the project.	ORG	4	//	//	Work plan prepared to tackle the impacts of SSP through strengthening of health facilities, establishment of monitoring cell; and creation of additional facilities by 1994/95 when submergence in MP commences.
MF 2.15, PA	MP to enter into a bulk supply contract with appropriate electric utility organisations for sale of electricity not later than 6 months prior to commissioning of first turbine-generator unit under either Part C or F of the project.	ORG	4	//	//	C&F refer to RBPH and CHPH respectively.
MP 3.01a, PA	MP to maintain separate records & accounts adequate to reflect its resources, expenditures & operations related to Parts L, N & O(iii)/Parts L, N & O(ii) respectively of the project.	FIN	1	//	//	N refers to Hydromet, O refers to M&E of R&R, L refers to M&E of activity other than R&R.
MP 3.01b, PA	MP to furnish copies of their accounts & financial statements related to Parts L, N & O(iii)/Parts L, N & O(ii) respectively of the project for each FY not later than 9 months after end of each such year.	FIN	1	//	//	As for 3.01a GUJ.
MP 3.02a-c, PA	MP to get their accounts & financial statements for Parts L, N & O(iii)/Parts L, N & O(ii) respectively audited by independent auditors acceptable to the Association, finalize & furnish immediately such other info. the Bank shall reasonably request.	FIN	1	//	//	As for 3.01a GUJ.
DCA 3.01a	Cause Guj, MP & Mah. to perform in accordance with Proj. Agreements and Raj. as provided for in the Decision; & with assistance of NCA, carry out Part P of the proj. with due diligence and efficiency, & provide funds, facilities & other required resources.	ORG	2	//	//	Part P refers to overall monitoring and evaluation of the resettlement and rehabilitation of oustees under Part O of the project, which is being strengthened.
DCA 3.02	Take all such actions, as necessary, including, the provision of forest land for enabling Gujarat, MP and Maharashtra to implement the project within their State boundaries.	ORG	2	//	//	Construction of irrigation bypass tunnel (Part H of project) has not been taken up so far due to non-resolution of invert level by MP.
DCA 3.03	Maintain at all times, the Narmada Control Authority, the Sardar Sarovar Construction Advisory Committee and the Narmada Review Committee and provide staff and funds to enable each of them to accomplish its purposes as set forth in the Decision.	ORG	1	//	//	
DCA 3.04	Employ or cause to be employed and thereafter assign to NCA, a Social Scientist, with qualifications, experience and terms satisfactory to the Association, to assist in carrying out Part P of the project.	ORG	2	//	09/30/85	Part P refers to overall monitoring and evaluation of the resettlement and rehabilitation of oustees, which is being strengthened.

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INDIA
NARMADA (GUJARAT) SARDAR SAROVAR DAM & POWER PROJ.
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Status of Covenants

Section	Summary Description	Type of Covenant	Level of Compliance	Revised Compliance Date	Original Compliance Date	Remarks
DCA 3.05	Furnish to the Association semi-annual and annual reports of the resettlement and rehabilitation of the oustees under Part O of the project right through June 1, 1995.	ORG	1	//	//	Part O refers to implementation, monitoring and evaluation of resettlement and rehabilitation plan for the oustees within Gujarat, Maharashtra and MP.

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NARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(CR.1552-IN/LN.2497-IN)
USE OF BANK RESOURCES/BANK MISSIONS

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
1.	<u>Before Appraisal</u>							
2.	<u>Appraisal to Board Approval</u>							
3.	<u>Board Approval Through Effectiveness</u>	09/85 - 10/85	5 1	16 3	EN(2)/LEG/R&R(2) PROC		T/LEG/R&R PR	Principal focus of the mission was to review progress of responsible governmental implementors in satisfying dated covenants prior to scheduled effectiveness, including understandings and actions with respect to R&R issues and the review of procurement issues prior to effectiveness.
4.	Supervision	04/86 - 05/86	10	13	EN(4)/EC/EG/PRO/ R&R(2)/MISP	3	T/R&R/Geo/ENVN/ MIS/PR/HYDROMET	Supervision Mission Delay in GOI environmental clearance for the project.
		01/87 - 02/87 01/87 02/87	4 1	4 2	EN(3)/MISP PROC	3/2	T/MIS/ENVN/Q	Supervision Mission. Delay in GOI environmental clearance; Mission stressed the need to accelerate establishment of comprehensive MIS.

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		04/87	5	13	EC/R&R(4)	3/2	R&R	Special R&R Mission
		06/87	4	5	EN(3)/MISP/	3/2	Q/CM/T/MIS	Supervision Mission
			1	3	PROC		PR	
		<u>11/87 - 12/87</u>						<u>Supervision Mission</u>
		11/87	3	1	EN(2)/WMS		POM	Review of SSPs Plans of Operation and Maintenance
		11/87	2	-	EN(2)		Hydromet	Review of progress of Narmada Basin Hydromet
		11/87	2	11	R&R	3/1	R&R	R&R Review Mission
			1	4	EN			
		12/87	5	6	EN(3)/MISP/PR	3/2	Q/MIS/IMPL	Engineering Review Mission. Mission focussed on problems associated with - Quality Control of Cement; project implementation and MIS
		01/88	2	2	Cement and Concrete Specialist/En		Q(Cement and Concrete Quality)	Special short mission to identify and rectify cement/concrete quality control problems
		01/88 - 02/88	2	15	R&R(2)		R&R	Bank pre-appraisal mission concerned with the proposed Narmada Sagar Project reviewed the progress of R&R of SSP oustees with GOI and participating states and outlined key

S.No.	Stage of Project Cycle	Month/Year	No. of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		05/88	2	10	R&R	3/2	R&R	steps for meeting obligations under the SSP Agreements. <u>R&R Review Mission.</u> Mission observed severe organizational, institutional and implementation problems connected with R&R.
		05/88	4	4	EN(4)/MISP	3/2	Q/CM/IMPL/MIS /ORG/EQP/DSP strengthening	<u>Engineering Review Mission.</u> Mission focussed on critical problems, namely, project implementation; construction equipment; construction management; quality control; organization & staffing; and the need to strengthen Dam Safety Panel.
		10/88	4	3	EN(3)/MISP	3/2	IMPL/MISP/CM/ Trg/T/EQP/ORG/FIN	<u>Engineering Review Mission.</u> Mission reviewed SSNNL's response to the implementation of 'critical steps' listed in Bank's letter of August 31, 1988.

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		10/88 <u>04/89 - 05/89</u>	1	7	ECOL	3	Environmental Aspects	<u>Environmental Review Mission.</u> <u>Supervision Mission</u> <u>R&R Mission.</u>
			3	9	R&R(3)	Gujarat 3/1 MP &Mah 3/2	R&R (R&R related submergence schedule; GOMP and GOM plans; orgnaization & traning of R&R staff).	Improvement in the pace and quality of R&R in Gujarat together with involvement of NGOs; Severe organizational policy and implementation problems in MP and Mah.
			1	9	ECOL	3/1	Environmental Aspects	<u>Environmental Review Mission.</u> Substantive evidence of progress on environmental studies and work programs on fisheries, forestry, public health, and archaeological aspects. Studies on wild life management still to be initiated
			6	5	EC/EN(4)/PROC	3/2	MIS/TMPL/MOU/PROC /T/ORG/Hydromet	<u>Engineering Mission.</u> The mission focussed on: overall project implementation; review of SSNNL actions in response to the MOU (12/88) between Bank, GOI and participating states; and SSNNL's actions on the 9 critical implementation steps outlined in Bank's letter of August 31, 1988

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		11/89	1	14	ECOL	3/1	ENVN/CAP /CAT/Ecological	<u>Environmental Review Mission.</u> The mission focussed on: the need for the preparation of a comprehensive environmental management work plan; actions by SSNNL, NCA, DOEF and MOWR for timely completion of environment studies; and preparation of wild life management component.
		12/89	5	7	EC/R&R(3) /FORSP	Gujarat 3/1 Mah 3/2 MP 3/2	R&R issues (outstanding policy issues; coordination between R&R wings; inter-state coordination; planning and preparation work; constructive collaboration with NGOs; implementation timetables including provision of infrastructure and amenities; submergence data and practical R&R plans).	<u>Supervision Mission.</u> <u>R&R Mission.</u> The mission focussed on R&R planning and implementation progress including monitoring of NVDA, Guj, MP and Mah. R&R activities gained greater momentum in Gujarat in respect of identification and allotment of replacement of agricultural land. R&R organizations also strengthened. R&R for majority of Mah outtees faced with significant problems. In MP, though some encouraging efforts were initiated much more was

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		12/89	5	4	EN(4)/MISP	3/1	T/ORG/DESIGN /IMP SCHD/POM /Hydromet	<u>Engineering Mission.</u> Overall substantial progress achieved in physical and financial implementation of project which appeared at qualitative and quantitative terms. A large number of technical issues resolved.
		05/90	2	8	EC/R&R	Gujarat 2 MP and Mah 3/2	R&R issues (dovetailing the entire R&R program with submergence schedule and preparing early action plans; R&R cost sharing; grievance redressal system; use of 2700 ha of Taloda forest land for R&R in Mah; non conducive atmosphere to successful R&R in MP villages and the need to establish constructive relations with PAPs; role of NCA and a central M&E organization).	<u>Supervision Mission.</u> <u>R&R Mission.</u> The mission noted a sustained overall progress. Both GOI and the state governments took a stronger interest in R&R issues. Most tangible progress continued to be made in Gujarat, including implementing R&R policy. GOMP's field activities were severely constrained and PAPs remained non-cooperative. Main constraint to R&R progress in Maharashtra was non-resolution of "forest land" issue.

S.No.	Stage of Project Cycle	Month/Year	No. of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		05/90	4	4	EN(3)/AgEC	2/2	MIS/Core O&M Units /Hydromet	<u>Engineering Mission.</u> Good physical and financial progress observed. The mission focussed on delay in commissioning of cable cranes and the left bank plant complex; and the need to improve construction methodology on exit tunnels construction.
		11/90 - 12/90	3	5	EN(2)/PROC	2/2	Non-resolution of T/G sets for RBPH/POM /Tunnelling/Hydromet	<u>Supervision Mission.</u> <u>Engineering Mission.</u> Overall high quality and much increased quantity of concrete placement at dam; excavation of key elements of water conductor system in RBPH (draft tube and exit tunnels) still to achieve the required progress. Very good advance made in computer based MIS scheduling and reporting.

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		MP	2	10	R&R/EN	3/2	R&R issues (lack of public and infrastructure facilities in relocation sites; tenuous oustee host relationship; unresolved policy issues related to interstate transfer of PAPs; policy difference on land compensation adjustment; revision of PAPs list in all respects; social problem of women PAPs; Training of staff in R&R etc.)	R&R Mission Overall good progress in Gujarat; indications of improvement in Maharashtra; and implementation constraints in Madhya Pradesh (causing great concern) due to anti-dam and anti-project resistance.
		(1	5	EC-R&R			
		(1	9	R&R			
		Mah	1	5	EC-R&R	3/1		
		(1	4	R&R			
		Guj	1	9	R&R	2		
		<u>04/91 - 07/91</u> 04/91-05/91	5	13	EC-R&R/EN /Ag/R&R(2)	Gujarat 2 Mah 3/1 MP 3/1	Strengthening of R&R organization; improving R&R provisions and land entitlements in MP and Mah for landless/major sons/encroaches; refinement of R&R plans; R&R implementation and monitoring; NGOs	Supervision Mission R&R Mission. Strong R&R performance by Gurarat; stronger support of R&R by GOMP including advising PAPs of their entitlements in MP and preparing a revised 1991-97 outline R&R plan; some progress also made in Mah. However, R&R implementation in MP and Mah continued to face resistance/agitation from PAPs

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		06/91	5	4	En(4)/PROC	2/1	involvement with PAPs; and formation of Land Purchase Committee in MP. RIS of RBPH/Irrigation BY-Pass Tunnel/Funding of T/G sets for RBPH/O&M Training	with R&R staff having limited /no access to many villages. <u>Engineering Mission.</u> Concrete placement on dam exceeded the FY 1990-91 target; record monthly progress achieved in 05/91; speed of tunnelling in RBPH increased; excellent progress on MIS and overall good quality construction.
		06/91 - 07/91	1	5	ECOL	3/1	Problems relating to environment in fulfilling the conditions of legal agreements and clearance stipulations of the MOEF, namely: compensatory afforestation (CAF); catchment treatment (CAT); wild life management; and fisheries, etc.	<u>Environment Review Mission.</u> Overall progress continued in fulfilling the conditions of legal agreements and clearance stipulations of MOEF. Gujarat, Maharashtra and Madhya Pradesh had formulated work plans for compensatory afforestation and catchment treatment with Gujarat and MP having initiated implementation as well. In respect of wild life (ecological) studies, Gujarat and MP were undertaking the required studies; Progress also continued on the

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		11/91 - 12/91	5	12	EC/R&R (2)/EN(2)	Gujarat 2/2 MP & Mah 3/1	R&R policies in MP and Mah; R&R cost sharing; participation of PAPs and constructive NGOs in R&R management, planning and implementation; R&R organization/multi-state agency; R&R planning and progress monitoring; development plans for the reservoir rim area; and developemt of resettlement sites.	studies and work plan on the development of fisheries. Training of staff in the environmental aspects of project execution and implementation was lacking. NCA's role in coordinating and comlementing environmental studies (being conducted by the 3 states)needed to be strengthened. <u>Resettlement and Rehabilitation Mission.</u> The mission while noting continuing signs of progress in R&R implementation, felt very concerned whether the numerous constraints, particularly in MP and Mah, could be overcome in time to enable satisfactory R&R in line with submergence schedule. The mission emphasised that much more was needed to be done on priority basis by all participating states.

S.No.	Stage of Project Cycle	Month/Year	No. of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		01/92	5	5	EN(4)/Health	2/2	T/G sets for RBPH/Irrigation By-pass tunnel/core O&M unit/structural problems in machine hall cavern walls/malaria and water-borne diseases issues.	Engineering & Public Health Mission. Engineering aspects of the Dam & Power continued to make very good progress in physical, financial and quality terms. Dam construction exceeded the targets set by RIS (12/89). The comprehensive MIS helped in keeping track of contractors performance as well as overall project implementation. Non-resolution of funding of T/G sets and non-initiation of construction of irrigation by-pass tunnel continued to cause serious concern. Delay in finalizing the treatment of machine hall cavern walls had held up further excavation and concreting work. The mission stressed the need for an anti-malaria scheme overall for the project.

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
		07/92	5	5	EC/R&R	3	R&R issues: policy improvements; R&R organization and management; redressal of grievances; mechanism for inter-state co-ordinations and verification of R&R; and implementation issues.	<u>Supervision Mission.</u> <u>Resettlement and Rehabilitation Mission.</u> The mission expressed concern about the slow implementation of R&R and opined that under current conditions and policies successful and timely R&R was not likely unless improvements were made in policies and implementation capacity. The mission outlined a set of criteria to link R&R with dam construction and detailed steps constituting an action program for ensuring effective and timely R&R of PAPs by the 3 states.
		07/92	3 1 1	5 5 5	EN(3) Health ECOL	2/2	T/G sets for RBPH/ Irrigation By-Pass Tunnel/Persistent difference of opinion between DSP and CWC/Treatment of RBPH machine hall cavern walls/ Environmental work plan/strengthening of NCA&NPG/Wild Life issues/Health Management plan/	<u>Engineering and Environmental Mission.</u> <u>Engineering.</u> Construction of dam was proceeding on schedule and of high construction standards. Underground works of RBPH also progressed well, except for the machine hall cavern where the fissures in the rock walls hampered further excavation and concreting.

S.No.	Stage of Project Cycle	Month/Year	No.of Persons	Days in Field	Specialization Represented 1/	Performance Rating (Overall)	Type of Problems	Comments
							Health Planning and Monitoring as well as Training.	<p>Environmental Inter-state coordination on environmental matters continued to remain weak; no comprehensive environment management plan prepared to date; integration of environment concerns in project designs and implementation was minimal.</p> <p>Public Health. The mission noted an intensified malaria control campaign, by GOG, at SSP dam site and 19 villages in its vicinity; and GOG's commitment to implement Bank missions recommendations on health aspects.</p>

Notes:

Abbreviations as used:

Specializations represented 1/

EN - Engineers; EC - Economist; AG - Agriculturist; PROC - Procurement Specialist; FIN - Financial Analyst; AG.EC - Agriculture Economist; SOC - Sociologist; R&R - Resettlement & Rehabilitation Specialist; FSP - Forestry Specialist; EG - Engineering Geologist; LEG - Legal Specialist; MISP - Management Information Specialist; ECOL - Ecologist.

Performance Ratings:

1st indicator; 1- minor problems; 2- moderate problems; 3- major problems;
2nd indicator; 1- improving; 2- static; 3-deteriorating.

Types of Problems:

M- Management Problems; F-Financial; OR-Organisational; T-Technical (Engineering); LEG-Legal Covenants;
PR-Procurement; Q-Quality Control; POM-Plan of Operation & Maintenance; G-Geological; CM-Construction Management;
MIS-Management Information System; ENVN-Environmental; HYDROMET-Hydrometeorological Network;
MOU-Memorandum of Understanding between Bank, GOI, GOMP, GUJ and GOM, EQP - Construction Equipment; CAT - Catchment Area Treatment; CAF - Compensatory Afforestation; MOU - Memorandum of Understanding between Bank and GOI.

INDIA

NARMADA (GUJARAT) SARDAR SAROVAR DAM AND POWER PROJECT
(Cr.1552-IN/Ln.2497-IN)

Staff Inputs (SWS)

Stage of Project Cycle	FY82	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93	Total
Identification/ Preparation	142.6	176.2	5.9										324.7
Appraisal			116.5	37.4									153.9
Negotiations				24.9									24.9
Supervision				7.4	68.3	44.9	45	41.2	43.9	45.6	30	121.5	447.8
PCR												2.8	2.8
Total	142.6	176.2	122.4	69.7	68.3	44.9	45	41.2	43.9	45.6	30	124.3	954.1

Table 14
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INDIA
SARDAR SAROVAR DAM AND POWER COMPLEX
Salient Technical Features

<u>Facility/Feature</u>	<u>Description and Magnitude as per SAR</u>	<u>As per PCR</u>
1. <u>Sardar Sarovar Dam</u>		
(a) Location	Narmada River near Navagam village (21° 50` N Lat x 73° 45` E Long)	Narmada River near Navagam village (21° 50` N Lat x 73° 45` E Long)
(b) Type	Concrete gravity	Concrete gravity
(c) Volume (Total)	6.000 Mm3	6.820 Mm3
Mass concrete	5.500 Mm3	5.370 Mm3 a/
Structural concrete	0.500 Mm3	1.450 Mm3
(d) Top of dam	146.50 m	146.50 m
Elevation	1210.00 m	1210.02 m
Length	9.14 m	9.14 m
Width (top)		
(e) Freeboard	6.29 m	6.29 m
(f) Height of dam	128.50 m (from top of fault plug) 157.50 m (from bottom of fault excavation)	130.0 m 163.0 m
2. <u>Spillway</u>		
(a) Type	Ogee crest(s)	Ogee crest(s)
(1) Service spillway with sloping apron stilling basin	23 -18.3 x 16.7 m Radial gates	23 -18.3 x 16.7 m Radial gates
(2) Auxiliary (& emergency) with chute/flip-bucket	7 - 18.3 x 18.3 m Radial gates	7 - 18.3 x 18.3 m Radial gates
(b) Crest length		
(1) Service spillway	524.3 m	525.69 m
(2) Auxiliary	161.0 m	158.53 m
(3) Total crest	685.3 m	684.22 m b/

a/ Concrete quantity for dam is 5.370 Mm3 and that for spillway and training walls is 1.45 Mm3.

b/ Clear waterway at crest = 549.0 m.

Table 14
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<u>Facility/Feature</u>	<u>Description and Magnitude as per SAR</u>	<u>As per PCR</u>
(c) Crest elevation	121.92 m	121.92 m
(d) Capacity		
(1) Service design (1000-yr. flood)	87,000 cumecs	84,950 cumecs
(2) Service and auxiliary (P.M.F. 1/ without overtopping dam)	171,000 cumecs	169,923 cumecs
3. <u>Outlet Works</u>		
(a) Irrigation bypass tunnel	(Intake located 350 m upstream on right reservoir rim)	Intake location is about 100 m upstream of Main Dam Axis.
(1) Invert elevation (reservoir side)	86.9 m	88.39 2/
(2) Diameter (twin tunnels)	6.4 m	5.5 m
(b) Construction sluices (Temporary)		
(1) Set no.1 (invert elevation 18.0 M)		
- Description	10 - 2.75 x 2.15 m Rectangular boxes	10 - 2.74 x 2.10 m Rectangular boxes
(2) Set no.2 (invert elevation 35.0 m)		
- Description	8 - 2.75 x 2.15 m Rectangular boxes	Set no.2 has been deleted
(c) Emergency outlets		
- Invert elevation	60.0 m	53.0 m
- Description	4 - 3.05 x 2.74 m Rectangular boxes	4 - 4.00 x 2.50 m
	300 cumecs	231.5 cumecs per sluice 3/
- Discharge (FRL)		

1/ Probable maximum flood.

2/ The sub-committee constituted by NCA recommended the invert level of IBPT as 88.39 m, but GOMP has not agreed to that.

3/ Though designed to operate under FRL condition, the sluices are to be operated only when the reservoir level is at El 128.0 m or below.

Table 14
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<u>Facility/Feature</u>	<u>Description and Magnitude as per SAR</u>	<u>As per PCR</u>
4. <u>Riverbed Powerhouse</u>	Underground (23x58x211 m machine hall)	23x58x212 m
(a) Location/Description	Cavern/right abutment	Cavern/right abutment
(b) Type units	Reversible turbine-generators	Reversible turbine-generators
(c) Unit capacities	6 x 200 MW Units	6 x 200 MW Units
(d) Total plant capacity	1200 MW	1200 MW
(e) Penstocks		
- Invert elevation	97.5 m	93.69 m
- Diameter (6 each)	7.62 m	7.61 m
- Combined discharge (max.)	1000 cumecs	227.50 cumecs from one unit at the design head.
5. <u>Canalhead Powerhouse</u>		
(a) Location/Description	Right rim of reservoir 800 m upstream of main dam axis/surface powerhouse (32 x 141 m) - intakes formed by Vadgam Saddle Dam.	Right rim of reservoir 800 m upstream of main dam axis/surface powerhouse (32 x 145 m) - intakes formed by Vadgam Saddle Dam
(b) Type units	Conventional turbine-generators (Kaplan)	Conventional turbine-generators (Kaplan)
(c) Unit capacities (5)	50 MW	50 MW
(d) Total plant capacity	250 MW	250 MW
(e) Penstocks (5)		
- Invert elevation	90.0 m	98.128 m
- Diameter (each)	6.7 m	6.7 m
6. <u>Reservoir</u>		
(a) Hydrology		
- Total catchment	89,000 sq.km.	88,000 sq.km.
- Average annual rainfall	1,214 mm	1120 mm
- Maximum annual rainfall	1,270 mm	1270 mm

Table 14
(Page 4 of 6)

<u>Facility/Feature</u>	<u>Description and Magnitude as per SAR</u>	<u>As per PCR</u>
- Minimum annual rainfall	760 mm	760 mm
- Runoff at 50% dependability	45,000 Mm3	40,952 Mm3
- Runoff at 75% dependability	35,200 Mm3	33,576 Mm3
- Runoff at 90% dependability	26,500 Mm3	24,386 Mm3
- Spillway design flood (1000-year)		
Peak discharge (inflow)	101,700 cumecs	101,700 cumecs
Peak discharge (outflow)	87,300 cumecs	87,300 cumecs
Flood volume (inflow)	16,410 Mm3	16,410 Mm3
Max. water surface (routed)	139.7 m	139.7 m
- Probable maximum flood		
Peak discharge (inflow)	171,000 cumecs	169,923 cumecs
Peak discharge (outflow)	132,000 cumecs	141,190 cumecs
Flood volume (inflow)	33,600 Mm3	27,702 Mm3
Max. water surface (routed)	144.3 m	145.90 m
(b) Storage		
- Maximum water level (MWL)	140.2 m	140.21 m
- Full reservoir level (FRL)	138.7 m	138.68 m
- Minimum drawdown level (MDDL)		
Power operation	110.6 m	110.64 m
Irrigation operation	93.6 m	97.54 m*
- Gross storage (FRL)	9,500 Mm3	9,500 Mm3
- Dead storage (MDDL)		
Power (MDDL 110.6 m)	3,700 Mm3	3,700 Mm3
Irrigation (MDDL 93.6 m)	2,100 Mm3	*
- Live storage (FRL)		
Power (MDDL 110.6 m)	5,800 Mm3	5,800 Mm3
Irrigation (MDDL 93.6 m)	7,400 Mm3	*
(c) Submergence data (FRL)		
- Forest land	6,273 ha	13,542 ha
- Cultivable land	12,141 ha	9,994 ha
- Other land	<u>18,616 ha</u>	14,054 ha
Total	37,030 ha	37,590 ha

* GOMP has not yet agreed to the NCA's suggestion of bringing down the reservoir below MDDL (110.64 m) to 97.54 m for irrigation diversions through IBPT. Normal irrig. diversions would be through CHPH and the reservoir is not likely to be lowered below MDDL (110.64 m).

** Population affected is 127,446 (as per latest information in March 1993).

Table 14
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<u>Facility/Feature</u>	<u>Description and Magnitude as per SAR</u>		<u>As per PCR</u>	
- Affected villages & population	Villages	Families	Villages	Families
. Madhya Pradesh	180	7,500	193	33,014
. Maharashtra	36	1,358	33	2,731
. Gujarat	19	1,900	19	4,500
Totals:	235	10,758	245	40,245**

7. Garudeshwar Weir
(pumpback storage)

(a) Location	18 km below main dam axis	12 km below main dam axis
(b) Maximum water level (MWL)	30.0 m	30.0 m
(c) Maximum live capacity at MWL	26 Mm3	26 Mm3
(d) Minimum tailwater for pump/ storage operation	25.9 m	25.9 m

8. Vadgam Saddle Dam 1/

(a) Location	Right rim of main reservoir 800m upstream from main dam axis near Vadgam village.	Right rim of main reservoir 800m upstream from main dam axis near Vadgam village.
(b) Type of structure	Stone masonry dam	Concrete dam
(c) Dam height	60 m	60 m

9. Canalhead Reservoirs and Dams

(a) Dams		
(1) Type	Earth and rockfill with core and filter zones and cutoffs to bedrock	Earth and rockfill with core & filter zones and cut-offs to bed rock.
(2) Total embankment volume (4 dams)	5.4 Mm3	6.89 Mm3
(3) Maximum height (dam no.3)	54.6 m	56.0 m (dam no.1)

1/ Facilitates structural support for CHPH intakes and penstock arrangements.

<u>Facility/Feature</u>	<u>Description and Magnitude as per SAR</u>	<u>As per PCR</u>
(b) Interlink channels		
Overall side slopes	0.5 H to 1.0 V	0.5 H to 1.0 V
Maximum depth of cut	100 m	100 m
Design discharge	1,133 cumecs	1,133 cumecs
(c) Storage		
Maximum reservoir (pond) level 95.1 m		95.1 m/99.1 m (FSL/MWL)
Minimum reservoir (pond) level 92.1 m		92.10 m
Active storage (EL 95.1 to 92.1) 13.0 Mm ³		13.0 Mm ³
Gross storage (EL 95.1) 63.3 Mm ³		63.39 Mm ³
(d) Submergence (EL 95.1)	773 ha	773 ha

