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IMPLEMENTATION COMPLETION REPORT
(IDA-27740 TF-28729)

ON A

CREDIT

IN THE AMOUNT OF XDR 90.1 MILLION
US$ 142 MILLION EQUIVALENT)

TO THE

REPUBLIC OF INDIA

FOR A

HYDROLOGY PROJECT

May 12, 2004

Rural Development Sector Unit
South Asia Regional Office

CURRENCY EQUIVALENTS

(Exchange Rate Effective)

Currency Unit = INR
Rs. 34.7 = US$ (Effective 1998)
US$ 1 = Rs. 45.51 (Effective 2003)

FISCAL YEAR
April 1 March 31

ABBREVIATIONS AND ACRONYMS

AQC	Analytic Quality Control	HLTG	High Level Technical Group
ARG	Autographic Rain Gauge	HP	Hydrology Project
AP	Andhra Pradesh	HYMOS	Hydrological Modeling System (software)
AQC	Analytic Quality Control	HLTG	High Level Technical Group
ARG	Autographic Rain Gauge	HP	Hydrology Project
AP	Andhra Pradesh	HYMOS	Hydrological Modeling System (software)
Ch	Chattisgarh	IA	Implementing Agency
CPCB	Central Pollution Control Board	IMD	India Meteorological Department
CGWB	Central Ground Water Board	Kar	Karnataka
CWC	Central Water Commission	Ke	Kerala
CWPRS	Central Water and Power Research Station	MP	Madhya Pradesh
DPC	Data Processing Center	Mah	Maharashtra
DSC	Data Storage Center	MOWR	Ministry of Water Resources
DWLR	Digital Water Level Recorder	NIH	National Institute of Hydrology
FCS	Full Climatic Station	NCC	National Coordination Committee
GEC	Groundwater Estimation Committee	NLSC	National Level Steering Committee
GEMS	Groundwater and Environment Management System (software)	NWA	National Water Academy
GIS	Geographic Information System	Or	Orissa
GOI	Government of India	PCS	Project Coordination Secretariat
GON	Government of Netherlands	SAR	Staff Appraisal Report
Guj	Gujarat	SLCC	State Level Coordination Committee
GW	Groundwater	SRG	Standard Rain Gauge
GWDES	Groundwater Data Entry System	SW	Surface Water
GWDES_WQ	Groundwater Data Entry System for Water Quality	SWDES	Surface Water Data Entry System
HDUG	Hydrological Data User Group	SWQAA	State Water Quality Assessment Authority
HIDAP	Hydrologic Institutional Development Action Plan	TA	Technical Assistance
HIDR	Hydrologic Institutional Development Review	TN	Tamil Nadu
HIN	Hydrological Information Needs	WISDOM	Water Information System and Data Online Management (software)
HIS	Hydrological Information System	WQ	Water Quality

Vice President:	Praful C. Patel
Country Director	Michael F. Carter
Sector Manager	Constance A. Bernard
Task Team Leader/Task Manager:	E.V. Jagannathan

INDIA
HYDROLOGY PROJECT

CONTENTS

Project ID: P010485	*Project Name:* HYDROLOGY PROJECT
Team Leader: E. V. Jagannathan	*TL Unit:* SASRD
ICR Type: Core ICR	*Report Date: May 12, 2004*

1. Project Data

Name: HYDROLOGY PROJECT
L/C/TF Number: IDA-27740; TF-28729
Country/Department: INDIA
Region: South Asia Regional Office

Sector/subsector: Central government administration (48%); Sub-national government administration (48%); Flood protection (4%)
Theme: Water resource management (P); Environmental policies and institutions (P); Pollution management and environmental health (P)

KEY DATES		*Original*	*Revised/Actual*
PCD:	05/27/1993	*Effective:* 12/20/1995	12/20/1995
Appraisal:	10/05/1994	*MTR:* 01/08/1999	01/08/1999
Approval:	08/22/1995	*Closing:* 03/31/2002	12/31/2003

Borrower/Implementing Agency: Government of INDIA/MOWR-CWC, CWB, CWPRS, NIH IMD and State agencies for surface and groundwater in Andhra Pradesh, Chattisgarh, Gujarat, Karnataka, Maharashtra. Madhya Pradesh, Orissa and Tamil Nadu./Ministry of Water Resources
Other Partners: Government of The Netherlands

STAFF	Current	At Appraisal
Vice President:	Praful C. Patel	Joseph Wood
Country Director:	Michael F. Carter	Heinz Vagen
Sector Manager:	Gajanand Pathmanathan	Shawki Barghouti
Team Leader at ICR:	E.V. Jagannathan	J. Cunningham
ICR Primary Author:	M. Fitzpatrick; E. Lemaitre; Thiruvengadachari; Rajagopalan (FAO/CP)	

2. Principal Performance Ratings

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HL=Highly Likely, L=Likely, UN=Unlikely, HUN=Highly Unlikely, HU=Highly Unsatisfactory, H=High, SU=Substantial, M=Modest, N=Negligible)

Outcome: S
Sustainability: L
Institutional Development Impact: SU
Bank Performance: HS
Borrower Performance: S

	QAG (if available)	ICR
Quality at Entry:		S
Project at Risk at Any Time:	Yes	

3. Assessment of Development Objective and Design, and of Quality at Entry

3.1 Original Objective:

3.1.1 The main objectives of the Hydrology Project (HP) were to: (a) improve organizational arrangements for hydrological, hydro-meteorological and water quality data measurement, validation, analysis and storage; (b) strengthen institutional and technical capabilities; (c) improve physical facilities and services for hydrological, hydro-meteorological and water quality data measurement, validation and analysis; and (d) improve the use of hydrological, hydro-meteorological and water quality data.

3.1.2 These objectives reflected Government priorities in the sector and were in line with the Bank's Country Assistance Strategy. They were consistent with the government strategy to evolve towards water allocation criteria based on reliable hydrological analyses using sufficient and adequate data. They also reflected the Bank's policies on water resources management and its strategies for the country's water sector, with the development of a free-standing project focusing on the institutionalization of hydrological data.

3.2 Revised Objective:

The original objectives remained unchanged during implementation of the project, although shortly after the original appraisal (July 1995), agreement was reached with the Government of the Netherlands to grant-finance consulting services and overseas training. Karnataka state was also included under the Bank loan, thus extending the project to full coverage of the river basins of peninsular India. Following the 1999 Mid-Term Review (MTR), internal adjustments were made to component activities to reflect evolving experience and requirements, without modifying the project's objectives.

3.3 Original Components:

The choice of components and their design was in line with the project's objectives as described above. The overall project design correctly recognized the complexity of the institutional and managerial implications of a project involving so many Implementing Agencies (IAs) at central and state levels, and deliberately planned for some degree of flexibility within a broad, two-phase implementation framework. The process approach was generally well-adopted and adjustments to the project's physical and financial targets were relatively easily determined and implemented. However, this approach did require changes in management culture–particularly related to annual planning–and the design specifically included the development and application of planning/monitoring tools to complement and contribute to the normal, regular budgetary planning process of the government departments concerned. Also, while the Staff Appraisal Report (SAR) indicated that data collection and data use institutions should be separated, in hindsight this may have been somewhat unrealistic, and even undesirable, given the Indian context. The design could also have benefited from the inclusion, in the project activities, of data-related, value-addition studies (see below at para. 8). Overall, the project design is rated as satisfactory.

3.4 Revised Components:

Following the MTR, some adjustments were made to the project to take account of initial administrative delays in implementation, local currency devaluation, falls in unit costs for information technology (IT) hardware, and increased training provisions. These adjustments, while resulting in a cancellation of SDR 15 million from the Credit, did not materially affect the components and reflected more a reallocation among the disbursement categories to include an intensification of the hydrological networks.

3.5 Quality at Entry:

No quality assessment of project design was made at entry although the SAR was subject to internal peer review covering environment, irrigation and water resources, hydrology, informatics and institutional

aspects before endorsement. The project objectives and setting, including the process approach, were appropriate at the project design stage and the SAR, considering the large number of IAs, was well developed. However, in the SAR and subsequent project documentation, there was a certain lack of consistency in the presentation of the project by components and sub-components and, to a lesser extent, by detailed categories of expenditure (e.g. in the cost tables, the agencies are assigned as components and sub-components appear to be of diverse importance). As a result, monitoring of project costs appears to have focused more on implementing agencies and categories of expenditure, without monitoring costs by components. In addition, little attention was given to project outcomes and associated monitoring indicators (including data use); this was not, however, a Bank requirement at the time the project was prepared. Overall, at implementation completion report (ICR), the quality of project design is rated satisfactory.

4. Achievement of Objective and Outputs

4.1 Outcome/achievement of objective:

4.1.1 **Improve organizational arrangements for hydrological, hydro-meteorological and water quality data measurement, validation, analysis and storage**: Based on the progress made in the project, the achievement of this objective is rated as satisfactory. The project at closure has established a paradigm shift in arrangements for data collection, validation and storage, resulting in the development of a national hydrological measurement network with standardized hydrological data collection and processing, and the design and implementation of valid, comprehensive, interactive, easily-accessed and user-friendly databases covering all important aspects of the hydrological cycle. The organizational arrangements for achieving this objective have involved the constitution of a number of formal structures, generally in the form of standing committees, the delineation of their roles and their empowerment through appropriate orders, and monitoring and co-ordination of performance through a Project Co-ordination Secretariat (PCS), all formed during the implementation period. Five committees at the central government level (National Level Steering Committee (NLSC), National Coordination Committee (NCC), High-Level Technical Group (HLTG), Committee each on Training and R&D) and generally two committees at the state IA level were formed (State Level Coordination Committee (SLCC) and procurement committee). Through these standing committees' coordination and supporting arrangements, modifications to the existing protocol and practices and revised organizational arrangements were introduced to the existing hydrology institutions. These include the development of standardized procedures, protocols and specifications for data collection, collation, analysis at different levels of agencies' hierarchy and storage, and the introduction of a mechanism for inter- and intra-agency data validation. A common monitoring format, for data exchange, management information system (MIS) I and MIS II, for process monitoring were developed and the reports generated were intended to provide actionable measures for follow-up by the IAs. Even with common procedures and protocols, it is noticeable that IAs led by championing managers have changed their culture and performed better.

4.1.2 While these arrangements have largely helped in achieving the project's first objective, the committees have generally not been fully successful in orchestrating collateral decisions in departments outside the hydrology project, and the PCS had not been fully effective in driving these committees towards this end. The result has been delays in procurement, in placing suitable staff, and in training due to state governments' imposed restrictions on recruitment, staff transfers and travel, and sometimes purchases.

4.1.3 Overall, the organizational arrangements have succeeded in delivering a functioning hydrometric system, and the achievement of this objective can be rated as satisfactory. However, it could have been achieved earlier with more proactive coordination.

4.1.4 **Strengthen institutional and technical capabilities**: Based on the evident progress and solid achievements made, this development objective has been achieved satisfactorily. To meet this objective, the project financed: (i) technical assistance for planning and designing common procedures and training curricula, and assisting with procurement and over-all implementation; (ii) incremental staff; (iii) staff training; and (iv) adequate infrastructure in the form of buildings, vehicles, equipment, and IT hardware and software. As a result, institutions have been strengthened and the project has created an attitudinal change and increased levels of commitment among data collection and processing staff, who have now developed a visible stake as important elements in the improved Hydrological Information System (HIS). The central government and state government departments dealing with hydrological data collection have collaborated closely to rationalize their networks and to share data, and while this has yet to be fully achieved it represents a noticeable improvement on pre-HP conditions. Agreed technical procedures for installing and operating a range of hydrological and hydro-meteorological instruments, and collecting and processing derived data, are embodied in a comprehensive set of manuals produced by the consultants in consultation with the end users. These manuals have been distributed widely and have received considerable appreciation. All concerned users are now using components of a generally-accepted and accessible HIS, which generally enjoys wide management support in the states and appears to have contributed to the development of state water policies. A large number of incremental staff has been positioned, mostly through redeployment, and all staff has been trained through extensive training programs, including a training-of-trainers approach. State-level and national help desks have also been introduced to support HIS users in regard to software and measuring instruments. A large measure of success was achieved through the Technical Assistance (TA) with respect to supporting these institutional strengthening measures.

4.1.5 However, in spite of the evident progress and solid achievements made, there do remain some areas of concern. These include: a general lack of formal, rigorous quality assurance at all levels, and third party independent audits; inadequate annual and long-term planning for HIS within the state agencies; incomplete deployment of HIS components, seriously affecting the flow of information; a generally inadequate system of technical support for all levels of staff involved; the need for more radical changes in institutional practices; a need for further education and advanced training to increase understanding and appreciation of HIS-based products (hydrology), even though adequate training has been provided to carry out the basic activities involved in HIS; and the need for agencies to network with other organizations outside the hydrology domain who can play a complementary role.

4.1.6 **Improve physical facilities and services for hydrological, hydro-meteorological and water quality data measurement, validation and analysis:** Overall, in view of the physical facilities already established and operational and the general level of hydrology services created, the achievement of the development objective is rated as satisfactory. At project closure, rational networks for hydro-meteorological data and surface water (SW) and groundwater (GW) data collection, including water quality (WQ), have been designed and implemented. Measuring instruments for data collection have been procured and are in use. A water quality monitoring network of sampling sites, laboratories with state-of-art equipment and standard sample collection and analytical procedures covering a wider spectrum of parameters in the SW and GW domains has been introduced for the first time in many agencies. Hydrological information is now being collected systematically and processed and archived in data banks in a standardized manner, and is accessible to different users. Valuable historic data has been computerized for the first time in all agencies and partly validated. Improved communication systems between HIS stakeholders have been established and are functioning. The increasing extension of HP systems and practices to non-HP locations at both central (e.g.. Central Groundwater Board) and state levels (e.g., Madhya Pradesh) indicates some mainstreaming and endorsement within the agencies.

4.1.7 However, the shortfall and long term sustainability of SW observers in a few agencies is of concern as it could affect basic data collection; additionally, the significant shortfall in IT and WQ specialists in some agencies may impact data storage functions and sustained WQ data generation. Also, a large number (20%) of Digital Water Level Recorders (DWLR) of one brand in four agencies (Gujarat, Maharashtra, Tamil Nadu and Central Groundwater Board) have been non-functional; although local solutions have been identified to address some of the technical shortcomings, including short interval manual observations. However, the shortfall risks impacting the collection of high frequency GW level observations, particularly needed for aquifer characterization. Other concerns relate to the delays in full implementation of the dedicated GW data processing and analysis software, Groundwater and Environment Management System (GEMS), and the dedicated database and data storage software, Water Information System and Data Online Management (WISDOM). A seamless link between the data processing software in SW and GW domains and the data storage software remains to be ensured.

4.1.8 **Improve the use of data:** Even with the delays in HIS in the project period, and the limited time for improving data dissemination and stimulating demand both within and outside concerned government agencies, this development objective is rated as satisfactory based on the achievement of the agencies. All agencies have established Hydrology Data User Groups (HDUG) through formal government orders to ensure that the HIS is demand-driven and sustainable. Membership is generally broad-based and has evolved during implementation to include non-governmental users (private and NGOs) in addition to governmental, semi-governmental and academic institutions. At project closure, most states have used the HDUG forum to create awareness of HIS data while Maharashtra has completed a Hydrological Information Needs (HIN) assessment and conducted user satisfaction surveys. In some states (eg. Tamil Nadu, Maharashtra.), mass awareness campaigns at village level, mostly related to GW and WQ, have raised the profile of HIS. Most agencies have undertaken steps to promote awareness of the HIS data among users through a range of media, including newsletters, year-books, national-to-village level campaigns, issue-based pamphlets and brochures in local languages, mass media, workshops, seminars, exhibitions and web sites. HIS data is currently generally accessible to the user community, except in situations where data is considered sensitive and higher-level authorization is required (particularly SW data). National guidelines on pricing of data have been approved and most agencies apply these. Data catalogues, data search results and request letters facilitate access to data archives, and data is supplied to users in hard or soft (electronic) form by most agencies. Data is supplied to governmental and non-governmental users to support rational water management decisions and, in some states, the use of HIS data has been made mandatory in the concerned planning and design departments. Most of the agencies are also monitoring data requests which can be used to characterize patterns of data use; WQ and GW data has been relatively more community-based than SW data, and WQ monitoring for point industrial pollution has been more widespread than for such non-point pollution as pesticides.

4.1.9 Use of HIS data in the IAs is accelerating with some states reporting policy and administrative actions (supporting the GW regulatory authority in Maharashtra, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu; developing a comprehensive GW bill in Tamil Nadu; developing the proposed Maharashtra. Water Planning and Regulation Authority), as well as technical inputs (drought monitoring and drought proofing in Andhra Pradesh; planning lower Kolar, Parwathi and Kalisindh dams in Madhya Pradesh; river-flow diversion studies in Mahadayi river between Goa and Karnataka; revising river-basin master plan in Madhya Pradesh; action against industrial polluters in Karnataka, Tamil Nadu, Kerala and other states; and identifying high fluoride and nitrate affected areas in many states), and investments (HIS triggering the ambitious "*Neeru-Meeru*" program: Rs. 20 billion with a direct investment of Rs. 80 millions for additional DWLRs at each micro-basin).

4.1.10 However, while data dissemination and use is clearly increasing, it is noted that the planning and design units in many SW agencies are yet to routinely use HIS data for improved hydrologic planning, design and long-term water resource management. Policy and administrative actions and investments directly resulting from an appreciation and use of HIS data remain opportunistic. HDUG meetings have mostly been conducted as a means of informing potential users about HIS rather than exploring, in a dynamic and participatory manner, feedback for improved HIS management. In addition, the meetings have generally been held at state capital level, perhaps limiting levels of user participation, and have usually been chaired by the Secretary of the state department, which has also adversely affected the frequency and regularity of the meetings. Few of the SW agencies have conducted awareness-raising campaigns which could contribute to lowering the emotive content in water disputes at local to state levels. In spite of the suggestions made by several Bank supervision missions, there is an absence of studies examining the value-addition from the use of HIS, and this limits critical benefit analysis and explicit delineation of data value. Focused marketing efforts are required for large-scale use of HIS data through targeted user campaigns, regional and thematic HDUGs, formal linkages with national and state entities including planning and regulatory authorities and programs, and customized data offerings for user segments.

4.2 Outputs by components:

4.2.1 Overall the project achieved the outputs satisfactorily in all its components albeit with some delays during the first half of the project period due to the reasons discussed in sections 5.1, 5.2 and 5.3 below. This was made up by extending the project to December 31, 2003 to operationalize specialized software and hydrometry equipment.

4.2.2 **Upgrading hydrology and data management facilities (US$92 million SAR, US$77 million latest estimate):** Overall, the output achievements of this component is considered to be satisfactory. A total of 916 river gauge stations, 7912 observation wells and 436 hydro-meteorological stations have been set up. GW networks are now providing observations that are representative in space as well as geologic formations, penetrate deeper aquifers, and monitor water level fluctuations at higher frequency. With the installation of DWLRs at more than 97% of targeted wells aquifer characterization has become possible for the first time. The collection and processing of WQ data, has now been substantially strengthened with the creation of a significant increase in analytical capacity (up to some 56 parameters, covering bacterial, physical and chemical pollutants - including heavy metals and pesticides). Central Pollution Control Board has accredited one HP laboratory as a national water testing facility and WQ data is also supporting regulatory action at community-level (eg. Karnataka, Tamil Nadu and Kerala), state-level through the State Water Quality Assurance Authority (SWQAA)s and, at national level, through the Water Quality Assurance Authority (WQAA).

4.2.3 The dedicated hydrological data entry and processing software (Surface Water Data Entry System (SWDES), Groundwater Data Entry Software (GWDES)) and data processing software (HYMOS and GEMS) have been deployed at 390 data centers and data storage software (WISDOM) at 28 data storage centers among all agencies to ensure standardization and data transfer. Current data is regularly entered, processed and archived. Valuable historic data has been computerized for the first time in many agencies, and primary validated. Geographic Information System (GIS) data sets of selected core themes with standard coding schemes were included at the MTR stage to support spatial analysis of HIS data. Communication systems have been formalized and are functioning between all state levels concerned with data collection, processing and storage, between national and state data storage centers, and between data storage centers and data users.

4.2.4 While the non-functional DWLRs are likely to affect the collection of high frequency GW observations, this is not expected to have a significant overall impact on the GW data within the HIS. GWDES is largely able to satisfy GW agencies' requirements and data dissemination is carried out with existing software. At project closure, SWDES, GWDES and Hydrologic Modeling System (HYMOS) are in full use, although GEMS and WISDOM are not fully operational and training assistance in these two software will be particularly required.

4.2.5 **Institutional Strengthening (US$72 million at SAR; US$59 million latest estimate)** Overall, the output achievement of this component is rated as satisfactory. The project has achieved considerable measure of success in the design and development of the HIS and the TA support was particularly important for the development of standardized HIS manuals and protocols for data entry, validation and storage. These also include protocols for WQ analyses and AQC exercises. Central Water Commission and Central Groundwater Board have extended the HIS software and practices for use in non-HP states, and several state IAs are adopting these practices for other programs in the state. Such mainstreaming of project practices within the IAs bodes well for sustainability after project closure. National and state helpdesks are providing support for software and measuring instruments. National guidelines on data pricing have been approved and most IAs are already following these. The training programs have been another major success and all agencies have exceeded their original SAR targets. Emphasis was also placed on Training-of-trainers and the IAs' training needs after project completion appear likely to be met, with finalized training calendars for the coming financial year included in their post project operation plans. The national R&D Evaluation Committee approved 11 R&D studies undertaken, often jointly, by National Institute of Hydrology, Central Water and Power Research Station and agencies at central and state levels. These made use of HIS data for such topics as impact on GW of rainwater harvesting and watershed management, location of artificial recharge structures, seawater intrusion, etc. Four reservoir sedimentation surveys have been undertaken using advanced bathymetric equipment, Some states (eg. Gujarat) have compared the results of such surveys with those using remote sensing techniques and recommended remote sensing use as a complementary survey technique. Overall, institutional support has helped the IAs to acquire some brand equity, to increase their visibility and improve their profile. This has led to an influencing of water-related policy decisions, with a number of states enacting bills, declaring water policies and generally moving into a regulatory regime. The National Planning Commission has also recognized the need for a quality data base and R&D studies and, in the Tenth Five-Year Plan, this need has been specifically articulated in the chapter on Irrigation, Flood Control and Command Area Development.

4.2.6 The provision for envisioning, strategizing and planning the HIS through such mechanisms as Hydrologic Institutional Development Review (HIDR) and Hydrological Institutional Development Action Plan (HIDAP), could be responded fully only by very few states (e.g. Maharashtra. and Karnataka). HIDAP was introduced to all agencies but remained generally unappreciated as it did not fit easily into their organizational culture. IA staff generally viewed such tools as cumbersome, statistics-driven and not helpful. MIS I and MIS II were intended to replace HIDAP, but in practice they have evolved into more of a means for reporting performance rather than for planning future activities. There is an urgent need to develop an acceptable planning tool to sustain HIS.

4.2.7 Due to a general ban on new recruitment, incremental staff provided by the project was, in most cases, provided through redeployment. However, the shortage of WQ specialists was not able to be addressed through such a mechanism and this will affect WQ data. Another weakness has been the lack of effective inter-agency validation, particularly for river gauge data, though some progress is reported by state agencies in hydro-meteorology and GW data exchange with India Meteorological Department and Central Groundwater Board, respectively. All these measures will help to create a platform for interaction

and confidence building. With regard to WQ, three rounds of Analytical Quality Control (AQC) exercises between the agencies have been completed and areas for improvement have been identified, including compliance with established procedures. A final matter of concern is that the R&D studies did not appear to respond to a coherent R&D agenda and were insufficiently replicated at different locations, thus limiting their use in operational applications. The design of the R&D program should have identified broad R&D thrust areas, and conducted a nationally-coordinated research program within each thrust area. This would have helped to complement and supplement the strengths of participating agencies. Furthermore, such studies should involve academic institutions to collaborate with HP agencies.

4.2.8 Overall, the project has performed satisfactorily though in view of participation of a large number of agencies the achievement across the agencies has been rather uneven. The major cause being the administrative, organizational and work environment in which the IAs carry out their tasks. In general, since HP activities were more closely aligned to the existing functions of the GW agencies, these appear to have benefited more strongly from the institutional strengthening activities. The major constraints faced by HP IAs included: (a) an inability to recruit specialized incremental staff and having to use redeployed staff; (b) frequent transfers of personnel at top management and at operational levels (latter more pronounced in the SW agencies); (c) resistance to HIDAP and cultural change workshops; and (d) delays in procurement of equipment, software packages and in construction of buildings in the initial stages of the project. However, across all IAs, awareness has been created, decision-makers have been sensitized to the needs and capacities of HIS, pride has been developed among operators and standard processes and protocols for hydrology data gathering, validation, archiving and dissemination have been created.

4.3 Net Present Value/Economic rate of return:

Not applicable since no economic analysis was presented in the SAR as it was considered, correctly, that the quantification of overall benefits would not be feasible given the project's focus on hydrological data and the impossibility of estimating the global value of both the country's historic data and the additional information generated by the HIS. However, limited and well-focused case studies could be undertaken, as described at para. 8.

4.4 Financial rate of return:

Not applicable.

4.5 Institutional development impact:

The impact of institutional development can be assessed at four levels: (a) impact within the project execution agency; (b) impact on the Government; (c) impact on the HIS users; and (d) impact on the general citizen. The institutional development activities had a very high impact in the IAs. Champions were created, new work protocols were institutionalized and, in general, scientific attitudes in relation to gathering, analysis and use of data were developed. This instilled a sense of pride, achievement and ownership among the project IAs. While the magnitude of this impact varied among the IAs, in general the project achieved its goal. Similarly, in states such as Tamil Nadu, Karnataka and Andhra Pradesh, a good deal was achieved in terms of impact on the general public thorough mass contact programmes, *jal utsavs* and the media. The project did not, however, have adequate impact within the government and among more professional hydrological data users. Champions within the government system, outside the IAs, did not emerge and the response to the HDUGs has been lukewarm. It should also be noted that the TA consultants assumed that the institutional strengthening component would, through the mechanisms of the HIDR and HIDAP, develop an impact strategy, but this failed to materialize.

5. Major Factors Affecting Implementation and Outcome

5.1 Factors outside the control of government or implementing agency:

The influence of outside factors has been mixed: the Bank's role has been a positive contribution to the outcome of the project, but natural disasters (the 1999 cyclone in Orissa, and the 2001 earthquake followed by the 2002 drought in Gujarat) have disrupted project implementation and delayed progress due to budgetary constraints and diversion of staff.

5.2 Factors generally subject to government control:

Project start-up was delayed by some 6-8 months due to late administrative approvals both at the centre (Expenditure Finance Committee) and at state levels, with the central coordinating body, PCS, set up in April 1996 and inadequate budgets contributing to little implementation being achieved during FY 1995/96. Incremental staff appointments were delayed due to a general ban on recruitment in most governments and this was aggravated by a general shortage of specialized staff with IT and WQ skills, causing further implementation delays. The frequent re-posting or reassignment to other priority programmes of HP staff, both at senior management (often insufficiently committed to HP) and operational levels (particularly affecting SW-related activities), also inhibited the build-up of full institutional strengths among the IAs and had a negative impact on project planning, management, coordination and implementation. During the early part of the project period, the budgetary process often led to late releases of the Letter of Credits causing delays in implementation, especially for civil works in the pre-monsoon period.

5.3 Factors generally subject to implementing agency control:

In addition to the factors described above, HIS staff in several IAs have had additional responsibilities causing implementation delays. In many cases, IAs lacked experience of the procurement procedures required by World Bank and early training for IA finance and accounting staff was not provided; this contributed to delays in procurement. The internal review mechanisms developed by the project, including pro-active central coordination, were not rigorously or regularly applied, and this contributed to the IAs not achieving the project activities on schedule (eg. network finalization, procurement of sophisticated equipment, software acquisition). Equally, project implementation was also impeded by a lack of both knowledge management through periodic peer group interactions in semi-annual or annual workshops and the use of the MIS for progress monitoring and planning - instead of just reporting to PCS. In particular, the reaction of most IAs to the cultural change workshops implemented towards project closure was lackluster and failed to generate attitudinal changes and increased ownership within the IAs concerned

5.4 Costs and financing:

5.4.1 *Project costs*: SAR total costs were estimated at US$180.9 million (INR 6626 million). IDA was to provide a credit of SDR 90.1 million (79% of totals costs) and the rest (US$17.4 million) was to be financed by the Government of Netherlands (GON), Government of India (GOI) and the state governments; the Netherlands' contribution being in the form of grant-financing for consultancy services and overseas trainings. After the mid-term review, it was decided to cancel SDR 15 million (16.6% of the loan) due to slow disbursement at this stage. According to the latest estimate, total costs, including the GON grant, will be US$152 million (compared to US$181 million at appraisal). Excluding the GON grant, the total cost in local currency is some INR 6050 million (100% of costs at appraisal). However, this figure contains wide variations in the budget allocation by implementing agency. Periodic revisions allowed a high level of flexibility. Thus, several IAs (Central Water and Power Research Station, Andhra Pradesh GW, Gujarat. GW, Madhya Pradesh SW, Maharashtra, SW and GW) disbursed more than 120% of the SAR estimate in rupees terms, with a maximum of 250%, whereas others (Ministry of Water Resources, India Meteorological Department, National Institute of Hydrology, Andhra Pradesh SW, Kerala SW and GW, and Orissa SW) disbursed less than 80% of the appraisal estimate, with a minimum of 27%. Projects

costs at the states' level increased in rupees term (112% of appraisal estimate), whereas they decreased at the level of the central agencies (77%).

5.4.2 The most noticeable change in expenditure pattern occurred for laboratory equipment (more than 200% of SAR estimates, in rupees terms) which reflected increasing concerns in WQ. Costs related to GW network (124%) and buildings (125%) also increased significantly, whereas costs related to SW and hydrology and hydro-meteorology networks (70% each), training (49%) and vehicles (79%) were significantly reduced, due to optimization of the networks, an increased use of in-house and national-level training, and a ban on the procurement of vehicles.

5.4.3 *Project financing:* Against the total available IDA Credit of SDR 75.1, after cancellation, the final disbursement is SDR 70.8 million (94%). The contributions of the central and state governments, in rupees terms, increased from 1,425 million (SAR estimate) to some 1,600 million at project closure due to the extension of the project period and the resulting increase in salary and overhead costs. Overall, the government contribution accounts for 26% of the project costs - excluding GON contribution - compared to 13% at SAR.

6. Sustainability

6.1 Rationale for sustainability rating:

6.1.1 The sustainability of the project has been assessed in relation to a number of criteria, relating to short-, medium- and long-term. These factors encompass HIS use and demand, infrastructure, organizational commitment and staff, and institutional processes. Overall the sustainability of the project is rated as likely for the reasons explained below.

6.1.2 At closure, there is clear ownership among project leaders and middle level managers, annual action plans have been developed, physical infrastructure has been completed and there is broad awareness of and access to knowledge infrastructure (software, manuals, quality assurance procedures, help desks, etc.). In addition, staff have been adequately trained to continue project operations and mechanisms for continuing training are in place. Most of the IAs have prepared post-project operation plans, with associated budget submissions, and assurances have been given regarding the availability of budget lines and financial approvals. Some reservations exist with regard to inter-agency validation, staff availability in some agencies. Though agencies using such staff have assured them that they will continue to work on HIS operations, doubts remain as to whether they will not be redeployed elsewhere, weak co-ordination mechanisms, the lack of champions within the government and among more professional hydrological data users, and the GEMS and WISDOM software, which has still to become fully operational. With increased proactive coordination from PCS and appropriate leadership from central-level agencies, given the levels of ownership and commitment and the availability of budgets, project sustainability in the short-term is rated as likely.

6.1.3 In the medium-term, sustainability is determined by the way an organization is able to positively anticipate and manage change, both in terms of people, infrastructure, and both emerging demands from, as well as increasing numbers of, users, etc. Though most IAs do not currently fully meet the criteria that ensure medium-term sustainability, there is clearly a base of competency within the organizations which, building upon the training in HIDAP, HIDR, and cultural change workshops, etc., can acquire these strengths in the next two years and grow into sustainable organizations. The potential for medium-term sustainability is generally higher among GW agencies and, overall, in such states as Andhra Pradesh, Karnataka, Tamil Nadu, and Maharashtra, with reasonable prospects in Madhya Pradesh and in Central Water and Power Research Station, CGWB, National Institute of Hydrology and Central Water

Commission, although less so among other IAs. Hence, medium-term sustainability is rated as reasonably likely.

6.1.4 In the long-term, sustainability is determined by an organization's ability to create, demonstrate and maintain comparative value, even within a government system where departments compete for financial resources. In this respect, while few of the IAs currently exhibit such an ability (possible exceptions being Maharashtra and Karnataka which could be used as role models for other IAs), their continuing and expanding operation over the medium-term could create a powerful group of users which would, in itself, help to drive the agencies to acquire such strengths. Based on current indications, it is concluded that the long-term sustainability of the hydrology project is likely only if the agencies do implement focused and time-bound programs to develop and continually maintain these management/institutional capacities within their organizations.

6.2 Transition arrangement to regular operations:

At the national level, the government has clearly indicated the importance it attaches to sustaining a quality hydrological data base and the Tenth Five-Year Plan includes specific reference to this activity under the fabric of R&D Studies: "For optimal utilization of the water resources and to ensure sustainable development institutionalized arrangements are necessary to compile and update the data on availability and utilization of surface and groundwater for various purposes and by sources in basins and sub-basins, on a continuing basis. Further, personnel involved in the sector have to be adequately trained to improve their knowledge and skills." At the level of the project, Post Project Operation Plans have been prepared by all IAs and include the following measures: the NLSC will continue as an HIS Coordination Committee supported by a Secretariat (ex-PCS); the SLCCs will also continue to function; state-level WQ Review Committees have been established; all HIS-related activities have been included in the state departments' annual action plans; provisions have been made in the IAs' budgetary requests for the continuing recurrent costs under non-plan budget lines; and training posts/cells have been included in the budget allocations for 2004-05. Arrangements are also in hand to ensure continued software maintenance from the suppliers (annual maintenance contract (AMC) for SWDES and HYMOS has been signed for one year with Delft Hydraulics; AMCs for the next four years for GEMS and WISDOM have been enrered into) and Help desks have been set up at central and state levels for assistance to users. A more focused, proactive and supportive role will need to be played by PCS and other concerned central agencies to ensure that these arrangements and other technical support to IAs are continued.

7. Bank and Borrower Performance

Bank

7.1 Lending:

Project preparation was substantial with a wide and active participation of the national agencies, bilateral agencies and several Bank and FAO/CP missions. With hindsight, preparation could have been improved if adequate recognition had been included of the time required, given the complexity and scale of the project, for initial institutional arrangements and development of ownership, network design and staffing, and the project schedule appropriately planned.

7.2 Supervision:

Bank supervision support has been of a high quality, in terms of scope, quality and timeliness. There has been an excellent level of staff continuity, particularly appreciated by the borrower and IAs, and the skill profiles of members of the regular, bi-annual supervision missions have been appropriate, timely and constructive in assisting with implementation problems, particularly in view of the project's process approach. During the second half of the project, the Bank organized joint supervisions with the Dutch Government, which further improved the supervision process and helped to reinforce the institutional

strengthening aspects of the project, particularly during the extension period.

7.3 Overall Bank performance:

The Bank's overall performance was highly satisfactory. The extension of the closing date by a total of 21 months was appropriate and enabled the IAs to substantially fulfill the project's objectives. The Bank also maintained a close, effective and constructive dialogue, through its New Delhi office, with all IAs as well as with the local representatives of the Government of the Netherlands, which financed the TA component.

Borrower

7.4 Preparation:

The time required for preparatory network planning involving joint visits was under-estimated at preparation and the commitment of the borrower could have also been improved through stakeholder workshops in the preparatory phase. These would have contributed to ensuring an appropriate level of institutional support from the beginning of project implementation.

7.5 Government implementation performance:

At the central level, the coordination, vision and technical leadership provided through the PCS was inadequate and possibly suffered more so by the pro-active role assumed by the consultant. The state IAs were looking for greater support from PCS in problem-solving and in preparation for the Bank's supervisory missions, which was not always forthcoming. Delays in the submission of reimbursement claims and discrepancies in reported costs could have been avoided if a dedicated financial monitoring officer had been appointed within the PCS. Furthermore, overall financial monitoring was carried out for the PCS by a consultant and, following the withdrawal of the TA team, the PCS has had difficulty in maintaining this system. Overall, the PCS did not have the appropriate strength in skills mix to be an effective counterpart agency and the gradual takeover from the consultant in many support activities, such as help desks and MIS, did not take place. In the absence of a fully-developed withdrawal strategy, the departure of the TA consultants created a gap in assistance to the IAs.

7.6 Implementing Agency:

While the IAs performed reasonably well within the constraints of the institutional framework, more commitment and support from the ministers and senior administrators should have been ensured from project start for better progress. The project turn-around was achieved in many agencies when a champion lead the agency, and hence proper care should have been taken in filling the top positions. Procurement performance would have been better with the training of all staff including finance and accounting staff dealing with the project. Training targets have been exceeded resulting in overall staff improvement. Staff positioning called for innovative strategies within the policy banning new recruitment within many agencies. The IAs relationships with PCS and the consultant were harmonious.

7.7 Overall Borrower performance:

The overall borrower performance is rated satisfactory, and would have been better if the institutional constraints had been recognized and appropriate strategies developed.

8. Lessons Learned

The major lessons emerging from the implementation of the project are:

Technical

a) Any novel technology and IT software being introduced by a project of this type should take into

account the ground conditions, the capacity for absorption by the users and therefore appropriate training and phasing needs to be part of the project design. The design of new software should also be phased with the requirement rather than overly elaborated in one phase.

b) HP design did not include data-related, value-addition studies as part of its MIS/learning environment. It is worth attempting to develop a benefit assessment mechanism in HIS-related activities using linkages with academic institutions and specific consultancies to develop assessments of value addition of a reliable data system.

c) Practical application and use of HIS should be further strengthened by introducing Decision Support Systems for water related operations.

Institutional

d) Any project of this recurring nature needs understanding and firm support of the high level management for success of project implementation and its sustainability.

e) There is a need to develop a project planning and monitoring mechanism suited to Indian conditions as externally developed HIDAP has proven ill-suited due to an insufficient recognition/ incorporation of institutional settings and culture in India.

f) At Project closure, it appears that the use of HIS data remains opportunistic and meetings of data user groups (HDUG) have mostly served as a means of informing potential users about HIS rather than exploring, in a dynamic and participatory manner, feedback for improved HIS management. There is, therefore, need to develop marketing strategies to promote data dissemination and use, packaging for specific users' requirements, use of various media, analysis of data requests and feedback from users, and HIS-related training/awareness raising for all users.A communication strategy as proactive reporting, publishing and dissemination are found as useful tool for data dissemination to public.

9. Partner Comments

(a) Borrower/implementing agency:

Ministry of Water Resources, Government of India (Project Coordination Secretariat)

9.1 Specific Comments are as below:

9.1.1 **Role of Central level Committees (Paras. 4.1.2 and 4.1.3):** These committees were constituted for definite objectives so that the work could be undertaken by Implementing Agencies (IAs) effectively. These committees worked effectively as per the objectives stipulated and contributed towards successful completion of the project. The earlier missions also did not comment about functioning of these committees. Some of the major decisions taken by NLSC/NCC relate to principles of data sharing and inter agency data validation, pricing of data, protocols for SW and GW activities, policy issues related to procurement etc.

9.1.2 **Quality Assurances (Para. 4.1.5):** Long term planning aspects during the project period were worked out with the help of consultants and the project has performed satisfactorily. In addition future requirements have been worked out in the form of Vision document which was also given to earlier World Bank Missions as well as to ICR mission.

9.1.3 **Non-functioning of DWLRs (Para. 4.1.7):** The DWLRS were procured by individual

implementing agencies as per provisions in their component. In various National Coordination Committee meetings, these agencies were requested to take necessary action with vendors so that defective DWLRs are repaired/replaced without further delay. However, technical skills available in some States/CWPRS are being used for repair of DWLRs.

9.1.4 **HDUG and value addition studies (Paras. 4.1.10 and 4.2.5):** HDUGs have been set up by all the agencies and regular meetings are being held to discuss the use of HIS in various activities of States. During the project period main thrust, interalia, was on the setting up of networks for HIS as per the objectives set for the project. However value addition studies are required to be incorporated as a project activity and included for future projects.

9.1.5 **Acceptable Planning tool to sustain HIS (Para 4.2.6):** HIDAP had inherent draw backs which emerged during the initial project period itself. Under the activity of Technical Assistance, MIS-I and MIS-II formats for reporting was developed which has not served as an adequate planning tool. Therefore, a fresh look on this is being made and working out requirements is in process now keeping long term sustainability aspects into account.

9.1.6 **Monitoring and problem solving by PCS (Para 7.5):** Adequate technical leadership was provided by PCS through the respective expert central agencies viz. CWC, CGWB etc. The assistance to the state was provided by development/procurement of common softwares like WISDOM, GEMS, HYMOS, SWDES, GWDES, common GW hardware through CGWB, standard SW&GW manuals, National Help Desks by CWC and CGWB, Inter agency data validation through CWC/CGWB/IMD. In case it is intended that a nodal agency like PCS will assume more pro-active implementation of a project involving a large number of implementing agencies suitable structuring of PCS for any future project is necessary.

9.1.7 Detailed comments of the Ministry of Water Resources and other implementing agencies are annexed (Annex 8).

(b) Cofinanciers:

9.2 **Royal Netherlands Embassy (RNE) (**Donor of: Technical Assistance (TA) to Hydrology Project. Project period: May 1996 till June 2003. Grant amount: € 15,00 million).RNE has indicated that as the ICR report itself spends little attention to the Final Evaluation of the TA, it has decided that it would be most appropriate to have the executive summary of the Final Evaluation, (with minor text adoptions) as their additional comments to the ICR report. (The executive summery is at Annex 9). Major findings and issues listed are as below:

9.2.1 **Achievements:** The project has brought about the establishment of a national hydrological measurement network with a standardised approach to hydrological data collection and processing. Central government and state government departments dealing with hydrological data collection have been brought together to rationalise networks, share data and carry out a mutual verification of each other's data. The technical procedures for installing and implementing different types of monitors and collecting and processing the data in a number of different situations are embodied in a comprehensive set of manuals produced by the consultants in consultation with the end users. These manuals have been distributed widely and have received considerable applause. In addition, the states have greatly appreciated the support given by the Consultants in procurement and implementation of equipment and buildings.

9.2.2 All groups are now using components of an accepted Hydrology Information System that ranges from data entry and preliminary validation to analysis and secondary validation leading to data storage for

both surface water and groundwater data. The implementation of HIS has been done within the context of institutional strengthening in the states departments. This has involved mobilising extensive support in the management of the states for HIS. It is interesting to reflect that at least in some of the states the development of state water policies appear to have been influenced by the Hydrology Project, and presumably by the activities of the Consultants.

9.2.3 A large number of staff has been trained through an extensive training programme introduced by the Consultants. In particular, a training of trainer programme has been initiated with a number of such staff trained in each state. Further support that leads towards sustainability of HIS is seen in the introduction of state and national help desks to support the various procedures that are involved in the data collection, processing and dissemination between the different users and institutions.

9.2.4 A considerable problem faced by the Consultants was in changing the work culture within the government and state departments that have yet to accommodate the arrival of the digital knowledge based economy. The Consultants have remained true to the process approach, which has underlined the whole of their activities, and have introduced a novel set of cultural change workshops that address the values of individuals and particular staff groups. These workshops appear to have been warmly welcomed by the three states that have participated in them, and they show a good potential for bringing about changes in working culture.

9.2.5 Finally, the Consultants have endeavoured to advise and assist in some innovative R&D projects that make extensive use of the data, and this way have set the pace as 'drivers' for the data. It is concluded that main objectives of the TA project have been reached.

9.2.6 **Issues/General overview:** Yet the sustainability of these achievements, in the sense of maintaining and even increasing the level of activity and scope of data collection and continually improving the processes and procedures involved, is at risk in most states. The key areas of concern include:

- Poor validation of much of the data, including the lack of formal quality assurance at all levels, despite extensive training and assistance by the Consultants and others.
- Inadequate annual and long term planning for HIS within the state departments.
- Incomplete deployment of HIS components, seriously affecting the flow of information.
- A barely adequate system of technical support in place for all levels of staff involved.
- The need for more far reaching changes in institutional practices.
- Further education and advanced training to increase the understanding and appreciation of HIS in its operation, even though adequate training has been provided to carry out the basic activities involved in HIS.
- Inadequate awareness of the real needs of potential data users and the lack of emphasis on the provision of relevant data.
- The need for many more 'drivers' for data both internally within government and externally by other users.
- The need to adopt appropriate strategies for strengthening the Hydrology Data User Groups and making them broad-based so as to create demand for data.
- The need for the agencies to network with other organisations outside the hydrology domain and who can play a complementary role to the agencies.

(c) Other partners (NGOs/private sector):

Not Applicable

10. Additional Information

Appendix

INDIA: Hydrology Project – ICR
Sustainability Ratings

Criteria	Sub-criteria	Importance (V-Vital; E–Essential; D-Desirable)	Comment
HIS use and demand	Easy access to HIS data and products	V	All the agencies have ensured sustained access to HIS data and products and are extending HIS practices beyond scope of HP.
	Extension of HIS practices and systems within agency	V	HDUGs and dissemination processes have, to a certain degree, been institutionalized although these and other essential criteria are still weak and will require effort/attention in the future.
	Vibrant HDUGs	E	The application of user fee systems been agreed and is broadly applied (at nominal fee levels); however, need to address value-based pricing for both hydrological data and analyses/products.
	Increasing requests with time for raw and processed data	E	Other desirable criteria will require promotional efforts and proactive interventions by concerned nodal and state agencies.
	Transparency of HIS process and procedures	E	
	Integration with planning and regulatory bodies involved in water management	E	
	Management/investment decisions based on HIS	E	
	Use of HIS in water disputes	E	
	User fee systems for verified data and products	E	
	Benefit analysis studies demonstrating data value	E	
	Suggestions from users for improvements to HIS	D	
	Strong user segments as data drivers	D	
	Energetic outreach programmes	D	
	Mechanisms for user information/interaction	D	
	Users willing to pay for value (hydrological products)	D	
	Use of HIS in community-based programmes	D	
Infrastructure	Physical infrastructure:		The availability of physical and knowledge infrastructure is generally sufficient and can underpin sustainability in the short- and medium-term.
	• Availability	V	Some reservations on the IAs' abilities/capacities to maintain this infrastructure – particularly with regard to the use and maintenance of manuals, procedures, protocols and quality assurance systems. These aspects will need particular attention.
	• Ability to maintain	V	Additionally, some uncertainty that the essential criteria can be met; in particular, aspects related to management changes and knowledge infrastructure which will require special attention: more of HPI efforts.
	Knowledge infrastructure (manuals, procedures, protocols, models, quality assurance, etc.):		
	• Availability	V	
	• Ability to use and maintain	V	
	Ability to upgrade physical infrastructure when required	E	
	Ability to manage change in knowledge infrastructure	E	
Organizational commitment and staff	Ownership/commitment:		At project closure, ownership/commitment among high-level stakeholders appears mixed, while generally solid among HIS project leaders, middle-level managers and staff.
	• Among Ministers and Senior administrators;	V	Organisational roles are generally well-articulated but more time is needed to consolidate linkages, develop both incentive frameworks for HIS champions and forward planning systems.
	• Among HIS staff at all levels	V	Overall, strong organisational commitments are needed and HIS will need to demonstrate value, both internally and externally.
	Clear role and integration within internal structure	V	
	Clear vision and goals	E	
	Adequate dedicated and permanent staff	E	
	Government orders on establishment and structure	E	
	Positioning/nurturing of champions	E	
	Forward planning on annual, short-term and long-term bases	E/D	
	Endorsement of HIS practices and systems within agency	D	
	Ability to retain, train and nurture	D	
	Incentives for better performance	D	
	Budget provision as separate head in annual		

	plans	D	
Institutional Processes	Quality assurance: • Inter- and intra-agency validation, authentication; • Third party certification Coordination mechanisms: • State/Centre • Among State agencies Tracking and monitoring • On basis of approved plans • Leading to action points Coordination mechanisms: • Among all concerned organisations • Among Central agencies • Dissemination of lessons learnt and best practices Quality assurance – TQM Tracking and monitoring • Feedback for improved performance Alliances and networks Peer group interactions for knowledge exchange Cultural change achieved	V V E E E E D D D D D D D D	Protocols have been developed for inter- and intra-agency validation but are still only weakly implemented and do not yet appear to be thoroughly integrated into practice. Third-part certification will need to be addressed. Coordination mechanisms have been established and are functioning, though with varying effectiveness. Increased central guidance on technical aspects needed from nodal agencies, as well as strengthened, proactive, overall coordination. Further training in TQM and M&E essential.

Annex 1. Key Performance Indicators/Log Frame Matrix

Outcome / Impact Indicators:		
Indicator/Matrix	**Projected in SAR at end-project**	**Actual/Latest Estimate**
Overall project outcome: easy access to a reliable and robust hydrological and hydro-meteorological data bank for all potential users, both public and private.		Transparent and easy data access to HIS established for user community, except when data considered sensitive (mostly SW data in sensitive areas) and authorization required.
Development Objective 1: Improve organizational arrangements for hydrological and hydro-meteorological data measurement, validation and analysis		
- Organizational structures in place		Completed
- Organizational processes in place		Completed and mostly followed: inter-Agency validation weak
Development Objective 2: Strengthen institutional and technical capabilities		
- requisite staff in-post and fully operational.	[1/]	Generally achieved OK though some specialist staff shortages (WQ and IT)
Incremental staff: professionals	794	87%
Incremental staff: specialists	348	60%
Training	30,681	96%
Development Objective 3: Improve physical facilities and services for hydrological, hydro-meteorological and water quality data measurement, validation and analysis		
- civil works, buildings (including instrumentation sites, data centers and laboratories) completed.		100 % with 398 data centres completed; WQ labs - 121%; buildings 98%.
- hydro. and hydromet. data equipment installed and operational.		95%
- systems for hydro. and hydromet. data collection and validation developed, installed and fully functional, with procedures for maintenance and updating.		SW systems in place and fully functional; delayed development and operation of GW software GEMS and data base/data storage software, WISDOM.
Development Objective 4: Improve use (transfer and dissemination) of hydrological and hydro-meteorological data		
- Hydrology Information Needs document prepared	All IAs	20 % of IAs have completed HIN exercise
- HDUGs formed.	All IAs	100%
- HDUGs include private organizations and NGOs	All IAs	Seven out of nine states
- Requests for HIS data	N.A.	Nos. requests range from 5 – 140 among 11 IAs with records available

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[1/] Revised target after MTR

Output Indicators:

Indicator	Unit	Projected in SAR at end-project	Revised targets after MTR and Desk Review	Actual/Latest Estimate
Project costs	US$	181 million	-	152 million
	INR	6,080	5,830 (excluding GOTN grant)	6,050
Data collection, entry and processing				
Data collection sites:				
• SW gauge sites fully equipped and operational	Nos.	1,009	916 (MIS - 1,020)	100%
• GW sites fully equipped and operational		6,434	7,912	100%
• WQ labs. equipped and functional	Nos.	254	274	94%
	Nos.	206	1,536	98%
• Standard RG	Nos.	233	668	99%
• Automatic RG	Nos.			
Nos. of inter-agency validations with IMD	No.of agencies		9	7
Nos. of inter-agency validations with SW agencies	No.of agencies		9	4
Data exchanged with CGWB	No.of agencies		9	9
Labs. Active in AQC programme	%	100	100	100%
HDUG membership as per revised TOR	%		100	100%
Nos. HDUG meetings (SW and GW)	No		2 per year	2 per year achieved in last year
Level of HDUG representativity (State/local/other)				Except Mah, all others at state level
HIN and user satisfaction surveys completed	Nos.	n.a.	20 agencies	5%
Level of systematic sharing of validated data	Nos.		20 agencies	Nil
In-house trainers active	%			100 %(113 hydrometry, 60WQ, 15 each in SWDES and HYMOS,70 GW, 30 GWDES
Post-project training plan prepared	Nos.		9 states and 5 central agencies	100%
R&D studies:	Nos		11	100%
States using HIS in support of policy formulation, implementation, planning and design.	No		20 agencies	All GW agencies and 50 %SW agencies
Nos. of Agencies monitoring HIS data requests and use	No		20 agencies	100%

Annex 2. Project Costs and Financing

Project Costs by Components (million $US)	ASR Estimate	Latest Estimate	% of Appraisal
Upgrading of Data Collection and Management Facilities	**91.5**	**77.0**	**84%**
Observation Sites (Works and Equipment)	43.2	32.4	75%
SW	22.2	13.0	59%
GW	18.6	18.1	97%
Hydrometeorology	2.4	1.3	55%
Buildings	22.3	22.1	99%
Data Management Hard/Software and Communication Equipment	23.3	18.1	78%
Laboratory Equipment	2.7	4.5	165%
Institutional Strengthening	**89.4**	**74.6**	**83%**
R&D, Survey and Special Studies	3.1	2.9	92%
Training	6.6	2.5	37%
Consultant Services (Dutch Grant)	17.4	15.7	90%
Equipment	9.8	6.6	68%
Office and Training Equipment	3.2	2.9	92%
Vehicles	6.6	3.7	56%
Incremental Reccurent Costs	52.5	46.9	89%
Incremental Staff Costs		36.3	
Other Incremental Recurrent Costs		10.6	
TOTAL	**180.9**	**151.6**	**84%**

Project Cost by Procurement Arrangement (Appraisal Estimate) (in US$ million equivalent)

Expenditure Category	ICB	NCB	Other	N.B.F.	Total Cost
1. Works		28.8	15.9		44.7
		(23)	(12.8)		(35.8)
2. Goods					
2.1 Vehicles	2.6	3.1	0.9		6.6
	(2.4)	(3.0)	(0.8)		(6.2)
2.2 Equipment	33.3	10.8	8.1		52.2
	(31.5)	(10.1)	(7.6)		(49.2)
3. Consultant Services					
3.1 Dutch Grant T.A.				17.4	17.4
4. Training					
4.1&4.2 Training			6.6		6.6
			(6.3)		(6.3)
5. Research & Development			0.9		0.9
			(0.8)		(0.8)
6. Miscellaneous					
6.1 & 6.2 Incremental Recurrent Costs			52.5		52.5
			(43.6)		(43.6)
Total	35.9	42.7	84.9	17.4	180.9
	(33.9)	(36.1)	(72.0)		(142.0)

Notes: Figures inclusive of contingencies, taxes and duties and rounded to one decimal point;
Figures in parentheses are the respective amount to be financed by IDA

Project Financing by Category of Expenditure	ASR Estimate				Latest Estimate				% of Appraisal			
(US$ million)	Gov of India	IDA	Dutch Grant	Total	Gov of India	IDA	Dutch Grant	Total	Gov of India	IDA	Dutch Grant	Total
Civil works	8.9	35.8	0.0	44.7	7.2	32.3		39.5	81%	90%		88%
Goods	3.5	55.8	0.0	59.3	10.7	36.2		46.9	307%	65%		79%
Training (training, studies, workshops, seminars)	0.2	6.8	0.0	7.0	-0.6	3.1		2.5	N.A.	46%		35%
Consultancy Services (Dutch Grant)	0.0	0.0	17.4	17.4	0.0	0.0	15.7	15.7			90%	90%
Incremental Recurrent Costs	8.9	43.6	0.0	52.5	20.5	26.4		46.9	230%	61%		89%
TOTAL	**21.5**	**142.0**	**17.4**	**180.9**	**37.9**	**98.0**	**15.7**	**151.6**	**176%**	**69%**	**90%**	**84%**

Note1: Data available does not permit to develop the breakdown of project financing by components but only project financing by category of expenditure.

Note2: The discrepancy observed in training and studies category (IDA financing exceeding reported expenditure) is probably mostly due to discrepancies in allocation of costs related to:
(i) R&D and special studies (allocation of equipment and civil work costs) or (ii) training (allocation of transport costs).

Annex 3. Economic Costs and Benefits

Not applicable since no economic analysis was presented in the SAR as it was considered, correctly, that the quantification of overall benefits would not be feasible given the project's focus on hydrological data and the impossibility of estimating the global value of both the country's historic data and the additional information generated by the HIS.

Annex 4. Bank Inputs

(a) Missions:

Stage of Project Cycle	No. of Persons and Specialty (e.g. 2 Economists, 1 FMS, etc.)		Performance Rating	
Month/Year	Count	Specialty	Implementation Progress	Development Objective
Identification/Preparation				
02/22/1994	*12*	TASK TEAM LEADER (1) HYDROLOGIST (6); REAL TIME DATA MANAGEMENT (1); METEROLOGIST(2); WATER QUALITY (1)		
Appraisal/Negotiation				
08/16/1994	*11*	TASK TEAM LEADER (1); CONSULTANTS (6); ODA (2); WORLD BANK STAFF (2);		
09/22/1995				
Supervision				
11/17/1995	*4*	INSTITUTIONAL SPEC. (1); SR. IRRIGATION ENG. (1); WATER RESOURCES (1); IRRIGATION ENGINEER (1)	S	S
06/02/1996	*3*	INSTITUTIONAL SPEC. (1); IRRIGATION ENGINEER (2)	S	S
12/03/1996	*5*	INSTITUTIONAL SPEC. (1); PROCUREMENT ENGINEER (2); IRRIGATION ENGINEER (2)	S	S
06/13/1997	*4*	INSTITUTION SPECIALIST (1); IRRIGATION ENGINEER (2); PROCUREMENT ENGINEER (1)	S	S
12/16/1997	*4*	IRRIGATION ENGINEER (1); INSTITUTION SPECIALIST (1); WATER RES. ENGINEER (1); PROCUREMENT ENGINEER (1)	S	S
07/20/1998	*4*	HYDROLOGIST (1); IRRIGATION ENGINEER (2); PROCUREMENT ENGINEER (1)	S	S
08/20/1999	*5*	HYDROLOGIST (1); PROCUREMENT SPECIALIST (1); FINANCIAL MANAG. SPL. (1); WATER RESOURCES SPL. (1); TEAM ASSISTANT (1)	U	S
08/20/1999	*8*	HYDROLOGIS (1); IRRIGATION ENGINEER (1); INSTITUTIONL EXPERT (1);	U	S

			FINANCIAL MANAG. SPEC. (1); PROCUREMENT SPEC. (1); WATER RESOURCES SPEC. (1); GROUNDWATER SPEC. (1); DATABASE MANAGEM. SPEC (1)		
	09/21/2000	*6*	HYDROLOGIST (1); SR. WATER RES ENGINEER (1); SR. PROCUREMENT ENGINE (1); FINANCIAL MANAG. SPL. (1); INSTITUTIONAL DEV. SPL (1); GR.WATER/DATA BASE SP. (1)	S	S
	04/25/2001	*7*	SR IRRIGATION ENGINEER (1); WATER RES. SPECIALIST (1); PROCUREMENT SPECIALIST (1); FINANCIAL MGMT. SPL. (1); WATER MANAGEMENT SPL. (1); IT/DATABASE MGMT. SPL. (1); INSTITUTIONAL SPL, RNE (1)	S	S
	10/19/2001	*6*	SR IRRIGATION ENGINEER (1); SR. WATER RES ENGINEER (1); SR PROCUREMENT SPL. (1); FINANCIAL MGMT SPL. (1); INSTITUTIONAL SPL. (1); GROUNDWATER SPL. (1)	S	S
	05/10/2002	*4*	WATER RESOURCES ENGG (2); PROCUREMENT SPECIALIST (1); FINANCIAL MANAGEMENT (1)	S	S
	11/01/2002	*7*	TASK LEADER (1); CO-TASK LEADER (1); PROCUREMENT SPECIALIST (1); GROUNDWATER SPECIALIST (1); DATABASE MGMT/GIS SPLS (1); FMS (1); INSTITUTIONAL SPLST (1)	S	S
	05/26/2003	*5*	TASK TEAM LEADER (1); IRRIGATION (1); WATER RESOURCES (1); WATER QUALITY (1); INSTITUTIONAL (1)	S	S
ICR					
	11/17/2003	*6*	TASK TEAM LEADER (1); ECONOMIST(1); INSTITUTIONAL (1); DATABASE MANAGEMENT (1); IRRIGATION (1); WATER		

		RESOURCES (1)		

(b) Staff:

Stage of Project Cycle	Actual/Latest Estimate	
	No. Staff weeks	US$ ('000)
Identification/Preparation	62	288
Appraisal/Negotiation	72	157
Supervision	283	1187
ICR	22	94
Total	439	1726

Note: ICR figures include FAO support

Annex 5. Ratings for Achievement of Objectives/Outputs of Components

(H=High, SU=Substantial, M=Modest, N=Negligible, NA=Not Applicable)

	Rating				
☐ *Macro policies*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Sector Policies*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Physical*	○ *H*	● *SU*	○ *M*	○ *N*	○ *NA*
☐ *Financial*	○ *H*	● *SU*	○ *M*	○ *N*	○ *NA*
☐ *Institutional Development*	○ *H*	● *SU*	○ *M*	○ *N*	○ *NA*
☐ *Environmental*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
Social					
☐ *Poverty Reduction*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Gender*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Other (Please specify)*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Private sector development*	○ *H*	○ *SU*	○ *M*	○ *N*	● *NA*
☐ *Public sector management*	○ *H*	○ *SU*	● *M*	○ *N*	○ *NA*
☐ *Other (Please specify)*	○ *H*	○ *SU*	○ *M*	○ *N*	○ *NA*

Annex 6. Ratings of Bank and Borrower Performance

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HU=Highly Unsatisfactory)

6.1 Bank performance	*Rating*			
☐ *Lending*	○ *HS*	● *S*	○ *U*	○ *HU*
☐ *Supervision*	● *HS*	○ *S*	○ *U*	○ *HU*
☐ *Overall*	● *HS*	○ *S*	○ *U*	○ *HU*

6.2 Borrower performance	*Rating*			
☐ *Preparation*	○ *HS*	● *S*	○ *U*	○ *HU*
☐ *Government implementation performance*	○ *HS*	● *S*	○ *U*	○ *HU*
☐ *Implementation agency performance*	○ *HS*	● *S*	○ *U*	○ *HU*
☐ *Overall*	○ *HS*	● *S*	○ *U*	○ *HU*

Annex 7. List of Supporting Documents

1. SAR, Hydrology Project, July 14, 1995
2. Proposed Amendment of Credit, June 1996
3. Mid-Term Review Report, Vols. I-III, Ministry of Water Resources, December 1998
4. Project Completion Report, Ministry of Water Resources, November 2003
    - Main Report and Abstract
    - Implementing Agency Reports
    - Abstract of MIS Report to September 30, 2003
5. Hydrology Project, MIS I and MIS II Reports (to September 30, 200)
6. World Bank Supervision Mission reports (PSR and Aide Memoire)
    - WB Project Launch/Supervision: October/November 1995
    - WB Supervision: May/June1996
    - WB Supervision: November/December 1996
    - WB Supervision: May/June1997
    - WB Supervision: December1997
    - WB Supervision: July1998
    - Mid-Term Review: January1999
    - WB Supervision: August 1999
    - WB/RNE Joint Supervision: February/March2000
    - WB/RNE Joint Supervision: Sepember2000
    - WB/RNE Joint Supervision: April 2001
    - WB/RNE Joint Supervision: October 2001
    - WB/RNE Joint Supervision: April/May 2002
    - WB/RNE Joint Supervision: October 2002
    - WB/RNE Joint Supervision: May 2003
7. Review of Technical Assistance, Final Evaluation Report, RNE, April 2003
8. Hydrology Project Technical Assistance, Final Report, June 2003
9. Implementation Completion Report, Andhra Pradesh Irrigation and CAD Dept., November 2003
10. Implementation Completion Report, Government of Gujarat, October 2003
11. Presentation to ICR mission, Karnataka Dept. Mines and Geology, November 2003
12. Report on Groundwater and Surface Water Components, Kerala State, November 2003
13. Presentations by all IAs to ICR mission, November-December 2003
14. Pilot Study – Mini Watersheds, State GW and SW Resources Data Centre, Tamil Nadu.
15. ICR with Appendix and Working Papers, January 2004

Additional Annex 8. Borrower's Detailed Comments on the ICR

Comments of the Ministry of Water Resources (Groundwater and Minor Irrigation Wing- Project Coordination Secretariat): The Development objectives of the Hydrology Project were to improve (i) Physical facilities through modernization/rationalization of the hydrological and hydro-meteorological observation network; (ii) Institutional and Technical capabilities through infrastructure build-up and trainings to the officials; (iii) Organizational arrangements through restructuring & mainstreaming of the activities; and (iv) Promote use of Data through setting up of HDUGs, websites, etc. for setting up of functional Hydrological Information System (HIS) consisting of Hydrological, Hydro-meteorological and Water quality data.

The project was fully able to achieve the development objectives. As far as the physical facilities are concerned almost 100% targets were achieved. Hydrological sites operational (100%), Meteorological sites operational (100%), Piezometers sites operational (100%), Computers installed (95%) and major equipments in position (98%).

The Institutional and Technical Capabilities were enhanced through constitution of Purpose driven Committees at National, Central and State Level for providing necessary guidance regarding various generic and implementation issues. Over 10,000 staff were trained in India (250% of SAR target) and 108 officers trained Overseas under nine study tours/trainings. Standard softwares for data entry, validation and storage were provided uniformly to all the implementing agencies. However some more time was required in development/modifications/fine-tuning of WISDOM (Data Storage Centre Software) and GEMS (Ground Water Data Entry and Processing Software) because of the nature of such software to be utilized by a large number of agencies as in this project. The 1,548 major/minor buildings were constructed (98% of SAR target), 519 New vehicles procured (91% target) and GIS Datasets (digitized maps) were procured under the project. Due to general ban on recruitment of staff, there was shortage of WQ/IT staff, however attempts were made to fill up the vacant posts by redeployment and providing on the job trainings etc.

The Organizational Arrangements were improved through restructuring of organizations by formation of separate hydrological divisions and rationalization of the number of data collection sites in consultation with the Consultants, central agencies and the state agencies. The data collection/collation system was modernized through provision of state-of-the-art equipments and standard softwares. Data processing and data storage centers were established for data storage and dissemination. The HIS activities were mainstreamed through issue of Govt. orders in almost all the states for mandatory use of HP data in water resources planning/design. IWRM studies were taken up in Sabarmati and Godavari basins. Establishment of Protocols for various HIS activities, documentation of Surface Water and Ground water manuals and establishment of 3-tier Help-desks at Central/State/Division level were also completed.

Hydrological Data Users Groups (HDUGs) at State level and central level, with members from Government/semi government/academic institutions/NGOs were constituted and regular meetings held to promote the use of data and to make the HIS demand driven. Websites were launched in almost all the agencies and mass awareness programmes taken up. Comprehensive HIS website is under advanced stage of launching by CWC.

In the wrap up meeting for the ICR mission held under the chairmanship of Secretary (WR) on 9.12.2003, the implementing agencies had reiterated their commitment for continuation of HIS activities in

post project period along with adequate funds for O&M of networks, trainings and continuation of trained staff for the purpose. The National Level Steering Committee would continue in the post project period as HIS – Coordination Committee (HISCC) under the chairmanship of Secretary (WR) with similar functions and participation at Secretary level of the states and Heads of Departments of central agencies. Secretariat work for HIS-CC and Coordination work for Hydrology Project activities would be continued by GW&MI wing, MoWR as HIS Coordination Secretariat (HIS-CS) State agencies have also assured for continuation of State Level Coordination Committees for post project coordination. Technical as well as operational details have been documented in SW/GW manuals and protocols for these activities have been developed and are under implementation. Help Desks have been established at National, state and division levels for HIS activities. Uniform pricing structure has been finalized in NLSC/NCC meetings.

However comments on some specific issues are as follows.

Role of Central level Committees (Para 4.1.2 and 4.1.3): These committees were constituted for definite objectives so that the work could be undertaken by Implementing Agencies (IAs) effectively. These committees worked effectively as per the objectives stipulated and contributed towards successful completion of the project. The earlier missions also did not comment about functioning of these committees. Some of the major decisions taken by NLSC/NCC relate to principles of data sharing and inter agency data validation, pricing of data, protocols for SW and GW activities, policy issues related to procurement etc.

Quality Assurances (Para 4.1.5): Long term planning aspects during the project period were worked out with the help of consultants and the project has performed satisfactorily. In addition future requirements have been worked out in the form of Vision document which was also given to earlier World Bank Missions as well as to ICR mission.

Non-functioning of DWLRs (Para 4.1.7): The DWLRS were procured by individual implementing agencies as per provisions in their component. In various National Coordination Committee meetings, these agencies were requested to take necessary action with vendors so that defective DWLRs are repaired/replaced without further delay. However, technical skills available in some States/CWPRS are being used for repair of DWLRs.

HDUG and value addition studies (Para 4.1.10 and 4.2.5): HDUGs have been set up by all the agencies and regular meetings are being held to discuss the use of HIS in various activities of States. During the project period main thrust, interalia, was on the setting up of networks for HIS as per the objectives set for the project. However value addition studies are required to be incorporated as a project activity and included for future projects.

Acceptable Planning tool to sustain HIS (Para 4.2.6): HIDAP had inherent draw backs which emerged during the initial project period itself. Under the activity of Technical Assistance, MIS-I and MIS-II formats for reporting was developed which has not served as an adequate planning tool. Therefore, a fresh look on this is being made and working out requirements is in process now keeping long term sustainability aspects into account.

Monitoring and problem solving by PCS (Para 7.5.): Adequate technical leadership was provided by PCS through the respective expert central agencies viz. CWC, CGWB etc. The assistance to the state was provided by development/procurement of common softwares like WISDOM, GEMS, HYMOS, SWDES, GWDES, common GW hardware through CGWB, standard SW & GW manuals, National

Help Desks by CWC and CGWB, Inter agency data validation through CWC/CGWB/IMD. In case it is intended that a nodal agency like PCS will assume more pro-active implementation of a project involving a large number of implementing agencies suitable structuring of PCS for any future project is necessary.

Agency-wise Comments

Central Water Commission: With regard to the concern expressed regarding sustainability of HIS, it is emphasized that one of the core activity of CWC has been data collection, processing, data dissemination and its use for last five decades. These activities have been further strengthened under HP and therefore there should not be any concern in this regard. In fact, being an apex organization at the national level in this field, CWC, by carrying out the following activities, will act as driving force for sustainability of the HIS in other participating agencies also:

(a) Continued operation of National Help Desk and provide assistance wherever needed in the use of SWDES , HYMOS and WISDOM software by all the participating agencies.
(b) Preparation and periodic updation of the combined catalogue of meta-data.
(c) Maintenance of HIS web-site.
(d) Inter-agency data validation.
(e) Trainings of personnel of state and central agencies at National Water Academy, Pune.
(f) Continued interaction with the participating agencies.

With reference to concern expressed regarding delay in the operationalisation of the WISDOM software it is to mention that the development of the WISDOM software has been a resource intensive and time consuming activity as it required significant amount of input and coordination with all the participating agencies. The revised version 1.2 of the WISDOM has been installed at all the DSCs. An eight days training course cum feed back programme on WISDOM was organized in Delhi from 15th December to 23rd December,2003. The training was attended by the participants from 22 DSCs. The feedback received from the participants is very encouraging and positive. In fact many of the participants handed over the meta-data during the training programme itself. WISDOM has been fully integrated with the GEMS as the correct export file from GEMS was also furnished by the CGWB during the training programme. Hence, the operationalisation of the WISDOM is assured. There exists a seamless link between the data processing software in SW and GW domains and the WISDOM.

National Water Academy of CWC is fully equipped to cater to the needs of the various training requirements of CWC as well as other participating agencies.

As suggested in the Aide-Memoire, to spread the gains made under the Hydrology Project, CWC is already in the process of introducing the data entry and data processing softwares in the areas not covered under the Hydrology Project. Also, it is planned to get the various soft wares developed in the country itself to avoid the problems related to upgradation and maintenance.

Central Ground Water Board: The ground water historical data was already in computerized formats and got converted to new format in the hydrology project period. The name of Dedicated Ground Water Data Processing and Analysis software, maybe read as Groundwater Estimation and Management System (GEMS). Now GWDES developed for data entry and bring data of all the agencies to a common platform has been dispensed with and data of all the agencies has been converted to GEMS. At present only one software i.e. GEMS is operational in all the agencies. GWDES is standalone software with limited data

entry and analytical capabilities. However, GEMS is an advanced GIS Integrated Software based on client – server technology which include the functionality of GWDES and other advanced functionality for analyses and report generation.

Central Water and Power Research Station: Hydrology Project has provided institutional strengthening primarily by way of upgradation of rating tank facility, hydrometric instrumentation services to the DWLR, procurement of: advanced hydrometric equipment, computers and communication equipment and integrated bathymetric system for reservoir sedimentation survey; which has resulted in state-of-the-art equipment and adoption of analytical procedures in the fields of calibration of current meter, water quality and sedimentation survey. The potential for sustainability of gains under HP at CWPRS is high, with the services of the institution being made regularly to other agencies on a payment basis under the principle of 'no-profit-no-loss'

National Institute of Hydrology: NIH has not only carried out a number of training programmes under the Hydrology Project successfully but also has organized the training programmes on Hydrological data processing in Patna & Guwahati for officers of Central and State organizations in States which are not covered by Hydrology Project Phase-I. Also the institute has the resources persons and infrastructure for organizing training programmes and undertaking Res & Dev projects. So the sustainability in case of NIH should be rated higher and not marginal. NIH is willing to organize training courses on Basic Hydrology and organize new as well as refresher courses on SWDES and HYMOS. NIH would also like to participate in the Help Desk.

Andhra Pradesh (GW): There was lot of commitment and support from the senior administrators in the implementation of Hydrology Project and also the use of HIS. The program of the project and data collection was closely monitored at the highest level.

Gujarat : A total 139 users have used the data on ground water, water level, water quality etc. These users include, Research Institutions, Academic Institutions, Research Scholars, Government and Semi Government departments etc. GWRDC has also launched the web site (www.gwrdc.nic.in) that covers general and technical information which include water level and water quality plans of the state for creating awareness among the people of the state. Both data on Surface Water and Ground Water was used in conjunction of water resources planning for the State of Gujarat. Both, this data collected for surface water and ground water component during Phase-I of the Hydrology Project was used in basin level / village level planning for its effective application at field condition. Creation of River basin Organization (RBO) for Sabarmati River Basin is in progress.

Karnataka (SW): The state has managed to overcome shortcomings about delays in procurement, in placing suitable staff and in training due to state governments imposed restrictions on recruitment, staff transfers and travel and sometimes purchases in the best possible manner within the framework of the state rules. Also where redeployment was not best possible, the state has managed recruitment of specialists posts through contract appointment. The HIS data has already been mainstreamed into Water Resources Dept. and all water related clearance are accorded in the Data Centre.

Karnataka (GW): HIS Core Group has been formed at the Directorate to provide technical support to field staff and this group will support technically all level of staff in sustaining the HP activities. HIS Data are being used for other projects by the dept. and the data is sold to voluntary agencies and universities for their requirement.

Kerala (SW): It calls on each one of us to maintain and improve the quantity and quality of fresh water available for future generation as well as the present. Total supply of water in river basins is non-expandable and hence there will be rising competition for scarce water, raising socio-economic pressure to define water rights more clearly. The Hydrology Project has helped the surface water component of Kerala Water Resources Dept. in upgrading and expanding its observation network and helping in generation of reliable and authentic data using modern technologies. An amount of Rs. 200 lakhs has been included in the state budget plan head for the year 2004-05 for O&M and Trainings.

Kerala (GW): Project implementation in our case has brought out the importance of need for staff dedicated solely to the activities of the Project at the District Data Center level, so as to ensure strict adherence to the collection schedules, timely analysis of data, and preparation of reports to ensure timely follow-up on urgent matters. In the case of Digital Water Level Recorders though there were initial setbacks due to acclimatization problems, we have achieved almost 100% functionality for DWLRs. During the period of Hydrology Project-I itself, based on HIS data, we have undertaken construction of artificial recharge structures, such as sub-surface dykes and check-dams, on pilot study basis, to augment the ground water resources. Significant attitudinal change has been achieved in our Department, and the intended modern work culture has been readily imbibed by the officers involved in the Hydrology Project. In fact, there was lot of enthusiasm amongst the officers despite the HP work being thrust upon them as additional work, especially in the District Data Centers, to make use of the new methodology and equipment made accessible to them by the Project. It is this enthusiasm that has ensured achieving the nearly 100% functionality for our Digital Water Level Recorders, despite major non-functionality in the beginning. Government authorities are now experiencing the indispensability of HIS data for their decision making processes. Budgetary allocation has been provided for the Financial Year 2004-2005, for continuing the Hydrology Project activities.

Madhya Pradesh: With hindsight it appears that the project design could have been improved in respect of the following for better project outcomes:-

(i) Training in HYMOS included as small capsule in Statistics which is inadequate. Handling large datasets and processing the same to obtain cogent results involves proper understanding of statistical analysis to avoid a GIGO situation.. Thorough training in advanced statistical analysis should have been a part of the project under HRD.
(ii) The project could have been inter-disciplinary in nature. The project has only involved civil engineers and hydrologists, geohydrologists, chemists, policy makers and others do not seem to be enthused by the project.
(iii) There was too much stress on vertical integration and less than optimal interaction with the state level IAs.

Maharashtra (SW): The state has completed a HIN assessment and conducted user satisfaction surveys. The state has undertaken steps to promote awareness of the HIS data among users through website, workshops, public meetings, Jal-Utsav and seminars. Recently GOM has directed that the Chief Engineer HP is the sole authority for issuing water availability certificate for irrigation projects in the state. The decision of GOM represents the value additions in HIS activity which is purpose driven. The state has planned certain key areas for sustainability of the project, such as physical infrastructure, O&M of the network established during the project, financial requirement for sustainability of HIS activities. Public awareness about HIS is being achieved through meetings, workshops, Jal-Utsav etc. The long term sustainability is practically possible in the state because of changed attitude not only at Manger level but at Observer level also. The project has created harmony amongst staff.

Maharashtra (GW): As regards DWLR, 2 out of 60 nos. INSITU make DWLR, all the 636 Greenspan make DWLR and 250 out of 299 installed (total procured 391 DWLR) Unidata make DWLR are non-functioning. Steps are being taken by the state for legal action in case of Greenspan make DWLR. As regards WQ staff, 25 nos WQ posts have been sanctioned. Senior chemist post has been filled remaining posts will be filled up very soon.

Orissa (SW&GW): The present system of audit is conducted by Auditor General, Govt. of India (Orissa) following the existing procedure of Public Works audit. Introduction of audit by an independent agency for HP would accelerate the process of reimbursement with an easy and guided procedure squarely applicable to HP norms and procedures.

Tamilnadu (SW&GW): The Hydrology Project target in all respects viz., procurement, civil work, training, establishing HDUG network, conducting mass awareness programmes and all other related goals wee achieved in full without any lapse. The HDUG members and NGOs are often meeting us regarding HIS. The HIS network established in Tamil Nadu has reached the rural roots as well as water planners. Tamil Nadu will prove itself as a fore runner in HIS sustainability. The lessons learnt are turned into fruitful results to strengthen the HIS.

Additional Annex 9. Detailed Comments of the Royal Netherlands Embassy (RNE) on the ICR

Donor of: Technical Assistance to Hydrology Project .
Project period: May 1996 till June 2003. Grant amount: € 15,00 million.
Summary of total TA staffing in person-months: International: 480, National: 1717.

Introduction: In March 2003 the Netherlands Embassy charged a Mission The Mission consisted of Roland K Price, Mission Leader and Hydrologist, Dimitri Solomatine, Data Management and Training specialist; S.Rajagopalan, Institutional Specialist; Dilip Fouzdar, Groundwater and User perspective; and Henk Nijland, Water Management Specialist, Resource Person.
with evaluating the Technical Assistance provided to the Hydrology Project. The Mission made brief visits to the implementing agencies, during which time the Mission assessed how well the TA had been effective in stimulating the performance of the agencies. Although the Mission could assess that the project achievements are considerable, the *sustainability* of the achievements of the Hydrology Project in the 24 implementing agencies is of key concern.

Major Findings

Achievements: The project has brought about the establishment of a national hydrological measurement network with a standardised approach to hydrological data collection and processing. Central government and state government departments dealing with hydrological data collection have been brought together to rationalise networks, share data and carry out a mutual verification of each other's data. The technical procedures for installing and implementing different types of monitors and collecting and processing the data in a number of different situations are embodied in a comprehensive set of manuals produced by the consultants in consultation with the end users. These manuals have been distributed widely and have received considerable applause. In addition, the states have greatly appreciated the support given by the Consultants in procurement and implementation of equipment and buildings.

All groups are now using components of an accepted Hydrology Information System that ranges from data entry and preliminary validation to analysis and secondary validation leading to data storage for both surface water and groundwater data. The implementation of HIS has been done within the context of institutional strengthening in the states departments. This has involved mobilising extensive support in the management of the states for HIS. It is interesting to reflect that at least in some of the states the development of state water policies appear to have been influenced by the Hydrology Project, and presumably by the activities of the Consultants.

A large number of staff has been trained through an extensive training programme introduced by the Consultants. In particular, a training of trainer programme has been initiated with a number of such staff trained in each state. Further support that leads towards sustainability of HIS is seen in the introduction of state and national help desks to support the various procedures that are involved in the data collection, processing and dissemination between the different users and institutions.

A considerable problem faced by the Consultants was in changing the work culture within the government and state departments that have yet to accommodate the arrival of the digital knowledge based economy. The Consultants have remained true to the process approach, which has underlined the whole of their activities, and have introduced a novel set of cultural change workshops that address the values of individuals and particular staff groups. These workshops appear to have been warmly welcomed by the

three states that have participated in them, and they show a good potential for bringing about changes in working culture.

Finally, the Consultants have endeavoured to advise and assist in some innovative R&D projects that make extensive use of the data, and this way have set the pace as 'drivers' for the data.

The Mission concludes that main objectives of the TA project have been reached.

Issues/General overview: Yet the sustainability of these achievements, in the sense of maintaining and even increasing the level of activity and scope of data collection and continually improving the processes and procedures involved, is at risk in most states. The key areas of concern include:

- Poor validation of much of the data, including the lack of formal quality assurance at all levels, despite extensive training and assistance by the Consultants and others
- Inadequate annual and long term planning for HIS within the state departments
- Incomplete deployment of HIS components, seriously affecting the flow of information
- A barely adequate system of technical support in place for all levels of staff involved
- The need for more far reaching changes in institutional practices
- Further education and advanced training to increase the understanding and appreciation of HIS in its operation, even though adequate training has been provided to carry out the basic activities involved in HIS
- Inadequate awareness of the real needs of potential data users and the lack of emphasis on the provision of relevant data
- The need for many more 'drivers' for data both internally within government and externally by other users
- The need to adopt appropriate strategies for strengthening the Hydrology Data User Groups and making them broad-based so as to create demand for data
- The need for the agencies to network with other organisations outside the hydrology domain and who can play a complementary role to the agencies

Data validation: The achievement of the Consultants in implementing a standard hydrology information system in the nine states with the co-operation of CWC and CGWB over a period of six years is remarkable. Yet it marks only the beginning of a long process of building up a truly Indian HIS. This is because as yet the people responsible for data collection and processing have not built up sufficient experience of what they are doing and an understanding of the importance and value of the data they are collecting. As a consequence in almost all states the Mission was concerned at the poor validation of the data collected so far and a lack of objective self-review of the processes they are using. This has lead to an overconfident trust in the accuracy of the data.

Such failure to appreciate the inherent uncertainties in the data is not unexpected as shown by the emphasis of the Consultants both on their manuals on data validation and on the coverage of the subject in the extensive training courses conducted. Yet the validation procedures agreed upon are not being followed, and additionally quality assurance is not being implemented through formal checking by superiors of the work done by their juniors. This is not a trivial problem to address in that it involves the accumulation of experience, an attitude of curiosity and support from management in ensuring that procedures are followed. Here, better procedures that are conducive to sharing information within and between the state data groups could have been tried. For example, communities of (good) practice in water data management could have been encouraged at the level of the data practitioners (rather than at the data users level), both at the state and national levels.

Infrastructure Action Plans: The lack of acceptance of the Hydrology Infrastructure Action Plan (HIDAP) by the states is disappointing and there were not enough attempts by the Consultants to adapt it in the light of Indian government experience. This has meant that, although each state department has produced its annual plan for HIS with its particular objectives and budget to satisfy its internal requirements, there has been no long term planning tool in place to identify objectives over, say, a five-year period. It is true that some states are struggling to make financial ends meet, and some are preoccupied with recovering from emergency situations such as flooding, riots and drought. Nevertheless, a long term planning tool that enables the state departments to look five years ahead would be valuable in targeting the necessary resources to meet proposed needs. Whatever form HIDAP takes in the future it should be the result of a relevant Indian format that should be developed primarily by Indian staff themselves.

Hydrological Information System: The complete HIS envisaged in the early stages of the project has not been achieved within the project duration. SWDES, GWDES and WQDES are in place along with HYMOS for surface water data. The consultants have largely been responsible for the introduction of the data entry and validation software, which has proved to be greatly appreciated by all of the states. It should be mentioned however that releases of the software through standard software engineering procedures were not fully followed. The final project versions of GEMS and WISDOM have yet to be delivered. The history of software development within the project has not been entirely satisfactory. Original contract obligations for GEMS and WISDOM have not been fulfilled. This situation has resulted in a tangible tension between the software developers and the Consultants. The situation is undoubtedly difficult and complex. Whereas there may be a number of different reasons why this situation has arisen and the Consultants have tried hard to resolve it, the Mission thinks that the Consultants could still have been more proactive in managing the conflict.

Support procedures and training: The TA project is presently due to finish at the end of March 2003. This means that the support given by the Consultants to the states and CWC and CGWB will then be stopped. Thereafter staff in the states will depend on internal facilities such as the help desks and the training provided by the internal trainers and institutes such as NWA and NIH. Apart from the problem of how to deal with training and support in using the software that is yet to be supplied the Consultants have endeavored to put in place a system of self-help for the states.

In the view of the Mission however, this has not gone far enough. A number of points can be identified. There is no formal process of recording, synthesizing and disseminating lessons learned by experience of data collection, processing and distribution. There is no procedure for improving and updating the manuals. The help desks have barely been used in all of the states, and there is little evidence that they are likely to be used significantly in the future, even though problems will arise and help will be required. In other words, they may fall into disuse. Part of the problem lies in the fact that the Consultants have perhaps been too proactive in designing, producing and implementing the software, technical manuals and management procedures, even though they involved staff from the states in setting up the terms of reference for these items.

Role of CWC and CGWB: Another issue comes from the position of the CWC and CGWB, which could ideally be more proactive in providing the states with the sort of technical assistance and advice that has been the responsibility of the Consultants during the HP project. The Project Co-ordination Secretariat (PCS) is supposed to co-ordinate this technical assistance and advice, but it does not appear to have been adequately prepared by the Consultants and properly staffed, and there is little evidence that the intended role is appreciated by the states.

Cultural and organisational change: It was recognised in the terms of reference for the TA that some radical actions would need to be taken in regard to the processes of the groups in the states handling hydrology data. The failure to introduce HIDAP shows that bringing about changes in the processes is a very difficult task. It was rather late in the project that the consultants turned to cultural change workshops. These place an emphasis on exploring individual and group values, as a means of making staff aware of how they form their beliefs and attitudes concerning their work, with the possibility of making changes to these values, beliefs and attitudes. In parallel, the Consultants could have explored other infrastructural arrangements, such as the CWC and CGWB taking on a more resource-oriented role concerning the states.

User Groups and Data 'Drivers': Sustainability of data collection in the states depends in part on the internal and external stakeholders for the data. Hydrology Data User Groups (HDUGs) have been set up in all of the states, some with more success than others have. In a few states little interest has been forthcoming from external users of the data and the groups have not met for a long time. In other states communications have been set up with potential users, but little has been gained in terms of data needs. Questionnaires have been distributed to users in some states and these have yielded useful results. No state appears to have changed any of its data collection procedures or processing in the light of user needs. Obviously, it is still early days in terms of making potential users aware of the benefits that can come from having good, reliable hydrological data, but the HDUGs are an important concept that may have not been exploited enough by the states.

There need to be many more 'drivers' stressing the need for data, both internally in government, for example, through the state planning departments, and external customers, such as industry, agriculture, finance institutions and research. Newsletters, websites, articles in the local newspapers, documentaries on TV, school and public education programmes, celebrations such as Jal Utsav (being co-ordinated by the Consultants in March 2003), can all help to raise awareness generally, as well as promoting and publicising the state water policies. Consultant initiated a number of such activities and these should be continued and extended.

Sustainability: All previously addressed issues considerably influence the sustainability of the Hydrology Information System (HIS). The following is a summary of the impression that the Mission has formed of the sustainability of HIS in each agency. We see good prospects for the sustainability of HIS in Andhra Pradesh (SW&GW), Karnataka (SW&GW), Tanil Nadu (SW and GW), Maharashtra (SW&GW), and in CWRPS. There are reasonable prospects for the sustainability of HIS in Kerala (GW), Gujarat (GW), Orissa (GW), Madhya Pradesh (SW&GW) and in CWC, CGWB, NIH and IMD . Finally, the Mission has some concern for the sustainability of HIS in Kerala (SW), Gujarat (SW), Orissa (SW), Chhattisgarh (SW and GW) and in PCS.

Recommendations: By March 2003 the loan period of the World Bank to India for the Hydrology Project had been extended for another nine months from 1 April 2003 to 31 December 2003. The Mission considered it reasonable to consider the future of any possible technical assistance in terms of the same period Due to the sudden ending of the bilateral development cooperation relationship between Netherlands and India in June 2003, the end date of the Technical Assistance could not further be extended beyond June 30, 2003. and of an extended period that may coincide with or bridge the gap to the possible phase 2 of the Hydrology Project. The primary focus has to be on the sustainability of HIS and the associated management processes and technical procedures within the states and at the central agencies.

Short term (to the end of 2003):

- Assist the states in developing formal QA in connection with validation protocols and procedures

for data collection, processing and communication.

- Assist in setting up a system of on-the-job training of staff responsible for data collection and processing at all levels.
- Ensure the satisfactory completion of the GEMS and WISDOM software by the contractors and the subsequent implementation, maintenance and training.
- Ensure that effective user manuals are in place for all components of the HIS.
- Improve the implementation of Help Desks at divisional, state and national (CWC and CGWB) levels.
- Carry out cultural change workshops in all states, addressing personal and group values, beliefs and attitudes of participants.
- Arrange for more advanced training on hydrology and information systems to be given to post graduate engineers aged 35 or less.
- Help the implementing agencies to develop annual and medium term plans using an adapted version of HIDAP.
- Ensure the operationalization of the HIS national co-ordination committee, the technical secretariat, and the corresponding committees at the state level.

Longer term (2004-):

Promote the need for a more vigorous acquisition of user requirements through HDUGs.

- Introduce lessons learned protocols for all technical and management processes.
- Introduce assessment procedures for the effectiveness of training.
- Work with CWC and CGWB to ensure improved inter-state sharing of data.
- Carry out workshops on marketing data and facilities (eg WQ analysis) and customer needs analysis.
- Put in place procedures and mechanisms such that the technical and procedural manuals can be adapted for Indian practice.
- Promote the establishment of state and national HIS staff groups (practitioners using the software, and collecting and applying data) that include national agencies as well as the state departments.
- Promote and support innovative R&D projects that have a high demand for hydrological data (eg flood forecasting and modelling, river basin management, drought proofing, conjunctive use of surface and ground water).
- Encourage CWC and CGWB to act as professional resource centers for the implementation of the HIS by the states.
- Put in place mechanisms for regularly updating visions, plans and processes related to the HIS.
- Establish a national mechanism for continuing professional development of the HIS personnel at all levels, including Masters and PhD levels.

Source: Review of Technical Assistance, April 2003.

Additional Annex 10. Borrower's Project Completion Report

Government of India,
Ministry of Water Resources,
(Ground Water & Minor Irrigation Wing)
India: Hydrology Project (Cr. 2774 –IN) Project Completion Report.

1. Project Concept/Objective:

1.1 The need for a reliable and easily accessible hydro-meteorological data base for various activities in planning and management of water resources to meet the challenges of ever increasing demand for reliable and good quality water supply for various uses such as Domestic water systems. Agriculture, Industrial and Power generation, is well accepted.

1.2 The main objective of the Hydrology Project was to improve the institutional and organizational arrangements, technical capabilities and physical facilities available for measurement, validation, collation, analysis , transfer and dissemination of hydrological, hydro-meteorological and water quality data, and for basic water resources evaluations within the concerned agencies at Central Government level and in the nine (9) participating States. The project, therefore, aimed at upgrading and expanding Hydrometry and Data Management, Institutional Strengthening with provision for technical assistance and training arrangements to support improvement of institutional and technical capability objectives.

1.3. The Project was launched in December 1995 with International Development Association (World Bank) assistance of SDR 90.1 million. At the time of mid-term review the credit assistance was reduced to 75.1 million SDR due to decrease in cost of computers, overestimation of training targets and increase in dollar parity with the rupee. The project was originally scheduled to be implemented in a period of 6 years (1995/96 to 2000-2001). The credit closing date has been extended twice first up to March 2003 and finally 31st December, 2003 for fully operationalizing the infrastructure and softwares developed under the project. The Government of Netherlands has provided a grant-in-aid of Euro 14.84 million in the form of Technical Assistance (TA) under a bilateral Indo-Dutch agreement, in the form of Consultancy services and overseas trainings. The TA started in 1996 and the closing date December 2001, was extended upto March 2003 co-terminus as World Bank assistance. The TA was closed w.e.f. 30.06.2003.

2. Project Design and Implementation:

2.1 As stated in SAR, it was considered that keeping in view the complexity of institutions and management challenges and involvement of a number of agencies in the project, a flexible responsive approach would be appropriate. The project implementation and inter related strengthening of capabilities of each implementing agencies (IA) was designed to be steered and managed through a “Process Approach”. It was accordingly considered that it would be best to take up specific work programmes through continuous monitoring, feed back and adaptions as experience is gained while the general objectives and direction of the project are defined.

2.2 It has been experienced that the built in flexibility in such an approach has been very useful in implementation of a project of this nature.

2.3 The main activities taken up under the project to achieve the desired objective were:-

i) Upgrading and establishment of appropriate River Flow Observation network for hydro-meteorological observation and data collection and improvement/establishment of surface water laboratory facilities.

ii) Upgrading and establishment of appropriate Ground Water Observation Network for data collection and improvement in ground water Laboratory facilities.

iii) Upgrading Data Management Facilities involving data processing, storage and transfer/communication facilities/network.

iv) Strengthening institutional arrangement through additional manpower and capacity building to enable operation and management of the infrastructure built through the project.

v) Organizing required formal training and on the job training.

vi) Other related activities e.g. R&D activities, procurement of equipments etc.

2.4 The performance of various activities have been quite satisfactory and the details about progress and project completion are given under paragraph 3 hereinafter.

2.4.1 In view of the complex nature and diverse activities involved in a project like this involving a number of agencies with spatial and thematic overlap of activities to be taken up, the need for strong co-ordination of activities and management was accepted in the project design as contained in the SAR. It has been observed that such an approach has been beneficial in delivering the targeted result. The project execution authority was devolved at central, state and project level and in each State two Participating agencies (viz SW&GW) were involved apart from several central agencies designated as nodal for particular subjects. The following major committees were very crucial towards successful implementation of the project.

- National Level Steering Committee (NLSC) under the chairmanship of the Secretary, Ministry of Water Resources, Govt. of India to resolve project policy, storage and generic implementation issues.
- National Co-ordination Committee (NCC) under the chairmanship of Member (RM), CWC for overall project coordination and advisory function to state level coordination groups.
- National Hydrology Training Committee (NHTC) under the chairmanship of Commissioner (WM), MOWR to review and approve training courses, workshop and seminar with related issues.
- R&D Evaluation Committee under the chairmanship of Member (RM), CWC to review and approve R&D proposals taken up under the project.

2.4.2 The Project Coordination Secretariat (PCS) headed by the Commissioner (WM) MoWR was an important nodal point towards successful implementation of the project. The PCS has provided effective support in project implementation through maintaining direct linkage with the W.B. on the one hand and handling matters related to procurement etc. processed by various agencies.

2.4.3 The pace of implementation in the initial years of implementation was comparatively slow. The reason for the same was a time consuming process in establishing observation network requiring systematic finalization of location, rationalization through joint visits, review by state and central agencies. However,

the works were carried out systematically inspite of some delay as the central agencies (viz., CWC, CGWB and IMD) possess expertise in the field.

2.4.4 In procurement, the initial delays were due to delay in finalizing specifications for different equipment, some of which were new to the IAs, by specification committee and consultants.

2.4.5 From the experience above, it appears that some initial period in the project needs to be provided for this kind of preparatory works while designing such a project. Also, it could have been more effective if the Central Coordinating Office (PCS) would have been entrusted with project implementation management in a broader manner supported by a project management consultant to oversee co-ordination of the various project management issues. As per the vision statement approved for HIS Coordination Secretariat (presently PCS), in the post project period one officer of the level of Scientist C from Central Ground Water Board and one officer of the level of Assistant. Director from Central Water Commission need to be continued for carrying out coordination with the nodal central agencies namely – CWC for Surface Water, CGWB for Ground Water and IMD for Meteorological aspects. The project finance management during the project period also would have needed an appropriate system rather than the coordination left to be consultants alone.

2.4.6 The project being the first of its kind and of a complex nature from the point of view of creation of infrastructure for data network related to different agencies, it was not easy to organize, execute and monitor various components of works. But the IAs have come out with success stories inspite of various constraints with the ultimate benefits in mind.

2.4.7 The main objective of the project i.e. setting up of an efficient Hydrological Information System (HIS) has been achieved and a versatile HIS is in place. The data management system is functioning although some related components e.g. GIS interface GEMS are not fully operational as yet as a result of various constraints in processing, statutory clearances required from other ministry etc.

3. Project Performance:

3.1 The project performance is being monitored on a quarterly basis through a Management Information System (MIS) developed by the consultants. The Consultants have withdrawn from the project since 30th June, 2003; however, the MIS analysis is being carried out by the PCS, although appropriate handing over was not done by the Consultants.

3.2 The progress of infra-structure development works are very good and almost fully achieved. Almost all the agencies are well into Phase II of the Project although there was some shortfall in targeted works for Kerala, Orissa and IMD as a result of some internal constraints. However, there is no shortfall in performance of I.M.D. in Training and Studies and incremental staffing (recurring costs) out of the four sub-heads. The percentage allocation of funds for Orissa and Kerala is comparatively low and, therefore, this shortfall does not significantly alter the overall project performance.

3.3 As of September,2003, full targets have been achieved in Establishment of River Gauging Sites, Meteorological Stations and Groundwater Observation Wells; 94% Water Quality Labs have been established; 98% of buildings have been completed, 95% of computers and 92% of vehicles are operational. Over 9000 staff were trained and about 95% training targets have been achieved overall. There is some savings in items like procurement of computers which is mainly due to reduction in costs. Against the revised allotment of Rs.5804.03 million, the expenditure upto September 2003 is Rs.5643.34 million which is about 97%.

3.4 The yearwise expenditure, category-wise allotment/expenditure and agencywise reimbursement claimed/reimbursed are given at Annexures-3, 4 & 5 respectively. The abstract of overall progress on Infrastructure Development upto September 2003 towards completion and IA-wise summary is at Annexure-1. Other IA-wise/overall performance is at Annexure-2. At the time of mid-term review the total cost of the project was estimated as Rs.611.67 crores. This was reviewed by the Ministry of Water Resources in October 2002 while forwarding the case for extension to World Bank. As per this estimate the revised allotment was Rs.5800.4 million spent in the balance project period i.e. December 31, 2003. Component-wise fund utilization upto September 2003 is quite satisfactory and is generally about 95% level. The total expenditure upto September 2003 is Rs.5644 million which is 97% of the revised allotment. The final allotment of the project is Rs.6020 million (tentative).

3.5 Uniform softwares developed under the project have been used by the I.As. Surface water and groundwater manuals have been prepared and required protocols have been formulated.

3.6 As per the reimbursement status (available from the World Bank) against the total credit of Rs.75.1 million SDR, disbursement as on 06.11.2003 is Rs.69.63 million SDR leaving an undisbursement claim of Rs.5.466 million SDR. As per the information from the IAs, the reimbursed amount is Rs.3996 million against claim preferred for Rs.4114 million. Considering a time gap of about 4 months required for consolidating and processing reimbursement claims by the agencies, it can be presumed broadly that expenditure incurred upto June 2003 has been reimbursed. The projected expenditure from October to December 2003 is Rs.376 million. Considering a reimbursement rate of about 75% and exchange rate of 1 SDR to Rs.65, amount of reimbursement for a 3 months period (October to December) works out to Rs.4.34 million SDR. Therefore, the balance reimbursement for a six month period considered to be still outstanding can match the undisbursed amount of Rs.5.466 million SDR. Thus the total credit is likely to be fully utilized by the end of project period.

3.7 Operationalization of the two main softwares WISDOM and GEMS is a very crucial activity under the project. Both these softwares have been installed at different places.

WISDOM Software has been installed in all locations by February-March, 2003. The revised version of WISDOM 1.2 has been released/installed in September 2003 after certain modifications/fine tuning. An eight day refresher training course at New Delhi will be held on December 2003 for the participants from all the Data Storage Centres.

Installation of the GEMS software after rectification of initial difficulties and refinements has been completed on all sites. A revised version is also to be installed by November 30, 2003. Various reports and maps are being generated utilizing this software at NDC Faridabad.

3.8 Hydrological Data User Groups (HDUGs) have been formed in all the States and central level with representatives of governmental and non-governmental organizations.

The data generated under Hydrology Project has been successfully used in the following fields which have direct as well as indirect impact on social sector:-

a) <u>Monitoring of droughts and floods</u>

(i) 'Neeru-Meeru' programme in Andhra Pradesh and 'Pani Roko Abhiyan' in MP for tackling drought.

(ii) Integrated River basin studies for Sabarmati basin in Gujarat and Upper Godavari basin in Maharashtra.

b) Optimum design of water conservation /control and highway structures

(i) Proper design of water conservation structures of over 13,000 check dams, re-designing of earth dams and rain water harvesting, e.g. check dams etc.

(ii) Planning of lower Kolar, Parvathi and Kalisindh dam in Madhya Pradesh.

(iii) Evaluation of impact of rain water harvesting structures on ground water recharge in AP, Karnataka, Gujarat, Maharasthra and CGWB, extent of sea water ingression along with coast in TN and AP.

c) Planning on inter state rivers

HP data has been used for river flow diversion studies for Mahadayi river, an inter state river of Goa & Karnataka.

d) Ground Water resource assessment and auditing at district/block/village and watershed levels

HP data has been used for development of a comprehensive ground water bill in Tamil Nadu.

e) Water Quality monitoring related to public health

(i) Water Quality analysis, indicated high levels of Nitrate, Fluoride and BOD/COD in some districts and 11 takes in the vicinity of Bangalore city.

(ii) HP data used by the Pollution Control Boards and PHE Deptts. For taking appropriate actions on polluters.

(iii) Detection of Arsenic/Fluoride in Madhya Pradesh and Fluoride in Kerala.

f) Supporting framing of state water policies, acts and regulations

(i) HP data is facilitating ground water regulatory authorities in Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu in their decision making.

(ii) HP data used for development of Master Plan for Krishna Basin, water availability studies for power projects.

(iii) Acts/Policy changes in Tamil Nadu, Maharashtra and Kerala are being effected through HIS dissemination and public awareness campaigns.

3.8 Websites have been launched at AP (SW&GW), Guj (GW), Ka (GW), Ke (SW), Mh (SW&GW) and Or (SW&GW). These websites have been used to disseminate HP data. Guj (SW), Ka (SW), Ke (GW) , MP (SW&GW), Ch (SW&GW), TN (SW/GW) are at an advanced stage of launching their website. Metadata has been placed on the web wherever the website is launched. Data and information are also disseminated in various forms: Year Book in many states; district-wise GW year-books (Ka, Guj and AP);

Monthly Reports (AP); and Newsletters/stickers/posters (AP,TN). Water awareness programs are also used as a platform to bring the HP data into public domain (AP, Ka, TN and Mh). *Jal-Utsav*--, a public awareness campaign -- was held all over the HP agencies during March 22 (World Water Day)-April, 25, 2003 to sensitize the public at large on the need for water conservation and judicious management.

4. Other experience/Lessons learnt

4.1 As role of PCS in overall coordination, management, monitoring at national level and providing uniformity in project development activities is vital, there is a need to suitably strengthen the PCS to enable taking up this responsibility in effective manner wherever such a project is taken up.

4.2 Appropriate training to the personnel in implementing agencies concerned with procurement and related matters about bidding procedures and intricacies in the beginning of the project could have been beneficial. Although the same set of personnel being responsible for different works (e.g. procurement and civil works/installations) was a constraint, this requirement will have to be considered from project management point of view for any future project.

4.3 Institutional strengthening through provision of additional personnel was a difficult task due to various reasons like, ban on recruitments, abolition of posts etc. Therefore, feasibility about deployment of staff need to be considered in more details and agreed upon by the IAs at the Appraisal stage so that project implementation becomes more systematic and sustainability is improved.

4.4 The probable risk of non utilization of HIS data does not exist any longer as data of HIS has already been utilized for various purposes.

4.5 In procurement, bids from reputed suppliers have to be sometimes declared non-responsive as a result of variations which are insignificant towards the quality of bid. This leads to delay in procurement and related project activities. It will be worthwhile to consider necessary revision in procurement procedure so that some such provisions can be suitably modified.

4.6 The amount involved in many of the ICB packages was too small to evoke interest from overseas bidders. The foreign bidders who have their representatives/authorized dealers in India normally bid for these procurements through ICB. The stipulations in Credit Agreement need to be made a little more flexible, so that provision for change to NCB in special cases with appropriate scrutiny and approval from the Bank is incorporated.

4.7 The consultancy services provided under the Hydrology Project provided assistance to the IAs in understanding various activities.

4.8 As a result of nature of project, a direct cost benefit assessment of the project is difficult. However, the project has rendered immense benefit by setting up a national hydro-meteorological network within the project boundary, development and integration of data entry, data storage, and communication network providing management facility. The institutional strengthening component has enabled creation of supporting manpower structure to sustain the HIS network although the full targeted objective for additional manpower could not be achieved due to various regulatory constraints in the Governments. However, the staff component related to the project is capable of operating its various components of the HIS effectively. The project also has generated due kind of enthusiasm in the operating personnel who are also involved in using the data in various ways and are undertaking data utilization for various purposes on their own. The HIS data has already been utilized for problem solving and planning purposes.

4.9 The Project period of six years was required to be extended as this ambitious project was to be completed. The experience of this project will be very useful in monitoring and management of any future project of this type in much more effective manner as the critical issues, requirements etc. are well anticipated/documented now.

4.10 In general the IDA performance in supporting and supervising the project has been positive and quite helpful. A rational assessment from IDA which has led to extension to the project period has enabled successful completion. However, the IAs have experienced difficulties at times in smooth flow of funds during implementation. A mechanism enabling reasonable amount of advance with the IAs will result in better implementation.

4.11 Annual visits of WB Supervision Mission have been very helpful towards Project Monitoring and Implementation.

4.12 Technical assistance from Government of Netherlands has been very helpful in implementation of monitoring of Hydrological project. It has been very useful in planning net work, providing software, preparation of standard manuals/guidelines for execution of HIS and trainings to the implementing agencies in various HIS activities. However, consultant contribution need to be considered, inter-alia, to serve capacity building endeavor so that the support can benefit in post project operation.

4.13 There has been significant technical in puts provided by the consultants (RNE) to the implementing agencies of the HP. Some of these are, framing of specification of all equipments, preparation of guidelines/manuals for installation, operation and observations, introduction of computerized Hydrology data processing, specification for dedicated data processing softwares, preparation of standard data validation and processing procedure and manuals, and assistance in planning and implementation in extensive training programme and development of large number of training modules. However, the consultants' performance towards the end of the project period in areas like validation of data, in inter agency data validation and finalization of ground water manual was not matching the requirements. The consultants input was quite significant in providing thrust towards implementation in the initial years; however, a proper withdrawal strategy was a major shortcoming which will need to be properly framed for any future project.

5. Sustainability in the post project period

5.1 Hydrology Project has strengthened the hydro-meteorological monitoring network to have high quality, better frequency and spatially represented water levels and water quality data and avoids duplication in efforts in data collection by the state and Central agencies. All the agencies have confirmed that they would be taking necessary action for ensuring sustainability of the project.

For sustenance and mainstreaming of the HP activities beyond project closing date, the agencies have taken following measures.

5.2 All the HIS activities have been included in the annual activities in the post project period.

5.3 Provisions are made in the agencies' annual budget for Operation and Maintenance and the agencies are confident about its approval in the budget for 2004-05.

5.4 Training plans for the post project period has been prepared and fund provisions have been made in

the normal budget allocation for 2004-05.

5.5 Necessary administrative measures are being taken to retain the trained staff in place in the post project period.

5.6 It has been decided that National Level Steering Committee (NLSC) would continue in the post project period as HIS – Coordination Committee (HIS-CC) and PCS as HIS-Coordination Secretariat (HIS-CS) with similar functions. Adequate funds have been provided for in X Plan period. The agencies also confirmed long term continuation of State Level Coordination Committee (SLCC). Other measures for long term sustainability are also being taken by IAs.. These include A.P. (hiring of vehicles for next five years, earmarking year-wise O&M funds for all the years under the X Plan); Gujarat (post project training under WALMI); Karnataka (periodic HIS divisional level workshop); Maharashtra-GW (establishment of a consultancy cell; change management process and participation and demand driven data collection and management process) etc.

5.7 Utilisation of the two main softwares developed under the project namely WISDOM and GEMS is an important activity in the post project period. Both the softwares have been installed in all locations by respective nodal surface water and ground water agencies (CWC and CGWB). Although a number of trainings have been conducted on these softwares, the training activities and organizing refresher course will be continuing activity in respect of these softwares for effective operation. Also because of the comprehensive nature and capability of the softwares, coming out which revised version of the software is a continuous process after incorporating suitable modifications etc. The High Level Technical Group (HLTG) will also function as the Technical Advisory Group for efficient functioning of these softwares.

6. **Principal gains:**

6.1 As covered in the main report, principal gains from Hydrology Project are:

- Establishment of Monitoring network with domain specific data collection infrastructure, integration of monitoring network amongst different agencies in same domain and uniform and standardized measurement techniques.
- Establishment of HIS involving Computerization of historical and current data; advance level of data processing and analysis through required hardware and software reducing time lag in processing and inferences.
- Establishment of data centers and inter-agency data exchange facility.
- Institutional Strengthening with incremental staff and Extensive skill and capacity building in staff through multiple training modules.
- Improved data dissemination and making it user friendly with help of HDUG.

6.2 Pre and Post Project Scenario – A comparison of the SW, GW, Meteorological, Water Quality monitoring networks along with data processing and dissemination prior to inception of Hydrology Project and the status in the post project scenario establishes significant gains from the project in the hydrometeorological system which is the backbone for many water sector activity. The main observations are given at Annexure-6. It is seen that the monitoring network prior to hydrology project was in a relatively unorganized stage with non uniform procedures between agencies which was improved upon by state of art equipment, scientifically located observations sites, uniform procedures between agencies and collection of reliable high frequency data and trained staff. Replication of the system/network established under the project will provide a versatile HIS at the national level.

6.3 The Water Quality Assessment Authority (WQAA) under the Ministry of Environment and Forests (MOEF) with MOWR has become operational with a clear objective of improving water quality regime in the country. State Level Water Quality Review Committees (WQRC) have been set up in most of the States and union territories including the nine HP states. The HIS under HP will be an important facility to provide immense support to this endeavour.

6.4 Realization of scarcity value of water with passage of time and increase in population has led to appreciation about importance of hydrometeorological data on which various decision about water utilization planning, development and management is dependant in the country. As a result of the National Water Policy and Water Vision 2050 (MoWR), the future perspective about water requirement and need for management is well understood also by a large number of NGOs and people in general as stakeholders. All these have boosted interest in HIS created at different levels. In line with the International Year of Fresh Water 2003, India is also observing 2003 as the year of Freshwater. Apart from increased awareness about water related activity in general, there has been increased plan of action at various water related agencies including Govt. Organizations. Keeping in view Millennium Development Goals and other international initiatives, development through the project is a very useful step forward in the water sector activity in the country and has opened up avenues towards integrated water resources management. Therefore, the impact of the project on the water sector is a very positive one.

Additional Annex 11. Borrower's Summary of Post Operation Plan

Post Project Operation Plans (Summary)

Hydrology Project brought in changes to strengthen the monitoring network to have high quality, better frequency and spatially represented water levels and water quality data and avoids duplicity in data collection by the state and Central agencies. These agencies have realized the advantages of the HP and many of them have encompassed these in their regular activities. For sustenance and mainstreaming of the HP activities beyond project closing date, these agencies have taken following measures.

- All the HIS activities have been included in the annual action plan during post project year

- Provisions are made in the agency's annual budget for O&M and the agencies are confident about its approval in the budget for 2004-05.

- Training plans for the post project period have been prepared and fund provisions have been made in the normal budget allocation for 2004-05.

- Necessary administrative measures are being taken to retain the trained staff in place in the post project period.

- As regards providing adequate specialists staff, fresh recruitment is difficult. The posts would be filled up by redeployment and outsourcing with training.

- It has been decided that National Level Steering Committee (NLSC) would continue in the post project period as HIS – Coordination Committee (HIS-CC) and PCS as HIS-Coordination Secretariat (HIS-CS) with similar functions. A vision paper has been approved for HIS-CS and adequate funds have been provided in X Plan.

- Most of the agencies also confirmed long term continuation of State Level Coordination Committee (SLCC) and formation of Water Quality Review Committee as a standing committee beyond the Credit closing date. In many agencies, certain initiatives are being taken which would lead to long term sustainability. These include A.P. (hiring of vehicles for next five years, earmarking year-wise O&M funds for all the years under the X Plan); Guj (post project training under WALMI); Ka (periodic HIS divisional level workshop); Mh-GW (establishment of a consultancy cell; change management process and participatory and demand driven data collection and management process) etc.

- The Water Quality Assessment Authority (WQAA) under the realm of the Ministry of Environment and Forests (MOEF) has become operational with a clear mandate of protecting the quality of national water resources. State Level Water Quality Review Committees (WQRC) have been set up in most of the States and union territories including the nine HP states. Close linkages will have to be established with respective State Pollution Control Boards.

- Prospects of mainstreaming and sustainability of HP activities looks encouraging. Task groups have been formed in Andhra Pradesh, Gujarat, Maharashtra, and Karnataka to initiate and manage the change process for sustainability. In other states the agencies have taken the responsibility of mainstreaming through interactive awareness. Action plan include:

- Creating link data bases and managing

- Use data for action plan for drought management, drought monitoring, artificial recharge/rain water harvesting and resource estimation

- Interaction with stake holders/water users

- Creating awareness and knowledge sharing.

Detailed agency wise Post Project Operation Plans have been prepared for all the agencies and a copy of the same was presented to the ICR mission.