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PERFORMANCE AUDIT REPORT

NEPAL

**NARAYANI III IRRIGATION PROJECT
(CREDIT 1715-NEP)**

**SUNSARI MORANG IRRIGATION II PROJECT
(CREDIT 1814-NEP)**

AND

**SUNSARI MORANG HEADWORKS PROJECT
(CREDIT 2430-NEP)**

August 21, 1998

Operations Evaluation Department

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Currency Equivalents

Currency Unit = Nepalese Rupee (NRs)

1987	US\$1.00	NRs. 22.30
1988	US\$1.00	NRs. 26.09
1989	US\$1.00	NRs. 28.55
1990	US\$1.00	NRs. 32.18
1991	US\$1.00	NRs. 43.26
1992	US\$1.00	NRs. 47.59
1993	US\$1.00	NRs. 49.02
1994	US\$1.00	NRs. 50.00
1995	US\$1.00	NRs. 50.00

Weights and Measures

1 meter (m)	=	3.28 feet
1 kilometer (km)	=	0.62 miles
1 hectare (ha)	=	2.47 acres = 1.50 bighas
1 million cubic meter (Mm ³)	=	810 acre-feet or 35.3 Mft ³
1 cubic meter per second (m ³ /s)	=	35.31 cubic foot per second (cfs)
1 cubic foot per second (cfs)	=	0.028 cubic meters per second (m ³ /sec)
1 metric ton	=	2,205 pounds

Fiscal Year

July 16 - July 15

Abbreviations and Acronyms

ADB	Asian Development Bank
CMC	Chatra Main Canal
DBC	Don Branch Canal
ERR	Economic Rate of Return
HMGN	His Majesty's Government of Nepal
ICB	International Competitive Bidding
ICR	Implementation Completion Report
IDA	International Development Association
M&E	Monitoring and Evaluation
NIP	Narayani Irrigation Project
NEC	Nepal Eastern Canal
NZIDB	Narayani Zone Irrigation Development Board
NZIDP	Narayani Zone Irrigation Development Project
O&M	Operation and Maintenance
PAR	Performance Audit Report
POE	Panel of Expert
SAR	Staff Appraisal Report
SDC	Swiss Development Cooperation
SMHP	Sunsari Morang Headworks Project
SMIDB	Sunsari Morang Irrigation Development Board
SMIP	Sunsari Morang Irrigation Project
<i>kharif</i>	Wet Season (June to October)
<i>rabi</i>	Dry Season (November to February)

Director-General, Operations Evaluation	:	Mr. Robert Picciotto
Director, Operations Evaluation Department	:	Ms. Elizabeth McAllister
Manager, Sector and Thematic Evaluations Group	:	Mr. Roger Slade
Task Manager	:	Mr. G. T. Keith Pitman

The World Bank
Washington, D.C. 20433
U.S.A.

Office of the Director-General
Operations Evaluation

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Performance Audit Report on Nepal
Narayani III Irrigation Project (Credit 1715-NEP)
Sunsari Morang Irrigation II Project (Credit 1814-NEP)
Sunsari Morang Headworks Project (Credit 2430-NEP)

Attached is the Performance Audit Report on three irrigation projects in Nepal, the Narayani III Irrigation project, the Sunsari Morang Irrigation II project and the Sunsari Morang Headworks project prepared by the Operations Evaluation Department (OED). Narayani III was approved in FY86 and supported by a Credit for US\$24.5 million and was cofinanced by a grant of US\$7.5 million from the Government of Switzerland which was administered by the Swiss Development Corporation (SDC). The credit closed one year late in June 1995, at which time US\$17.1 million of the credit and US\$6.3 million of the grant was disbursed, and the balances were canceled. The Sunsari Morang-II was approved for a credit of US\$40 million in FY87 and US\$39.6 million was disbursed. It was closed on schedule in November 1995, at which time the undisbursed balance was canceled. The Headworks Project was approved for a credit of US\$28 million in FY93 and closed as planned in December 1998 when an undisbursed balance of US\$2.3 million was canceled.

The main objectives of Narayani III and Sunsari Morang II were to increase dry season agricultural production; provide supplemental irrigation during the monsoon season; reduce risks to cropping and physical infrastructure by improving flood protection and drainage; and turn over operation and maintenance (O&M) of the system at the tertiary level to farmer groups. A major feature was remodeling the existing irrigation system to simplify management and reduce inequities in deliveries of water. In addition, Sunsari Morang II aimed to solve a severe siltation problem.

Narayani III is unsuccessful primarily because farmers cannot rely on the erratic water supplies. The project is supplied through the 94 km Don Branch Canal (DBC) linking it across several large rivers to India's Gandak Barrage. The DBC suffers from excessive siltation and is periodically cut by floods. Despite a bilateral agreement, water releases from India to Nepal are unpredictable, and in the 15 years preceding the project, averaged slightly more than half the amount agreed. Ignoring this history, the project was appraised on the assumption that the agreed amount of water would be supplied. Major floods breached the DBC and main project canals just as Narayani III was approved in 1986 and water supplies were not resumed until mid-1991.

Implementation of Narayani III was fraught with problems. Inadequate counterpart funding slowed both construction and O&M as did shortage of fuels and construction materials. Irrigation and drainage design preceded consultation with farmers and later caused problems. Bids for civil works were 80 percent more than appraisal estimates and required major *ad hoc* project redesign in the first year. Although in 1988 the Swiss Development Corporation, which was administering Swiss cofinancing of the project, seriously questioned the validity of Narayani III, the Bank took until 1993 to reformulate the project. The project area was reduced by a third (to 24,500 ha) to match the water supplies, and the river training and flood protection components were increased.

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Canal remodeling and flood protection and river training works was mostly completed as planned, but little road improvement was done. In line with government's new irrigation policy, responsibility for construction of the tertiary canal system was transferred to farmers and two thirds remain unfinished. The new supply-based irrigation system and water users' groups (WUGs) are ineffective because of the water supply problem. There is no attempt at cost recovery. Project benefits are difficult to assess as monitoring and evaluation was poor. In the absence of assured surface water supplies, farmers have installed their own wells, which account for about 40 percent of agricultural production. The audit estimates that the economic rate of return (ERR) is 5 percent.

OED rates the outcome of Narayani III highly unsatisfactory. Institutional development was negligible and sustainability is unlikely. Bank performance was highly unsatisfactory primarily because of extremely poor quality at entry and the seven years Nepal was saddled with a non-performing project while fundamental design problems were addressed.

Sunsari Morang II was to provide secure irrigation to 16,700 ha and upgrade facilities provided by the stage I project over 9,750 ha. Although the second phase project was supposed to build a dredged desilting basin in the first two years, government, in view of its experience of the Bank's technical solutions at Narayani, insisted that more options be carefully appraised. A solution (the Headworks Project) was finally agreed four years into the project. In the meantime, although civil works were substantially complete, these were ineffective because there was insufficient funding of O&M to clear shoals from the canal intake and desilt the project's canals. As at Narayani, detailed design preceded users' group formation and caused disputes with farmers—and they were not convinced the sediment problem would be solved. For these reasons, and gross underfunding for land acquisition (actual costs were 750 percent of appraisal estimates), farmers resisted completion of drainage works and the lower-lying areas are subject to flooding. As a result, project performance continued to deteriorate until 1993.

Following approval, the Headworks project was quickly and successfully implemented. The canal intake was moved upstream, a new stilling basin was installed, and the siltation problem was resolved. Farmers have renewed confidence, and agricultural production is up. By 1997, almost 90 percent of the Sunsari Morang's users' groups have agreed to be responsible for O&M and one third of the area has been completely turned over to them. However, project management is weak and staff turnover is high. Inadequate budgets for O&M are again jeopardizing system integrity and government is looking to a further phase of IDA funding to meet medium-term O&M needs. Little progress has been made on cost recovery, not least because government is ambivalent about enforcing collection and upholding the authority of users' groups to manage supplies. Treated as standalone projects, Sunsari Morang II has an ERR of 15 percent and the Headworks Project an ERR of 42 percent. If all three phases of the project are treated as a single investment, the ERR is 30 percent.

OED rates the outcome of Sunsari Morang II and the Headworks Project satisfactory. Institutional development is rated modest for Sunsari Morang II and improved to substantial for the Headworks Project. Sustainability is rated uncertain for both projects because of the unresolved O&M issues.

There are six main lessons: (i) project outcome is highly correlated with the integrity and timeliness of independent quality assurance review both at appraisal and during the first few years of project implementation; (ii) speed is sometimes the enemy of quality and great care must be taken also that streamlined appraisal and supervision does not replace substantive review; (iii) formation of water users' organizations should precede detailed design; (iv) no matter how well designed, participatory irrigation management will not work if water supplies are uncertain; and (v) the existence of an international water treaty defining water rights is no guarantee that those rights will be observed.

Robert Picciotto
by Elizabeth McAllister

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Principal Ratings

NARAYANI III IRRIGATION PROJECT

	<i>ICR</i>	<i>Audit</i>
Outcome	Unsatisfactory	Highly Unsatisfactory
Sustainability	Uncertain	Unlikely
Institutional Development	Modest	Negligible
Borrower Performance	Unsatisfactory	Unsatisfactory
Bank Performance	Unsatisfactory	Highly Unsatisfactory

SUNSARI MORANG IRRIGATION II PROJECT

	<i>ICR</i>	<i>Audit</i>
Outcome	Satisfactory	Satisfactory
Sustainability	Uncertain	Uncertain
Institutional Development	Modest	Modest
Borrower Performance	Satisfactory	Unsatisfactory
Bank Performance	Satisfactory	Satisfactory

SUNSARI MORANG HEADWORKS PROJECT

	<i>ICR</i>	<i>Audit</i>
Outcome	Satisfactory	Satisfactory
Sustainability	Uncertain	Uncertain
Institutional Development	Modest	Substantial
Borrower Performance	Satisfactory	Satisfactory
Bank Performance	Satisfactory	Satisfactory

Key Staff Responsible

NARAYANI III IRRIGATION PROJECT

	<i>Task Manager</i>	<i>Division Chief</i>	<i>Country Director</i>
Appraisal	E. Gazit	C. Helman	J. Kraske
Midterm	O. Myint	R. Slade	J. Kraske
Completion	O. Myint	S. Barghouti	H. Vergin

SUNSARI MORANG IRRIGATION II PROJECT

	<i>Task Manager</i>	<i>Division Chief</i>	<i>Country Director</i>
Appraisal	Y. K. Choi	C. Helman	J. Kraske
Midterm	B. Albinson	C. Helman	J. Kraske
Completion	O. Myint	S. Barghouti	H. Vergin

SUNSARI MORANG HEADWORKS PROJECT

	<i>Task Manager</i>	<i>Division Chief</i>	<i>Country Director</i>
Appraisal	B. Albinson	C. Helman	J. Kraske
Completion	O. Myint	S. Barghouti	H. Vergin

Preface

This Performance Audit Report (PAR) for the Nepal Narayani III Irrigation Project (Credit 1715-NEP), Sunsari Morang Irrigation II Project (Credit 1814-NEP), and Sunsari Morang Headworks Project (Credit 2430-NEP) was prepared by the Operations Evaluation Department (OED) of the World Bank.

The PAR is based on the Implementation Completion Reports (ICR) prepared by the South Asia Regional Office, Staff Appraisal Reports (SAR), and legal documents; on a review of the projects' files, supervision reports, and project documents; and on the findings of an OED mission to Nepal in January 1998. During this mission, the OED audit team met officials of the central and state governments, the implementing agencies, and project beneficiaries. The collaboration of these officials and other persons is gratefully acknowledged.

The draft PAR was sent to the government for comments. The comments received from His Majesty's Government of Nepal's Ministry of Finance, Ministry of Water Resources and Ministry of Agriculture are reproduced as Annex D.

1. Introduction

1.1 Nepal has abundant water resources capable of irrigating 8 to 10 million hectares (ha) but limited irrigation development potential. About 40 percent of the nation's 2.6 million ha of irrigable lands are developed; 64 percent of this lies in the Terai plains below the Siwalik foothills of the Himalayas. Development of Nepal's rivers for irrigation is costly because of the large diversion structures needed to manage the annual floods, a problem made more difficult by the large quantity of sediment these waters carry. A further constraint is the need to have India's agreement to any diversion of these trans-boundary rivers.

1.2 Nepal implemented its first public sector irrigation projects in the 1920s with assistance from the Government of India. India made its expertise and finance available to Nepal in recompense for water rights for much larger irrigation schemes in India, an approach still in use. The three credits covered by this audit were initiated following the Kosi Project Agreement of 1954, which includes the 53 kilometer (km) Chattra Canal Project in eastern Nepal that supplies water to the Sunsari Morang Irrigation Project (SMIP), and the Gandak Barrage-Eastern Canal System Agreement of 1959, which includes the Narayani Irrigation Project (NIP).

1.3 Project design was based on the Indian policy of spreading water relatively thinly over large areas to provide drought insurance for wet-season (*khari*) crops. Distribution systems were developed only down to blocks of 700–1,000 ha for the Narayani project and 200 ha for the Sunsari Morang project. Below this level farmers were expected to build water distribution systems, but failure of this concept meant that much of the potential command went undeveloped.

1.4 In the late 1970s, His Majesty's Government of Nepal (HMGN), with assistance from the World Bank and Asian Development Bank, set out to extend the distribution system to the 50 ha level, organize water users' groups, and provide agricultural support services. More recently, the policy has been to extend irrigation infrastructure to serve areas of 28 ha (chaks) subdivided in 4 ha subchaks and to upgrade the quality of support services.

1.5 Both Narayani and Sunsari Morang irrigation projects suffered from inadequate hydraulic design. In both, the main canals carry diverted river water toward the east and run across the regional drainage pattern. The situation at Narayani is made more difficult because the main canal, the 75 km Nepal Eastern Canal (NEC), is fed by the Don Branch Canal (DBC), which traverses 94 km of Bihar state in India. Ensuring cross-drainage structures that are sufficiently robust has been a major problem. Severe monsoonal floods breached these canals on numerous occasions, and in Narayani the main canals have been disabled for months at a time.

1.6 The high silt loads carried by the Gandak and Kosi rivers—two of the largest northern tributaries of the Ganges—compound this problem. While NIP is partly buffered by being 94 km downstream of the Gandak offtake, sedimentation creates a chronic maintenance problem in the Indian DBC and within the NEC distributaries. At SMIP the situation is worse because it is adjacent to the Kosi River and sedimentation within SMIP completely smothered parts of the distribution system. More critically, the high sediment load in the Kosi River caused formation of sand bars that periodically closed the entrance to the intake canal thus depriving SMIP of water.

1.7 As designed, both irrigation projects were continuous flow systems in which water supplies were generally insufficient for rice irrigation and seldom reached the ends of the system. Sedimentation also reduced canal conveyance capacity. The solution adopted was to rotate the full supply to sections of the system to enable rice cultivation and equitably distribute it within them. To achieve this, the canal freeboard was increased to improve conveyance capacity, improved flow regulation structures were installed, and more attention was paid to desilting. The tertiary canal system serving 28 ha blocks was converted to rotational water supply and operated on an "on-off" basis. Institutional development programs for farmers and government irrigation staff supplemented these engineering improvements with varying degrees of success.

1.8 Public irrigation in Nepal is the responsibility of the Ministry of Water Resources through its Department of Irrigation, Hydrology and Meteorology. Responsibility for Narayani and Sunsari Morang projects rests with their semi-autonomous Boards which consist of representatives from the various ministries and other agencies concerned with rural development. The Boards are chaired by the Secretary, Ministry of Water Resources, and the Project Manager/Director is the Member-Secretary. The Boards' principal function is to approve annual budgets appoint senior staff, award large contracts, coordinate policy matters on programming, budget, and finance; monitor and evaluate progress; and determine the level of water charges.

1.9 Each project has had three successive Bank credits to improve performance, NIP since 1973, and SMIP since 1978. Each has similar objectives, design, participatory involvement of farmers, and operation and maintenance (O&M) procedures. While the results of the investments in SMIP have shown a steady improvement and the Region rates the third phase as satisfactory, the performance of NIP has steadily deteriorated and the third phase is rated as unsatisfactory. The primary purpose of this performance audit is to account for these divergent outcomes and see what lessons can be drawn.

NARAYANI III IRRIGATION PROJECT		
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Credit no: 1715-NEP	Project Costs	US\$ million	
Approved: June 1986		Appraisal	Actual
Effective: March 1987	Total	35.5	25.5
Closed: June 1995 (1 year behind schedule)	IDA Credit	24.5	17.1
Cofinancing: Swiss Development Corporation	Cofinancing: SDC	7.5	6.3

Objectives:

- Increase dry season agricultural production by introducing an equitable, predictable, and reliable irrigation system
- Reduce the risks to monsoon crop production by making supplemental irrigation available when requested
- Develop full farmer participation and cooperation in the operation and maintenance of the tertiary water distribution systems

Components:

- Improvements to NEC, including lining of selected canal reaches, construction of control and access structures, and repairs to the Tilawe weir that diverted additional water to the NEC
- Irrigation and drainage down to the farm level in Stage III area (8,700 ha) and providing about 40 shallow tubewells
- Improvement and repair of irrigation and drainage systems in Stages I and II areas (28,700 ha) down to the farm level
- Flood protection and river training works on the Lal Bakeya and Bagmati rivers (Stage III area) and flood protection on eight rivers crossing the Stage I and II areas
- Technical support including consultancies for design and supervision of construction, project monitoring and evaluation, and studies
- Support of project establishment and O&M costs

SUNSARI MORANG IRRIGATION PROJECT - PHASE II

Credit no: 1814-NEP	Project Costs	US\$ million	
Approved: June 1987		Appraisal	Actual
Effective: February 1988	Total	49.9	45.3
Closed: March 1995 (on schedule)	IDA Credit	40.0	39.6
Cofinancing: None			

Objective: Increase agricultural production by:

- improving design and operation of the irrigation system to ensure reliable and equitable water supply;
- installing a desilting facility near the river intake;
- improving O&M procedures by enhancing beneficiary farmers' participation;
- providing technical support and training to strengthen local capacity to implement and operate the project; and
- strengthening linkages between the Department of Agriculture and the Department of Irrigation.

Components:

- Rehabilitation and improvement of Chatra Main Canal and its flow regulation structures, completion of bridges; repairs and improvements to cross drainage works; and desilting of the canal
- Studies to improve desilting operations
- Modifications to the Stage I irrigation area of 9,750 ha
- Rehabilitation and improvement of irrigation distribution and drainage networks in Stage II area (16,700 ha)
- Construction of offices, staff quarters, and a guesthouse
- Technical support and training through the provision of consultancy services for design and supervision of construction, training, monitoring and evaluation, and studies
- Support for incremental project establishment and maintenance costs

SUNSARI MORANG HEADWORKS

Credit no: 2430-NEP	Project Costs	US\$ million	
Approved: November 1992		Appraisal	Actual
Effective: January 1993	Total	29.7	26.4
Closed: December 1997 (on schedule)	IDA credit	28.0	27.6
Cofinancing: None			

Objectives:

- Provide the system with silt-free irrigation water during the monsoon through construction of a desilting basin equipped with continuous dredging facilities
- Eliminate dry season blockage of the intake through construction of a new intake

Components:

- Construction of the new intake 1.3 km upstream and linking it by a culvert to a new pre-settling basin in front of the existing intake
- Modification of the existing intake
- Improvements in the desilting basin constructed under SMIP II
- Provision of electrically powered dredgers and a micro-hydropower plant
- Management, O&M, and training
- Technical assistance for construction, supervision, and training

2. Project Design

Narayani III

2.1 The primary concern of this project initially was securing reliable water supplies. Under the terms of the 1959 Water Agreement, Nepal was to receive 24.1 cubic meters/second continuously on demand except when the DBC or NEC was being maintained.¹ In the three years preceding appraisal, water releases by India averaged about half the quantity agreed, and even that was intermittent. In consequence, the appraisal mission had to consider carefully the risks associated with having the project headworks in India.

2.2 The appraisal concluded that India was willing and able to supply water within the terms of its agreement and deleted the new groundwater component. It found that the past constraints on water supplies were due to lack of demand in Nepal because the NIP-II was not completed and to difficulties caused by unreliable information exchange and poor communications with the Gandak headworks in India. The SAR states that the risk of future supplies being less than the agreement was small as the water requirements only represent about 8 percent of the March low flow in the Gandak, and one-third of the design capacity of the DBC.

2.3 Based upon these arguments, and assuming that India would provide at least 60 percent of the agreed flow, it was calculated that an additional 8,700 ha of the tail end of the Narayani command area could be irrigated. At yellow cover review, the Bank's irrigation adviser cautioned that the area and crop production estimates were too optimistic. Seepage losses from the unlined water distribution system would account for two-thirds of the water, rather than half as assumed.² In consequence, the advisor recommended that the groundwater component be significantly increased to recycle these losses through tubewells. This would complement the warabundi irrigation system being introduced by the project.³ Under warabundi, equitable water distribution normally guaranteed that there would be some irrigation over all the area, but not necessarily at the optimal level. Thus maximum crop production, as assumed in the SAR for economic appraisal, was incompatible with warabundi. As far as the audit can determine, these comments were ignored.

2.4 Inadequate funding for O&M and difficulties in collecting irrigation service fees have been constant problems in Nepal's irrigation sector. Accordingly, at negotiations the government

1. The original agreement between India and Nepal was signed in December 1959. It was amended in April 1964 and clarified in Agreed Minutes of Discussion, October 1971.

2. Irrigation efficiency of large canal systems in the United States was 42 percent from source to field; in Thailand it ranged from 35 to 42 percent. A realistic value for Nepal would be 30 to 35 percent, not 50 percent.

3. Warabundi is the allocation of irrigation water in proportion to land area rather than allocating it to meet the demand of specific cropping patterns, which vary from area to area. It is widely and successfully practiced in the drought-prone areas of northwest India and relies on fixed structures that divide the available flow proportionately providing a fixed water level in the canals is maintained. The design for both Narayani and Sunsari Morang was based on rotating water supplies from the main canal by gates to the secondary and tertiary canals to keep them at full supply level. Distribution below this level was by the warabundi system. In demand-based systems gated controls are required to control supplies down to field level. Warabundi and rotating water supply is operationally simpler and needs significantly fewer gate operators. However, when it rains it is important to close off the free-flowing warabundi network to avoid flooding and good drainage is essential.

agreed to undertake a national study of all major irrigation projects to identify means to improve cost recovery. In addition, the IDA stipulated that within the areas with access to regular water supplies, irrespective of utilization, irrigation fees would double within 12 months for formerly single-cropped land and increase by almost half for double-cropped land.

2.5 Local project management questioned this covenant as they believed the rapid increase in fees would be a disincentive, particularly for rainfed farmers, to participate in the project.⁴ Experience under NIP-II showed that these farmers' first priority was to improve their quality of life and would require a few years to adjust their financial planning to pay for improved agricultural inputs and water. The same letter also says "farmers do not agree to organize into [water users' groups] and do not contribute to field channels till they see that water can be really delivered." Insecure and erratic water supply was the primary reason that only 20 percent of billings were collected in 1984/85. Conversely, the predictable supplies from the adjacent Birganj tubewells project enabled recovery of 95 percent.

Sunsari Morang Phase II

2.6 The project was originally estimated to cost US\$77 million but HMGN was unable to attract about US\$29 million of cofinancing needed to complement the US\$40 million available from the IDA. In consequence, the project was reduced from 24,000 to 16,700 ha, a proposed groundwater component was dropped, and the roads and O&M equipment components reduced. Much of the difficulty in attracting cofinancing for the Sunsari Morang project was because of HGMN's apparent inability to control massive sedimentation of the completed canal works. Since completion of 9,750 ha of Stage I almost half the distributaries had been silted and much of the anticipated agricultural development did not take place.

2.7 During appraisal, Bank technical staff and independent consultants reaffirmed that a mechanically dredged stilling basin near the headworks was the only feasible way to control sediment influx and this was to be constructed in the first two years of the project (1987–88).⁵ Yet HMGN persisted in the belief that the problem could be solved by low-maintenance non-mechanical means, a view given credence in early March 1987 by a proposal put forward by contractors based on their experience in China. At the same time, a high-level Bank mission arrived to discuss country strategy.

2.8 Soon after the responsible Division Chief departed Nepal the Bank's Vice President for South Asia unilaterally changed the project scope. During a meeting with government officials, the vice president said that he found the idea of dredging in Nepal "appalling" and a "very last resort," and was fully confident that the equipment would not be maintained over the long-term.⁶

4. Letter from General Manager, Nepal Zonal Irrigation Development Project to Division Chief (C Division), South Asia projects Department. February 25, 1986.

5. This solution was first proposed as part of the Stage I project in 1978 but was deferred to reduce cost overruns caused by inadequate design of the irrigation network, and the government's wish for low-cost sediment control structures. A technical report on sedimentation by Hydraulics Research Ltd., U.K. (June 1986) showed that annually about 300,000 cubic meters of sediment entered the Chattra Canal. Vortex tube extractors removed 100,000 cubic meters, 150,000 m³ was deposited in the main canal, and 50,000 m³ was carried into the distributary canals. Thus 200,000 m³ had to be removed each year at a cost of NRs 7/cubic meter or two thirds of the NRs. 2 million allocated for O&M.

6. Cable to Bank headquarters from Bank's Resident Mission, Kathmandu, March 16, 1987.

As a result, only three weeks after approval of the yellow cover, it was amended to postpone the construction of the desilting facility by two years to allow sufficient time for further Bank-funded studies.⁷

2.9 Another reason for the lack of cofinanciers was that several felt that the Bank placed too much emphasis on heavy and sophisticated irrigation engineering to the detriment of building human capital. The task manager noted: "conceptual differences with IDA on irrigation strategy also made it unlikely that USAID would wish to participate." This particular view arose because, although USAID/Nepal participated in the appraisal of the project, its recommendations were not taken into account.⁸ This was unfortunate because USAID's experience was based on extensive fieldwork in the Phase I project area and on participatory irrigation management techniques being piloted in the Philippines and successfully applied on a small scale in Nepal.

2.10 Specifically, USAID/Nepal said that the evidence showed that mandated users' groups formed mechanically and with no specific operational tasks or responsibilities remained non-functional. It was also unwise to restrict their formation to the chak "below the outlet" as the link between the chak and the irrigation block was important for O&M activities particularly for rotating water supply systems. The viability of these groups was undermined when they were excluded from the decisionmaking process over water courses and water rights, and they grew resentful as their local knowledge was ignored. Attention to organization of farmers should be given before final design and construction are initiated, and not, as in the SAR, after their completion. USAID also argued that farmers were well able to organize themselves and make their own rules if they had the right incentives, but that NGOs could better catalyze this process. A major incentive would be for the users' groups to retain the irrigation service fee and administer it as a revolving fund for O&M. Regrettably, none of this advice found its way into the SAR.

Sunsari Morang Headworks Project

2.11 An alternative to further investment in the Sunsari Morang Project was to use the area's plentiful groundwater. This was rejected for three reasons. First, the economic rate of return of the groundwater alternative at 15–19 percent was less than the project's 23 percent.⁹ Second, power shortages were anticipated after 1996. Third, it would be politically difficult to abandon some US\$70 million of earlier investment.¹⁰

2.12 Two issues were raised in 1992, one by Bank management, the other by the U.S. Executive Director. Bank management expressed concern that the credit included US\$120,000/year for O&M until the year 2000. This sum reflected the task manager's concern that the government would not always provide sufficient funding for the mechanical desilting

7. The Chinese proposal was made March 2, 1987; the yellow cover review meeting convened on March 6; the vice president met with government officials on Friday, March 13; the project scope was revised by March 30.

8. Letter from USAID Mission to Nepal to the Bank's Resident Representative, Kathmandu, December 30, 1986.

9. This is based upon the experience of the three Bhairawa Lumbini Groundwater Projects (Credit 654, Credit 1316, and Credit 2144) and assumes that SMIDP I and II are sunk costs. Appraisal Mission Economic Analysis, September 1991.

10. While similar groundwater potential exists at Narayani, it was never seriously considered as an alternative to surface water.

plant. Management's view was that this undermined the credibility of the proposal, was the government's responsibility, and if they did default, it could be made up in future credits.

2.13 The U.S. executive director directly challenged this sort of paternalism and claimed it undermined sustainability. Citing the 19 years the Bank had assisted Narayani and the 16 years of support for Sunsari Morang, he said that this long association weakens the self-help attitude within the farmer community and encourages their dependence on government for even minor work. What is needed is: "relatively less money and relatively more effective assistance to Nepal's farmers." And "assistance should be designed so that it is not driven by the fund disbursement process," which causes project staff "to be more concerned with construction activities than systems operation and management." The task manager responded that this "reveals the absence of understanding of the past five years of epic struggle" to get the headworks project agreed and approved. While the final Memorandum of the President mandated regular and systematic planning for operation and management, it did not identify social sustainability as an issue.

3. Implementation

Narayani III

A Poor Start

3.1 Shortly after Board approval of the Stage III project, the main Don Canal in India and the Nepal Eastern Canal were breached in September 1986 by the worst floods since 1924. While the government expeditiously repaired the NEC and had much of it operational by late 1987, water supplies from India were not resumed until mid-1991.

3.2 Initially, procurement was a bigger problem than lack of water. Minor canals and roads were through local competitive bidding (LCB) and force account and were awarded early in the project. The main canal improvement and extension works, estimated to cost US\$17.5 million, were through international competitive bidding (ICB). Unfortunately, the lowest bid was 83 percent greater than the appraisal estimate and 42 percent larger than the final engineer's estimate. The primary causes were unrealistically low unit rates and increases to the quantity of work following additional surveys since appraisal.

3.3 As a result, it was decided to "design to cost" despite the adverse consequences this approach had for the Sunsari Morang Phase I project.¹¹ The quantity of ICB work was reduced by deleting some of the road works and shifting 90 percent of drainage works from LCB to force account. The work was rebid and the contractor finally mobilized in late 1989. By then, however, the 1989–90 transit and trade dispute between India and Nepal disrupted work as diesel fuel, cement, and steel were scarce.

3.4 Detailed design of irrigation distribution systems, particularly for the Stage III area, was completed in October 1987. However, lack of water from NEC precluded efforts to form users' groups. Similarly, although a pilot irrigation subsystem of 400 ha was initiated in the Stage I area and completed by late 1988, it could not operate.

Growing Concern about Risks to the Project

3.5 In the period to mid-1989, Bank supervision was more concerned with progress on civil works and lack of counterpart funding and staff than with empty canals. In contrast, by early 1988 the Swiss Development Corporation (SDC) was concerned about escalating risks to the project, primarily (a) insecure water supply from India and (b) faltering institutional development because of failure to implement lessons from the Phase-I project. There was no plan to integrate the activities of project management, farmers, and agricultural support services. Support for users' group formation was totally inadequate,¹² project consultants were too

11. The Sunsari Morang Phase-I project had the same problem between 1978 and 1981 when actual cost were US\$60 million compared with the SAR's estimate of US\$37.5 million. Clearly, the region learned nothing from this experience (Performance Audit Report No. 8670, May 1990).

12. NIP-III was to develop users' groups over 37,400 ha of surface irrigated land and 2,700 ha of groundwater irrigated land. In all, 1,400 water users' associations and 10,000 water users' groups would be needed. To support this

narrowly focused on civil works, and systematic monitoring and evaluation (M&E) was missing. Clearly, the earlier concerns of USAID were well founded. Unlike the Bank in this period, SDC advocated short-term measures to harness local water resources to provide some assured water supplies, a position later endorsed by the Bank and successfully carried out by the project.¹³

3.6 In bilateral Secretarial-level meetings in New Delhi, May–June 1988, the failure of India to meet its obligations under the agreement was raised. Before the 1986 breach, the rate of water supply was only 56 percent of the treaty amount, and even then scheduled disruptions to supply were five times greater than agreed (191 days per year versus 45 days). In individual weeks, supplies sometimes fluctuated 50 percent. Since 1986, the NEC had received virtually no water. Regrettably, India informed HMGN that it could only meet its obligation for the 1990 irrigation season. In fact, supplies were only restarted in 1991 and then only to a pattern similar to the pre-1986 period (Figures 1 and 2).

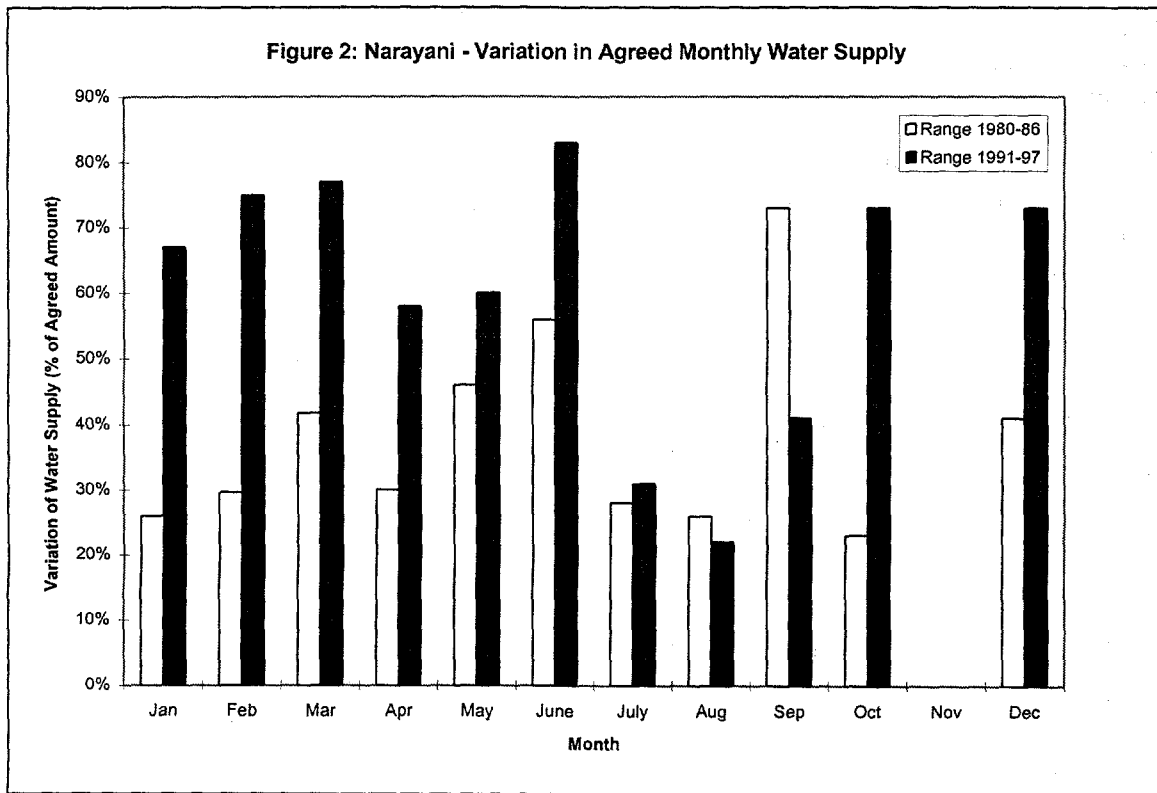
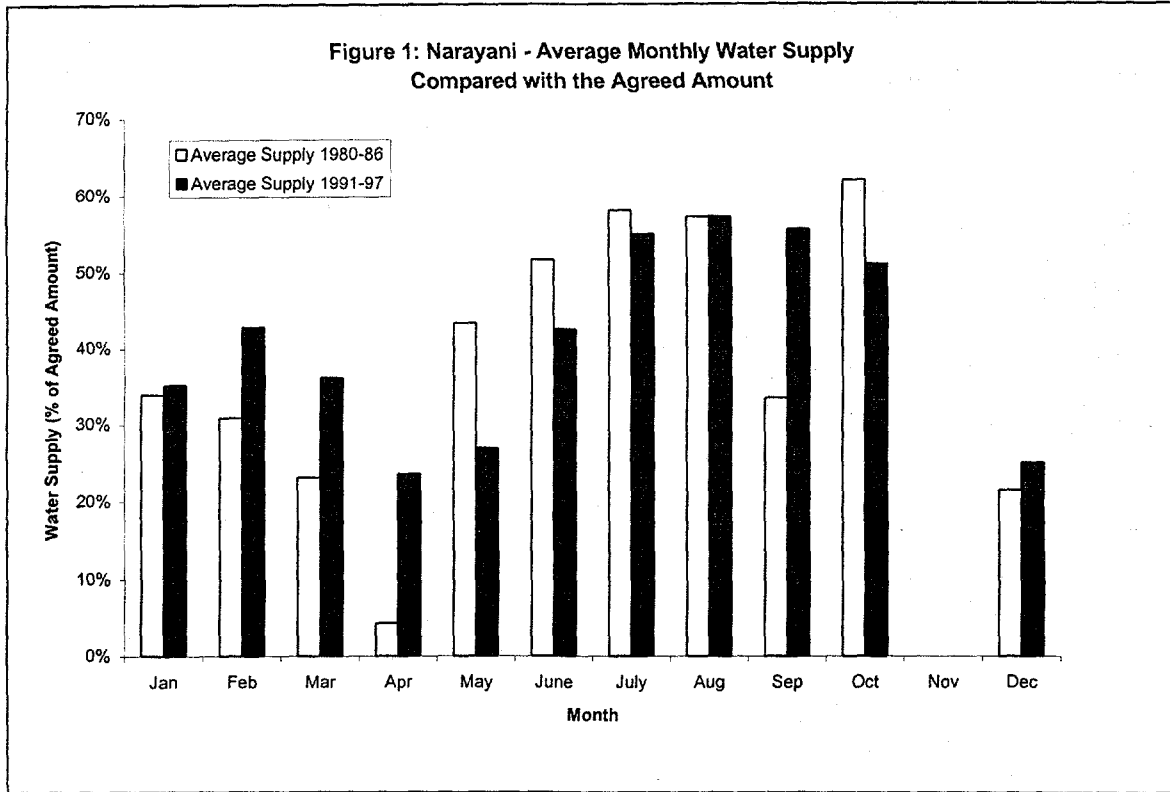
3.7 By the end of 1989, the project was downgraded to highly unsatisfactory. The Bank's task manager admitted: "the treaty deliveries have been so erratic in timing and deficient in quantity as to make rational water management impossible." Work by SDC's consultants showed that even with full and *predictable* NEC supplies, only 70 percent of the project could be irrigated and thus confirmed the earlier opinion of the Bank's internal advisors (para. 2.3).

3.8 The new HMGN's Budget Speech of June 1990 preempted action by the Bank. The government said "that *inter alia* the [Narayani III and Sunsari Morang II] projects will be reappraised and a decision taken in six months on the appropriate scale of operations." Meanwhile, minimal funds were to be allocated to the project. The Bank responded disingenuously: "we have reviewed data recently made available on the historical pattern of water supply from the DBC before the 1986 flood damage. This review . . . gives us some concern that the realistic water supply . . . may be inadequate for the entire project command area planned."

3.9 HMGN finally decided to go ahead with the project in February 1991 while the SDC made its continued support contingent on the project meeting agreed measures of performance for water management and agricultural monitoring. Indeed, the M&E issue became a source of friction between the Bank and SDC as the Bank clearly regarded M&E as a side issue while the project had no water.

effort the project had a cooperative officer supported by an assistant, four supervisors, a surveyor, and a typist. At this level of staffing, SDC estimated it would take 20 years to provide the requisite training at 7–10 days per users' association.

13. The Bank's reaction was cautious: the local rivers are highly variable in discharge, have high sediment loads, and their use could create problems for Nepal with the downstream riparian. The Bank's view was that it would be better to develop solutions in the context of a regional surface and groundwater study than being considered—but findings emerged too late to affect the restructuring of the project (see paras. 3.11–3.12 below).



Redesign

3.10 The Bank's initial move to redesigning the project were to advocate a biannual rotation of water throughout the command to ensure irrigation at least every other year and fully use the infrastructure—a critical need given that canal work contracts had been let under ICB for the whole project. This idea was abandoned as socially unacceptable and the following considerations drove redesign. Erosion of the project's eastern boundary along the Bagmati river affected 40,000 people each year, and by 1991 over 5,000 were homeless. In addition, the April 1992 supervision concluded: "we now believe it was a serious mistake to omit the provision of access roads; unless some all-weather roads are provided, the project will be difficult, if not impossible, to maintain." Groundwater was not considered as an alternative given the focus on making the surface water system work (see para. 2.11) and the government's unwillingness to vacate its water rights under the Gandak water agreement.

3.11 The project redesign was completed in 1993. The Stage III command area development was deleted and the area covered under Stages I & II rehabilitation was reduced. Farmers would construct the tertiary canals themselves in accordance with the Irrigation Policy of 1992. More attention was given to roads (this was also to offset claims from the international contractor for the canceled Stage III works). The flood protection training components were enlarged, while the tubewell component was eliminated as being more appropriate for the private sector.

3.12 The reformulated project was designed to operate on an "on/off" basis with rotational water supplies. Gated controls installed under earlier IDA financing were removed to facilitate the warabundi operation. Even though over 80 percent of the canal rehabilitation works were completed in the Stage I and II areas, water diversion structures were not designed for unreliable and erratic water supplies. In consequence, farmers broke the crests of diversion structures when water levels were too low to ensure a supply. They also complained that, given the frequent flood damage to canals, gates were essential to conserve water and stop local flooding from breaches. Farmers were also aggrieved that they had to pay for and build tertiary-level canals while in earlier IDA projects they were free. Not surprisingly, farmers completed only a third of the canals required.

Sunsari Morang Phase II and Headworks

Initial Setbacks

3.13 The Stage II project got off to an inauspicious start. Insufficient attention by the Sunsari Morang Irrigation Development Board (SMIDB) to maintenance of essential plant (provided under the Phase I project) jeopardized timely clearing of the canal intake area and thus irrigation supplies. This problem was worsened by the movement of the main channel away from the intake point following a major landslide in the early 1980s. Ironically, while concern about dwindling irrigation supplies was growing, major floods in August 1987 caused extensive damage to the Chattra Canal and distributaries, and severed irrigation canals serving 12,000 ha. Flood water eroded 960 ha of the Stage I area and damaged crops over a further 15 percent. With almost biblical timing, brown plant hopper subsequently infested crops in the Sunsari district.

Elusive Solutions

3.14 Annual floods also exacerbated the sediment problem. With only half the O&M budget provided by HMGN, the project faced a dilemma. Clearing the sediment left little budget for institutional support and routine O&M; spending on routine O&M allowed the sediment to build up and throttle water supplies. The SMIDB ultimately tried to satisfy both demands and the situation got worse. Reflecting this, only 12 percent of irrigation fees were collected in 1987/88.

3.15 By the summer of 1988, the project had become a national *cause célèbre*. It was the largest surface water irrigated project in Nepal, and despite IDA assistance its performance was rapidly declining. Allegations of corruption against the SMIDB in the national press focused attention on its failings¹⁴—not least of which was the delay in finding a solution to the sediment problem. The Bank strongly disagreed with the technical solutions proposed by the government's short-listed specialist consultants as “not so much technically unsound, as unimplementable.”¹⁵ And the Bank proposed to ask the government to either reevaluate the proposals or call for new ones.

3.16 This was preempted in July 1988 by an order from HM King Birendra—following a visit to the project—that an immediate solution to the silt problem be found. Consequently, the Bank had little option but to accept the short-listed consultants' recommendations subject to adequate safeguards. These included: (a) contract negotiations must begin in August 1988; (b) the dredging options must be given balanced and equal treatment; and (c) that a tripartite review of the consultants' proposals and agreement on the most promising option would be the basis for detailed design.

3.17 By the end of 1989, farmers clearly were losing the battle against siltation of the distributary system. Only 40 percent of the capacity of the minor canals remained, but on-farm canals were almost completely filled and disposing of the spoil without harming the soil was a growing problem. Two small projects designed to pilot the rotational water supply concept could not be tested for lack of water. Although the project had formed 990 users' groups in the Stage 1 area, they were ineffective, and contending groups of farmers were damaging canals and structures to secure water. Heightened tensions over silt and water also showed the weakness of the regulatory authority of the SMIDB, which failed to enforce systematic canal operation or quell disputes between users' groups and farmers.

Good Progress on Civil Works

3.18 Work to improve system canal capacity and regulation required to manage rotational water supplies was successful. Civil works continued steadily throughout the project period marred only by top-down design, government budgetary problems, and the trade and transit dispute with India. While the contractor was able to complete canal works on about 4,500 ha/year, HMGN could not mobilize budget at the same rate, thus slowing progress. Shortages of imported fuel periodically stopped work.

14. Nepal Recorder Newspaper. Saptahic Birmarsha, July 22.

15. World Bank Cable Reidingen to Helman, July 26, 1988.

3.19 Detailed design was almost complete and contractors were at work before farmers' water groups were formed. Thus, some canal and drainage layouts were disputed by farmers—and they were not convinced that the project could solve the sediment problem. For these reasons, and gross underfunding for land acquisition (actual costs were 750 percent of appraisal estimates), farmers resisted completion of drainage works in the Stage II area (8,400 ha) and the lower lying areas are subject to flooding.

3.20 It was intended to extend the supply canals in the Stage I area (9,750 ha) down to chaks of 28 ha because neither the farmers nor project staff could manage the larger area. As with the Narayani project, because the government left construction of tertiary canals to farmers, only half of them were built. It was only in 1992, after construction of the new desilting basin, that farmers agreed to the work. In consequence, modifications were only completed over 1,000 ha and there are still unresolved water management problems over much of the project area.

Emerging Consensus on Sediment Control

3.21 At the start of SMIP-II, the major problem was controlling the adverse impact of extremely high silt loads in the river Kosi. Experiments with vortex-tube silt extractors in the Chattra Canal during Phase I had proved unsuccessful; during appraisal of Phase II alternative methods were examined. The least costly was closure of the canal during periods of high silt loading, but this was impractical. This left two alternatives, both based on the construction of a desilting basin near the intake. The first proposed that the basin be periodically desilted by hydraulic flushing (favored by the government); the second relied on installing dredgers (favored by the Bank).

3.22 An additional problem was to keep the river open in front of the canal intake. This had two solutions. The solution the Phase I consultants favored was relocation of the canal intake upstream to the gorge section of the river where the flow was deep. The government dismissed this as too expensive and too complex. The favored alternative was periodic removal of sediment and shoals near the canal intake using bulldozers aided by modest training works. The Bank endorsed this approach at appraisal but subject to additional studies quickly being implemented.

3.23 The specialist consultants produced several alternative designs but none was technically acceptable to the Bank. An international panel of experts then convened in January 1990 to advise on a solution. The panel unanimously favored the dredging alternative with an enlarged settling basin and endorsed the idea of a small run-of-canal hydropower station to power the dredgers. As the siltation of the intake was getting worse, they recommended that the intake be moved 1.3 km upstream and connected to the desilting basins through box culverts. The total cost was estimated at US\$24 million. Allowing for inflation, the Bank reckoned the cost would be about US\$28 million with an ERR of 15 percent.

3.24 At this stage, the Bank gave the government an ultimatum: either go ahead with the panel's recommendation or close the project.¹⁶ If the government went ahead, it would need to find US\$22–24 million to supplement US\$4 million already in SSMP-II. There was also the question of making the additional works more cost-effective. The Bank proposed that capital cost/ha could be reduced if irrigation works were extended to the 31,550 ha Stage III area. The

16. The DCA required suspension of disbursement if desilting works were not implemented by April 30, 1990.

government, however, decided that the additional cost of US\$45 million could not be justified until the new sediment control works were proved, and were also concerned that it could jeopardize negotiations for other donor-financed water sector projects. Consequently, decisions on works for the Stage III area were postponed. Bank management was also concerned about the cumulative costs and benefits of its substantial investment and directed that the economic analysis of the headworks project should not treat the Stage II project as a sunk cost.

3.25 Because the ultimatum came amid great political change and review of national priorities, the new government took until early 1991 before deciding to proceed.¹⁷ In the interim, and assuming a positive government decision, the Bank funded detailed design work so that tender could be floated before Board presentation of the supplementary credit in November 1992. Following the government's go-ahead, the SMIP-II project was reformulated to enable work to start on an enlarged stilling basin in mid-1992 and procurement of two dredgers.

3.26 The new stilling basin alone reduced siltation by 70 to 80 percent and irrigation coverage increased by 30 percent. However, until the dredgers became operational in 1995, siltation of the system remained a problem once the stilling basin was filled. In the first year of operation, the dredgers removed 250,000 cubic meters of silt. Thereafter the problem receded. At last the training efforts of the project consultants bore fruit as farmers became motivated. Two hundred ninety-six of the targeted 551 groups formed in the Stage II area, and rehabilitation restarted in the Stage I area. By the end of 1995, a third of all tertiary irrigation blocks in Stage II were turned over to users' groups for operation and maintenance, and rotational water supply was adopted. At closure of SMIDP-II in March 1995, the region rated project outcome as successful but sustainability as uncertain because the headworks remained incomplete.

Completion of Headworks

3.27 The civil works were completed in May 1996, six months behind schedule, at 86 percent of the estimated cost of US\$35.7 million. At the close, US\$2.5 million of the IDA credit was canceled.

17. See para. 3.8.

4. Outcomes

Narayani III

Summary

4.1 Most farmers are convinced that the regulated rotational water supply system will not work given the unreliable water supplies. They were not involved in project design and have no sense of ownership. In addition, although 512 km of on-farm, service and village link roads were planned, only 18.6 km were constructed. In consequence, access to markets and inputs is still poor, thus decreasing profitability. Even though most of the flood protection works were satisfactorily completed, on-farm and main drainage was not improved. Thus while being deprived of reliable irrigation, farmers are still at risk from waterlogging in the lower-lying areas.

HMGN Review

4.2 A review by the National Planning Commission in 1994 was very critical of the project. "After 20 years of command area development activities under IDA funding, almost at the end of intensive involvement, NZIDB is embarking on extensive formation of [water users' associations] . . . hurriedly . . . just to fulfill the covenants of IDA. . . . Generally, the farmers seem apathetic to the project as well as to project staff." By July 1997, 855 users' groups had formed but most were ineffective because of (a) erratic and uncertain water supplies, (b) top-down design of canals with negligible farmer participation, (c) hurried formation, and (d) lack of discipline and remedies to settle illegal usage. Many farmers had installed small wells to ensure a reliable water supply and avoid the management problems of the surface water system.

Project Management

4.3 Management of the project is jeopardized by insufficiently trained staff and inadequate budgets. NZIDB lacked technical expertise to monitor performance of project consultants, and the project did not build on the institutional capacity that did exist. It is further weakened by a high turnover of staff, and project directors change with every government. Appointment of agricultural extension staff is far below requirements and this perceived lack of support for farmers weakens NZIDB's relations with the users' groups. The NZIDB establishment has been downsized from 513 in 1985 to 357 staff in 1998 (compared with the target of 304 staff). However, about a third of the remaining staff serve no useful purpose and have been retained to satisfy political favors. Thus NZIDB is still short of key staff in critical areas—particularly extension and water management. Adequate funding for these staff and for O&M is uncertain.

4.4 Efforts to collect water charges from farmers were fraught with reversals. The Bank covenanted HMGN to undertake a national study of measures to increase cost recovery, transfer collection responsibility from NZIDB to the Revenue Department, and increase fees to cover the full costs of O&M by FY93. Soon after the project started, the government told the Bank the cost recovery study was not needed as it duplicated an ongoing study financed by the Asian

Development Bank. When the ADB study finally reported in 1988, the government rolled its recommendations into the new Irrigation Law (April 1988) and again made irrigation authorities (i.e., NZIDB) responsible for assessment and collection using the users' groups.¹⁸

Budgets for O&M

4.5 Inadequate budgets for O&M afflicted the project throughout its life, and fee collection from the project is negligible. During the project (1988–94) the government typically could only provide between a third and a half of O&M needs. This has not changed.¹⁹ From 1986 until now fees for surface water have been neither levied nor collected. However, some users' groups have worked on the O&M of their tertiary canals since 1993/94 and NZIDB has imputed that in 1995/96 this saved them NRs. 0.5 million in labor costs. Even so, insufficient funding is accelerating deterioration of project facilities and its sustainability is unlikely for financial as well as social reasons.

Water Supply is Still the Issue

4.6 Water supply is still insecure and the outlook is bleak. The audit mission inspected the 94 km of the Don Canal within India and parts of the adjacent canals supplying the Gandak project. Over much of its length the Don Canal is heavily silted and its flow capacity is significantly reduced. Maintenance is *ad hoc* and appears to be based on administrative jurisdiction. Some reaches have been rehabilitated to the original sections over significant lengths, but upstream reaches remain heavily silted, thus nullifying the effort. Most turnout structures have been damaged by floods and would allow unregulated outflow when the canal is full. Many sections of the embankments are in poor condition, particularly at cross-drainage points, and the risks of breaching are high. The embankment service road is deteriorating for want of adequate maintenance. The condition of the parallel Gandak main canals is even worse, which suggests that Bihar state is aware of India's obligations to maintain the Don Canal but has inadequate funds for the purpose. In summary, it is highly unlikely that the Don Canal could supply the agreed quantity of water in the short to medium term without major rehabilitation. Even then, sustainability would require implementation of sediment control structures similar to those installed at Sunsari Morang.

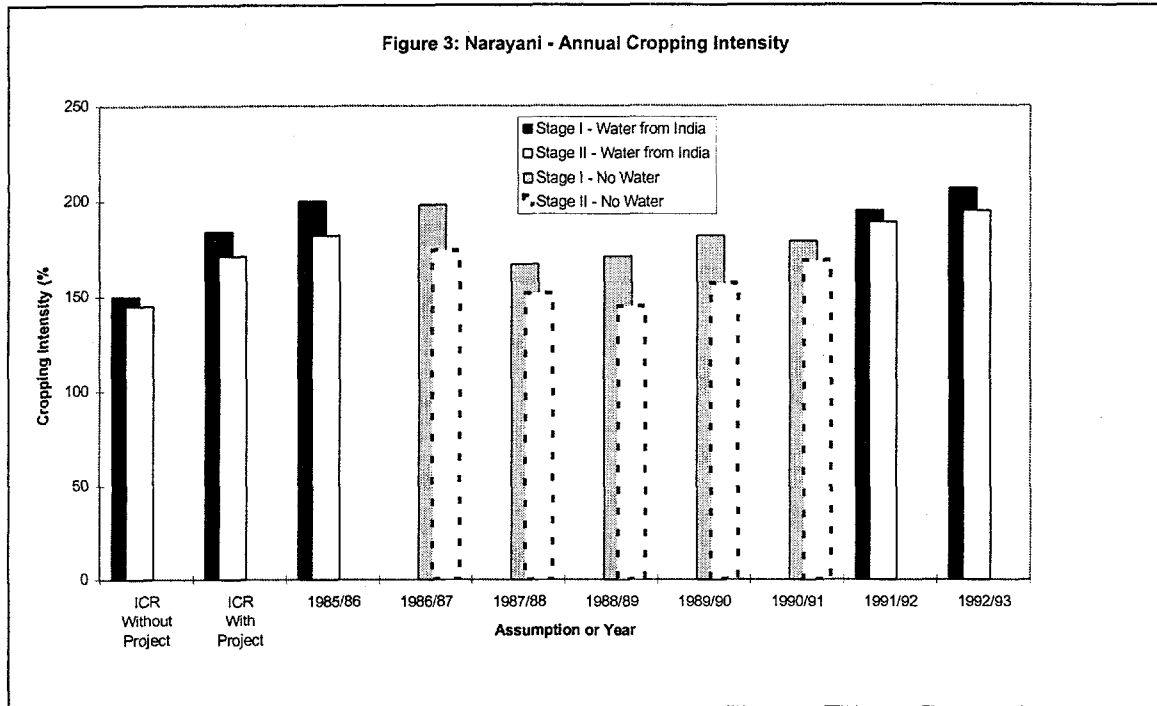
Economic Reevaluation

4.7 Despite the erratic water supply, the Implementation Completion Report (ICR) estimates that the incremental cropping intensity attributable to the revised project is 34 percent for the Stage I area and 26 percent for Stage II. Accordingly, the ICR's economic rate of return (ERR) is 19 percent for the revised irrigation project. But as the ICR reports, "a significant part of these benefits, perhaps around 40 percent, is attributable to farmers' own investment in pumps and motors." Because the ICR without project assumptions are much worse than reality (1985–86),

18. Similarly, the Bank insisted that the NZIDB develop its own experimental farm. Only in 1988 did the Bank recognize that this would duplicate the efforts of a nearby agricultural research station at Parwanipur by quietly deleting it from the project.

19. Fee collection from the adjacent Birganj DTW (also managed by NZIDB), was originally better than 80 percent of billings, but is now less than 20 percent owing to inadequate O&M.

improvements in cropping intensity are probably less than 7 percent for Stage I and less than 15 percent for Stage II (Figure 3). The audit has recalculated the ERR for the revised irrigation and flood control component at 5 percent. The details are given in Annex C.



Sunsari Morang

Summary

4.8 The headworks now provide silt-free water to the Stage I and II areas and are capable of supplying more than the Chattra Canal's current capacity. Farmers were quick to respond to an assured, silt-free water supply, and agricultural production has increased substantially as a result of the two sequential projects. Several problems remain that could affect the sustainability of the project: high managerial turnover; less than optimal management of the dredgers and their power supplies; insufficient funding for O&M; and inadequate support for users' groups.

Project Management

4.9 Frequent changes of senior staff have been the norm (five between 1993-97) and jeopardize the successful management of this technically complex project. Dynamic and knowledgeable leadership is required to juggle the competing O&M demands of the headworks, the main irrigation system, participating users' groups, and collection of irrigation service fees and to make correct and timely decisions. A review of the project's O&M budgeting system showed there are no priorities and disbursement is *ad hoc*. Thus, given the normal underbudgeting, some essential O&M tasks are not done. An essential Water Management Division established to oversee, plan, and regulate main and secondary canal water distribution

was allowed to disband, and their work is dispersed among three quasi-independent O&M divisions.

4.10 The Nepal Electricity Authority seems unwilling to take over the mini-hydropower station despite HMGN's cabinet order and training of staff. Problems with the national grid connection periodically disrupted dredging from the fall of 1997. Failing to get spares from NEA, project management is procuring independently.

4.11 A qualified engineer to head the dredger team is still to be appointed, and attempts to replenish the depleted stock of imported spare parts are running into problems. The current operational policy for the dredgers leaves 2.3 meters of sediment in the settling basin. This decreases the basin's trapping efficiency and increases the risk of siltation in the project should one of the dredgers fail. Farmers interviewed said that while there had been tremendous improvements since 1994, high sediment caused by dredger problems in 1997 took about a month to clear in their tertiary irrigation unit. Erosion is undercutting a groin constructed to protect the main canal. Unfortunately, senior project staff seem indifferent to these risks.

Inadequate Budgets for O&M

4.12 Securing adequate budgets for O&M is a chronic issue. During the second phase project, the government's allocation was typically less than half of needs and almost negligible in the period 1989–91. Full funding was provided under the Headworks Project, but once IDA funding ceased it fell to 52 percent in 1997/98.²⁰ The situation is worse because the budget assumes that users' groups will increasingly contribute to O&M costs—eventually paying 27 percent. In reality their contribution is very small and less than one percent of their assumed contribution.²¹

4.13 Water charges were assessed from the whole of the Stage II area by 1995–96 but only 26 percent of the assessment was collected, primarily through the efforts of project consultants and agricultural officers. Unfortunately, the service of these personnel ended with the conclusion of the Headworks Project and fee collection is now declining.

4.14 Several users' groups explained that they believe they have no legal authority to manage water or collect water charges—a task earlier led and enforced by agricultural officers.²² For example, a group of farmers (not members of the users' group) blocked one secondary canal and disrupted the rotational water supply. This became so persistent that the users' group took them to court; but the court dismissed the case as the users' group had no legal right to deny farmers water. Even within successful users' groups, 30 percent of farmers refuse to pay water charges as penalties are never enforced by SMIDB. This unwillingness to pay is made worse by SMIDB's policy of not enforcing charges for water in the Stage I and III areas of the project. Part of SMIDB's indifference to water charges is that it does not directly benefit: either it goes to the

20. This is taking account of 9 percent inflation in O&M costs since the Operations Plan is based on 1994/95 prices. Without inflation it appears to meet 70 percent of plan needs.

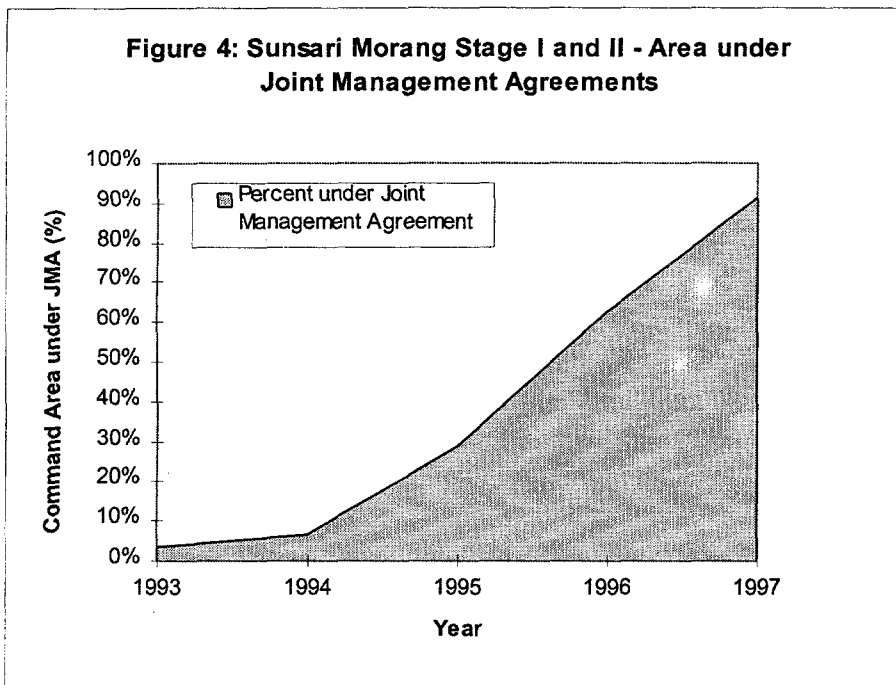
21. The O&M plan estimated that the total cost in 1996/97 was NRs 40.21 million (1994/95) of which the users' groups would contribute NRs. 7 million. The government's contribution was NRs. 19.7 million while the users' groups only collected NRs 0.86 million, half of which they sent to the central revenue department.

22. Agricultural officers were employed by the SMHWP and their task was to form farmers' groups and facilitate uptake and training in new irrigation technology.

users' groups or the central revenue. Keeping all fees collected within the project would be a substantial incentive and improve funding for O&M.

Management Turnover

4.15 According to the government's Irrigation Policy, the ultimate objective of irrigation projects is to turn over full responsibility for O&M of secondary and lower-level canal systems to the farmers and lower the O&M cost to the government. This is being achieved through joint management agreements under which users' groups have three years to assume responsibility to the sub-secondary canal level and collect irrigation water charges. Users' groups retain half the fees collected for their O&M activities, the balance going to central revenue. Following the first joint management agreement in the 891 ha Jhumka sub-secondary canal in April 1993, it took only three years to cover the whole 16,550 ha of the Stage II area. The first agreement in the Stage I area was in January 1997 and the work continues (Figure 4).



Greater Extension and Training Required

4.16 Farmers told the audit team that the facilitation, training, and extension service provided by the agricultural officers was highly regarded and their termination removes a vital link between users' groups and project management. Many users' groups complained that on some canals responsibilities were not clearly demarcated—a task earlier facilitated by agricultural officers—and maintenance suffered as a result. A major maintenance problem in both Sunsari Morang and Narayani is widespread canal bank afforestation.²³ The roots cause extensive

23. The trees were planted by the Forestry Department on public lands (i.e., canal banks)—an excellent example of where blanket application of “green” policies can be harmful.

damage and access problems—yet felling these trees is subject to heavy fines. Other factors reducing agricultural benefits, and thus fee collection, are a limited understanding of the rotational irrigation system, misaligned and poorly constructed tertiary canals, haphazard or zero on-farm water distribution facilities that caused high water use and therefore shortages for those at the ends of the system, and disputes over water.

4.17 Agricultural extension and marketing were ignored in project design even though the Agricultural Department was represented on SMIDB. There is no link between the irrigation engineers and the Department of Agriculture at the field level. Knowledge of modern scientific agriculture is missing and almost all farmers visited at audit wanted agricultural extension services and training. Good seed and fertilizer are scarce, and most farmers rely on poor quality Indian imports from the local market.²⁴ While there are good project roads, the project has no funds to maintain them and wearing surfaces are deteriorating. Village and district development committees were supposed to take over the roads, and while they maintain *ad hoc* toll collection points, most of the money collected is used for other purposes.

Economic Reevaluation

4.18 Providing these sustainability issues can be overcome, the outlook for the Sunsari Morang is good. Agricultural production has risen quickly in response to an assured supply of silt-free water. Treated as standalone projects, the ERR of the SSMP-II is estimated to be 16 percent and that of SSMHWP is 49 percent. If the three phases of the project are treated as a single investment, the ERR is 20 percent.

24. Excellent foundation seeds are produced by the National Agricultural Research Council and distributed to research farms and seed growers on recommendation of district officers. Unfortunately, the national distribution system is poor and much seed remains unsold. Fertilizer policy promotes the role of the private sector but the Ministry of Agriculture's committee is slow in making recommendations in view of unresolved subsidy issues. The first official private sector imports are expected to occur in the summer of 1998. In the meantime, farmers resort to Indian fertilizer of inferior quality (e.g., 3 percent N, instead of 18 percent). Farmers also raised the issue that the World Bank's anti-subsidy policy is more effective in Nepal than India, and thus Indian imports are cheaper—price being a bigger issue than quality. Subsidy issues in Nepal should be considered in relation to India's policies.

5. Ratings

Outcome

5.1 Narayani III is rated highly unsatisfactory in contrast to Sunsari Morang II and the Headworks Project, which are rated satisfactory. The primary reason for the difference in ratings is that the water supply and silt problem was solved at Sunsari Morang but not at Narayani.

Institutional Development

5.2 Both Narayani and Sunsari Morang were handicapped by a high turnover of managerial and technical staff. Technical assistance did little to train project staff, and improvement in their capability to manage the projects was modest. Efforts to organize farmers into users' groups and provide training in rotational water management were top-down and premature in both projects. The final institutional development rating for Narayani is negligible.

5.3 Conversely, the initial effort was rejuvenated under the Headworks Project and well-focused technical assistance enabled rapid and substantial development of users' groups. Thus, although institutional development is rated modest for the Sunsari Morang Second Phase, it was substantial for the Headworks Project.

Sustainability

5.4 Farmers have finally bought into the project concept at Sunsari Morang and are taking more responsibility for O&M. However, government's unwillingness to provide adequate O&M budgets and press for collection of water charges jeopardizes the sustainability of all three projects, as does the lack of consistent and technically knowledgeable project management. Thus sustainability of Sunsari Morang is uncertain. Narayani has the additional disadvantages of an unreliable water supply and non-viable users' groups, so its sustainability is unlikely.

Bank Performance

5.5 Bank performance on Narayani III is rated highly unsatisfactory. Appraisal was deficient. The experience from the previous Bank investment showed that water supply was a major problem yet this was ignored. There was no attempt to involve beneficiaries in project design that reversed some aspects of the Bank's earlier investment. Some project components (cost recovery study, a new research farm) duplicated others' efforts and had to be dropped later. There were severe procurement problems because of a failure to learn from earlier mistakes at Sunsari Morang. This forced an *ad hoc* redesign of the project, some elements of which were subsequently found to be in error. Despite the cofinancier's concern about the lack of water supply two years into the project, the Bank was indecisive and took another five years to restructure the project, during which time Nepal had to pay the Bank's loan charges.²⁵

25. Even then, the groundwater alternative was not considered although experience at nearby Bhairawa Lumbini was very favorable.

Meanwhile, early institution building efforts were undermined by the government's policy to not pay for tertiary canals and by the lack of water to manage.

5.6 Bank performance on both Sunsari Morang projects was satisfactory despite a poor start. Appraisal of the second phase was deficient. It failed to recognize that the maintenance solution for the main canal intake was impracticable and ignored the recommendations of USAID regarding the conditions necessary to establish viable users' groups. Last-minute intervention by the Regional Vice President delayed the technical solution to the silt problem—and project benefits—by two years, yet it did lead to the technical resolution of the canal intake problem. Subsequent Bank performance was excellent, and the Headworks Project gave more attention to beneficiary participation and formation of users' groups.

Borrower Performance

5.7 Borrower performance was unsatisfactory for Narayani and the second phase of the Sunsari Morang but was satisfactory for the Headworks Project. Frequent changes of government and indecision (over pressing for water rights at Narayani, and over adopting a technical solution to the silt problem at Sunsari Morang) marred achievement of project objectives. Once it committed to the technical solution, however, the government expeditiously and efficiently implemented the Headworks Project.

5.8 In fairness to government, some of the indecision may have resulted from the Bank's performance and government's inexperience with large-scale irrigation. At Narayani the Bank's technical solutions did not work, and the initial experience at Sunsari Morang was problematic. Consequently, it is not surprising that the Bank's capital intensive solutions for the Headworks Project were disputed within Nepal or questioned by outsiders (see para. 2.13).

5.9 Totally inadequate counterpart funding and frequent staff changes created severe managerial problems during implementation, and underfunding of O&M costs now jeopardizes sustainability of both Narayani and Sunsari Morang. While HMGN has passed progressive policies for management turnover of irrigation facilities to users' groups, failure to press collection of water charges and uphold the authority of users' groups compounds the O&M problem.

6. Findings and Lessons

6.1 A secure and regular supply of silt-free water is a prerequisite for investing in irrigation infrastructure and institutions. Without such a supply, investment in infrastructure, institution building, and extension activities is likely to be inefficient.

6.2 The solution to Narayani's erratic water supply is no nearer today than it was in 1985. Now that the complex negotiations with India for water-sharing and power development of the Mahakali river have been completed, Nepal may be willing to raise the issue of India's non-compliance with the 1959 Gandak Water Agreement and press harder for an equitable solution. Providing water, however, is only part of the solution. The sedimentation and maintenance problems of the Don Branch Canal in Bihar also have to be solved.

6.3 Although India's failure to comply with the 1959 Gandak Water Agreement undermined the efficacy of the Bank's investment in Narayani, the Bank did little to investigate the reasons for India's non-compliance or facilitate a solution. While the Bank could strictly only intervene if requested by HMGN, there was nothing to stop the Bank from raising the international water issue with India during its country dialogue.

6.4 The issue of international water rights is still the most difficult constraint facing HMGN's long-term irrigation strategy. This has prevented Nepal from fully developing its water resources and IDA from supporting promising investments in some major rivers. At Narayani, the groundwater alternative was not considered for these reasons.

6.5 Quality at entry of the Narayani project was highly unsatisfactory, as was supervision until the early 1990s. A root cause was lax managerial oversight, and inadequate independent quality assurance monitoring. Unfortunately, at appraisal the concerns of the Bank's internal advisors and the client were ignored. And during supervision little account was taken of the cofinancier's concerns. The result was a disastrous series of investments that has damaged the Bank's reputation in Nepal.

6.6 All three projects were capital intensive, yet the greatest risks to sustainability are inadequate attention to the development of human capital, involvement of beneficiaries, and funding O&M. Expatriate consultants did most of the design work to a critical path that met appraisal timetables but allowed little transfer of technical knowledge to project staff or feedback from farmers. As a result, some assumptions were unrealistic and project staff were not fully conversant with the principles of the new irrigation system and critical operational components, a problem compounded by frequent transfer of government staff. Farmers complain that as much as 10 percent of the irrigation and drainage system has operational problems, problems that would have been avoided had users' groups been formed before the detailed design stage.²⁶ Care should be taken that this approach is applied to the proposed Sunsari Morang Stage III project.

26. They also urged that more attention should be given to forming women's' water user's groups, particularly in the Stage III area of Sunsari Morang recently appraised by the Bank.

6.7 Similarly, had the government mitigated the adverse impact of its decision not to construct tertiary canals—possibly through more intensive extension and training activities—farmers may have been more motivated to assume this burden.

6.8 Funding to ensure adequate O&M is a major concern because without it the achievements of Sunsari Morang are not sustainable. Until sufficient funds can be generated within the project, government will have to provide funding for the O&M of headworks and main and secondary canals. Continuity of technically qualified staff and development of realistic and up-to-date annual O&M plans is essential, as are better incentives for SMIDB to perform, particularly in enforcing collection of water charges. Water supply costs are NRs 530/ha while actual charges are NRs 200/ha. The government is currently designing a program to achieve full O&M cost recovery assisted by the recently approved Nepal Irrigation Sector Project (Cr. 3009-NEP).²⁷

6.9 Devolution of authority for tertiary-level O&M and water charge collection to users' groups is a necessary but not a sufficient condition. The Irrigation Sector Project provides for strengthening the private sector (users' groups, NGOs, and community-based organizations) to help project farmers increase their water use efficiency and adopt modern agronomic inputs and practices, and to facilitate building of a viable hierarchy of water users' organizations. The new sector project also proposes that before building Stage III irrigation works, there should be a preparatory year to allow users' group formation and strengthening and their participation in water course design and construction.

6.10 Finally, these projects made little effort to learn from other irrigation projects and develop some institutional synergy in Nepal. By all accounts the West Gandak project has made remarkable strides in management turnover and participatory irrigation with a marked impact on cost recovery. Yet none of the staff of the audited projects had an opportunity to visit West Gandak and learn from its experience. Farmers and mid-level project staff also complained that only senior government personnel were given the opportunity to visit successful model projects in other countries. Furthermore, these personnel were usually transferred before they could apply what they had learned.

Lessons

- Project outcome is highly correlated with the integrity and timeliness of independent quality assurance review both at appraisal and during the first few years of project implementation.
- Speed is sometimes the enemy of quality. Task managers are frequently on the horns of a dilemma: either taking time to address stakeholders' views or completing appraisal on time. Great care must be taken also that streamlined appraisal and supervision does not replace substantive review.

27. Following review of the draft PAR, HMGN's Department of Agriculture says that it is imperative (in the design of future cost recovery programs) to assess the effect of any increases in water **from the perspective of farmers' participation**. They also note that while agricultural extension workers play an important role in onfarm water management, their technical training is inadequate to meet these needs and should be addressed in future Bank-funded projects.

- Appraisal must ensure that a secure source of good quality, silt-free water is available before recommending investments in irrigation infrastructure and institutions.
- No matter how well designed, participatory irrigation management will not work if water supplies are uncertain.
- The existence of an international water treaty defining water rights is no guarantee that those rights will be observed.
- Where surface and groundwater resources are readily available appraisal must compare their relative merits.
- Detailed design of irrigation distribution and drainage systems should include system managers, operators, and farmers. Formation of water users' organizations should precede detailed design. This process is more efficient if facilitators assist farmers (including women's groups) to form water users' organizations appropriate for the scale of the project activities.
- Design of Bank-financed projects should learn from the experience of other development partners and promote synergy across the investment subsector.

Basic Data Sheet

NARAYANI III IRRIGATION PROJECT (CREDIT 1715-NEP)

Key Project Data (amounts in US\$ million)

<i>Item</i>	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
Total project costs	35.5	25.5	72
Credit amount	24.5	17.1	70
Cofinancing (SDC)	7.5	6.3	84
Cancellation	—	10.0 ^a	—
Date physical components completed			
Economic rate of return (%)	22	5	23

a. SDR 7.3 million IDA and SWF5.0 million were cancelled during project restructuring in 1993. SDR 1.802 million IDA and SWF0.5 million were undisbursed and cancelled in June 1995.

Cumulative Estimated and Actual Disbursements

(in US\$ million equivalent)

	<i>FY 87</i>	<i>FY 88</i>	<i>FY 89</i>	<i>FY 90</i>	<i>FY 91</i>	<i>FY 92</i>	<i>FY 93</i>	<i>FY 94</i>	<i>FY 95</i>
Appraisal Estimate	0.8	3.1	6.5	11.5	18.0	21.7	24.0	24.5	24.5
Actual	0.0	0.5	1.3	2.8	5.3	8.3	10.8	15.3	17.2 ^a
Actual as % Appraisal	0	15	21	24	29	38	45	62	70 ^b

b. Final cancellation of unused amount was made on February 1, 1996.

Project Dates

	<i>Original</i>	<i>Actual</i>
Preparation	—	06/81
Appraisal	11/85	11-12/85
Negotiations	03/17/86	04/16-22/86
Board presentation	05/20/86	06/19/86
Signing	—	11/14/86
Effectiveness	—	03/20/87
Mid-term review Reformulation Report	—	06/92
Project completion	—	06/94
Closing date	06/30/94	06/30/95 ^c

c. Closing date was extended by one year to permit disbursement of retention money due to ICB contractor, 12 months after substantial completion of the contract.

Staff Inputs (staff weeks)

<i>Stage of Project Cycle</i>	<i>Actual</i>
Preparation to Appraisal	105.9
Appraisal	10.9
Negotiations through Board approval and supervision	95.3
Completion	5.0
<i>Total</i>	217.1

Mission Data

	<i>Date</i> (month/year)	<i>No. of</i> <i>persons</i>	<i>Staff days</i> <i>in field</i>	<i>Specializations</i> <i>represented</i> ^d	<i>Performance rating</i> ^e <i>Imple. status</i>	<i>Dev objec.</i>	<i>Types of</i> <i>problems</i> ^f
Through app.							
Appraisal							
Supervision 1	09/86	1	23 ^g	I	nr	nr	nr
Supervision 2	11/86	1		P	nr	nr	P
Supervision 3	02/87	^h					
Supervision 4	05/87	2	3	A,W	2	2	M
Supervision 5	10/87	2	3	A,I	2	2	M
Supervision 6	05/88	1	4	E	2	2	F,M
Supervision 7	11/88	1	4	E	2	2	F
Supervision 8	04/89	2	4	A,I	2	2	F
Supervision 9	11-12/89	3	7	I,C,A	2	3	F
	07/90	1	7	E	3	3	F
Supervision 10	11/90	1	8	I	3	3	F,P,T
Supervision 11	03/91	2	13	I	3	3	F,P,T
Supervision 12	09/91	2	7	I	3	3	F,P,T
Supervision 13	04/92	1	5	I	3	3	F,P,T
Supervision 14	06/92	1		I	nr	nr	nr
Supervision 15	11/92	1		I	3	3	F,C,P,T
Supervision 16	04/93	4	5	I,A,P	3	3	F,C,P,T
Supervision 17	10/93	4		I,A,P,F	3	3	F,P
Supervision 18	03/94	5		I,A,P,F	3	3	F,P
Supervision 19	04/95 ^h	2	2	I			
Completion	02/95	2	12	I,E	-	-	-

d. A = Agriculturalist; C = Construction; E = Economist; F = Farmers Organization; I = Irrigation Engineer; P = Procurement; W = Water Management Expert.

e. 1 = Problem-free or Minor Problems; 2 = Moderate Problems; and 3 = Major Problems.

f. C = Compliance with Legal Covenants; F = Available Funds; M = Project Management; P = Procurement; and T = Training.

g. Includes other projects.

h. No report on file for this mission.

nr = not reported.

Other Project Data

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

<i>Operation</i>	<i>Credit no.</i>	<i>Amount (US\$ million)</i>	<i>Board date</i>
Irrigation Subsector Project	3009-NEP	80	11/25/97

Basic Data Sheet

SUNSARI MORANG IRRIGATION II PROJECT (CREDIT 1814-NEP)

Key Project Data (amounts in US\$ million)

<i>Item</i>	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
Total project costs	49.9	45.30	91
Credit amount	40.0	39.61	99
Cancellation	—	0.39 ^a	—
Date physical components completed			
Economic rate of return (%)	21	16	76

a. SDR 2.8 million cancelled at final disbursement, November 1995.

Cumulative Estimated and Actual Disbursements

(in US\$ million equivalent)

	<i>FY</i>	<i>FY</i>	<i>FY</i>	<i>FY</i>	<i>FY</i>	<i>FY</i>	<i>FY</i>	<i>FY</i>
	<i>88</i>	<i>89</i>	<i>90</i>	<i>91</i>	<i>92</i>	<i>93</i>	<i>94</i>	<i>95</i>
Appraisal Estimate	4.60	7.80	12.80	20.40	30.30	35.80	39.10	40.0
Actual	2.80	4.49	7.21	11.61	19.71	27.35	37.57	39.61
Actual as % Appraisal	60.9	57.5	56.3	56.9	65.0	76.4	96.1	99.0

Project Dates

	<i>Original</i>	<i>Actual</i>
Preparation	—	06/85
Appraisal	11/86	11-12/86
Negotiations	04/87	04/14-17/87
Board presentation	05/26/87	06/02/87
Signing	—	11/20/87
Effectiveness	—	02/03/88
Mid-term review Complementary New	—	09/91
Headworks Project Appraisal		
Project completion	09/30/94	05/31/94
Closing date	03/31/95	03/31/95

Staff Inputs (staff weeks ^b)

<i>Stage of Project Cycle</i>	<i>Actual</i>
Preparation to Appraisal	75.3
Appraisal	45.3
Negotiations through Board approval	7.9
Supervision	130.2
Completion	7.1
<i>Total</i>	265.8

b. As given in the Operations Information System.

Mission Data

	<i>Date (month/year)</i>	<i>No. of persons</i>	<i>Staff days in field</i>	<i>Specializations represented^c</i>	<i>Performance rating^d Imple. status Dev. objec.</i>	<i>Types of problems^e</i>
Through app.						
Appraisal						
Supervision 1	09/86	1	23 ^f	I	nr	nr
Supervision 2	11/86	1		P	nr	P
Supervision 3	02/87	^g				
Supervision 4	05/87	2	3	A,W	2	2
Supervision 5	10/87	2	3	A,I	2	2
Supervision 6	05/88	1	4	E	2	2
Supervision 7	11/88	1	4	E	2	2
Supervision 8	04/89	2	4	A,I	2	2
Supervision 9	11-12/89	3	7	I,C,A	2	3
	07/90	1	7	E	3	3
Supervision 10	11/90	1	8	I	3	3
Supervision 11	03/91	2	13	I	3	3
Supervision 12	09/91	2	7	I	3	3
Supervision 13	04/92	1	5	I	3	3
Supervision 14	06/92	1		I	nr	nr
Supervision 15	11/92	1		I	3	3
Supervision 16	04/93	4	5	I,A,P	3	3
Supervision 17	10/93	4		I,A,P,F	3	3
Supervision 18	03/94	5		I,A,P,F	3	3
Supervision 19	04/95 ^g	2	2	I		
Completion	02/95	2	12	I,E	-	-

c. A = Agriculturalist; C = Construction; E = Economist; F = Farmers Organization; I = Irrigation Engineer; P = Procurement; W = Water Management Expert.

d. 1 = Problem-free or Minor Problems; 2 = Moderate Problems; and 3 = Major Problems.

e. C = Compliance with Legal Covenants; F = Available Funds; M = Project Management; P = Procurement; and T = Training.

f. Includes other projects.

g. No report on file for this mission.

nr = not reported.

Other Project Data

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

<i>Operation</i>	<i>Credit no.</i>	<i>Amount (US\$ million)</i>	<i>Board date</i>
Irrigation Subsector Project	3009-NEP	80	11/25/97

Basic Data Sheet

SUNSARI MORANG HFADWORKS PROJECT (CREDIT 2430-NEP)

Key Project Data (amounts in US\$ million)

<i>Item</i>	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
Total project costs	29.68	26.29	89
Credit amount	28.00	23.19	80
Cancellation	—	4.55 ^a	—
Date physical components completed			
Economic rate of return (%)	49	49	100

a. Canceled amount is smaller than the actual difference because of fluctuations in the value of SDR:US\$.

Cumulative Estimated and Actual Disbursements

(in US\$ million equivalent)

	<i>FY 93</i>	<i>FY 94</i>	<i>FY 95</i>	<i>FY 96</i>	<i>FY 97</i>	<i>FY 98</i>
Appraisal Estimate	7.00	15.00	25.00	27.00	28.00	29.00 ^b
Actual	1.51	5.85	11.20	17.75	21.59	22.90 ^c
Actual as % Appraisal	22	39	45	66	77	79

b. On December 12, 1997, SDR 1.7 million (US\$2.3 million equivalent) was cancelled.

c. Actual disbursed through May 31, 1998; closing of books in process.

Project Dates

	<i>Original</i>	<i>Actual</i>
Preparation	—	—
Appraisal	—	09/16-29/91
Negotiations	—	09/8-11/92
Board presentation	—	11/05/92
Signing	—	12/16/92
Effectiveness	—	01/22/93
Project completion	06/30/97	06/30/97
Closing date	12/31/97	12/31/97

Staff Inputs (staff weeks)

<i>Stage of Project Cycle</i>	<i>Planned</i>	<i>Revised</i>	<i>Actual</i>
Preparation to Appraisal	7.6	7.6	7.6
Appraisal to Negotiations	24.7	24.7	24.7
Negotiations through Board approval	14.4	14.4	14.4
Supervision	73.9	60.8	65.0
Completion	5.0	8.2	7.4
<i>Total</i>	125.6	115.7	119.1

Mission Data

	<i>Date (month/year)</i>	<i>No. of persons</i>	<i>Staff days in field</i>	<i>Specializations represented^d</i>	<i>Performance rating^e</i>		<i>Types of problems^f</i>
					<i>Imple. status</i>	<i>Dev. objec.</i>	
Through app.							
Appraisal	09-10/91	6	13	Eng(3), Env,Ag., Eco			
Post-appraisal	03-04/92	1	7	Eng.			
Supervision 1	11/92	1	4	Eng.	2	2	T
Supervision 2	03/93	3	3	Eng., Prog., Agr.	2	2	T
Supervision 3	09-10/93	6	5	Eng(3), Ag(2), Soc.	2	1	-
Supervision 4	02/94	3	6	Eng., Ag(2)	2	1	-
Supervision 5	05/94	7	7	Eng.(2)	-	-	-
Supervision 6	06/94	2	3	Eng.(2)	S	HS	-
Supervision 7	11-12/94	3	5	Eng.(3)	S	HS	T
Supervision 8	07/95	2	7	Eng.(2)	S	HS	T
Supervision 9	11/95	2	3	Eng.(2)	S	HS	T
Supervision 10	03/96	3	2	Eng.(2), Fin.	S	S	-
Supervision 11	06/96	1	6	Eng.	-	-	-
Supervision 12	12/96	4	7	Eng.(2), Eco., Ag.	S	HS	-
Supervision 13	12/96	4	2	Fin., Eng.	-	-	-
Supervision 14	06/97	4	4	Eng.(3), Ag.	S	S	-
Supervision 15	11/97	4	8	Eng.,Ag.,Eco., Fin.	S	S	-
Completion	01/98	1	7	Eng.	-	-	-

d. Ag. = Agriculturalist; Eco. = Economist; Eng. = Engineer; Env. = Environment; Fin. = Financial.

e. 1 = Problem-free or Minor Problems; 2 = Moderate Problems; S = Satisfactory; HS = Highly Satisfactory.

f. T = Technical.

Other Project Data

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

<i>Operation</i>	<i>Credit no.</i>	<i>Amount (US\$ million)</i>	<i>Board date</i>
Terai Groundwater Project			1999

Table B1: Narayani III: Key Indicators of Project Performance

A. CIVIL WORKS	SAR	Audit	Completed
1. Nepal Eastern Canal			
Canal Lining (km)	3.6	1.1	31%
Canal Slope Protection (km)	2.0	-	0%
Bank Strengthening (km)	7.0	9.8	140%
Structures (number)	316	11	3%
Service Roads (km)	18.5	-	0%
2. Irrigation and Drainage			
<i>Stage I Area</i>			
Earthworks & Canal Lining (km)	28.0	227.0	811%
Structures (number)	190	1,224	644%
Tertiary - Canals (km)	386.0	182.0	47%
Tertiary - Structures (number)	5,756	784	14%
Canal Service Roads (km)	72.0	-	0%
<i>Stage II Area</i>			
Earthworks & Canal Lining (km)	15.6	143.0	917%
Structures (number)	517	700	135%
Tertiary - Canals (km)	292.0	30.0	10%
Tertiary - Structures (number)	3,828	114	3%
Drainage Canals (km)	80.8	-	0%
Drainage Structures (number)	104	-	0%
Canal Service Roads (km)	72.0	-	0%
<i>Stage III Area</i>			
Earthworks & Canal Lining (km)	150.5	5.0	3%
Structures (number)	513	-	0%
Tertiary - Canals (km)	93.0	-	0%
Tertiary - Structures (number)	1,125	-	0%
On-Farm Drainage (ha)	8,700.0	-	0%
Drainage Canals (km)	168.4	-	0%
Drainage Structures (number)	467	-	0%
Service Roads (km)	124.8	-	0%
Shallow Tubewells (number)	40	-	0%
3. Flood Protection Works			
Embankment & Dykes (km)	19.3	13.4	69%
River Training (km)	7.5	7.1	95%
4. Upgrade Project Area Roads			
Village Link Roads (km)	91.0	-	0%
Resurface Existing Roads (km)	152.0	18.6	12%
B. IRRIGATION			
Incremental Area (ha)			
Stage I & II	5,800	2,225	38%
Stage III	8,700	-	0%
Incremental Cropping Intensity			
Stage I & II	33%	9%	28%
Stage III	38%	0%	0%

Table B2: Sunsari Morang II: Key Indicators of Project Performance

A. CIVIL WORKS	SAR	Audit	% SAR
1. Chatra Main Canal			
Desilting (cubic meters)	1,298,700	1,298,700	100%
Rehabilitated Structures (num)	150	150	100%
New Structures (number)	37	37	100%
2. Irrigation and Drainage			
Secondary Canal (km)	26	26	100%
Subsecondary Canals (km)	52	52	100%
Tertiary Canals ((km)	170	170	100%
Watercourses (km)	695	686	99%
Subsecondary Drains (km)	10	9	90%
Tertiary Drains (km)	80	64	80%
Collector Drains (km)	153	125	82%
Irrigation Structures (number)	6,962	6,876	99%
Drainage Structures (number)	1,185	1,023	86%
B. IRRIGATION			
Area Irrigated (ha)	26,450	26,450	100%
Incremental Foodgrain Production (tons/yr)	39,980	62,346	156%
C. SOCIO-ECONOMIC			
Beneficiaries (number of families)	13,560	15,560	115%
Generated Employment (person-years/yr)	3,100	3,330	107%
Area Assessed for Water Charges (ha)	26,450	4,500	17%
Amount Collected (percent)	100%	4%	4%

Table B3: Sunsari Morang Headworks - Key Indicators of Project Performance

	Cost US\$ (million)		As a % SAR Estimate	Physical Status
	SAR	Audit		
A. CIVIL WORKS				
1. Intake Works and Culvert	7.76	5.92	76%	100% Complete
2. Pre-Settling Basin	3.92	4.6	117%	100% Complete
3. Main Settling Basin	0.94	0.48	51%	100% Complete
4. Dredging Equipment	3.44	2.66	77%	100% Complete
5. Mini-Hydro Station and Power	6.12	5.2	85%	100% Complete
B. TECHNICAL ASSISTANCE/TRAINING	2.16	2.78	129%	100% Complete
C. INDICATORS OF PROJECT OPERATION				
1. Sediment Trapped (m3/year)	380,000	332,000	87%	Satisfactory
2. Quantity Dredged (m3/year)	480,000	241,000	50%	Problematic
3. Sediment Concentration (ppm) in project canals at RD32 km		651		Satisfactory
4. Hydropower Generated (Mwh)				
total	12.5	0.305	2%	Too little
used by dredgers	2.5	0.305	12%	Too little

1. The Implementation Completion Report (ICR) projects that the cropping intensity increased significantly during implementation of the project. In the stage I area cropping intensity is stated to have increased 34 percent from 150 percent preproject to 184 percent post project. Similarly the ICR states cropping intensity increased by 26 percent (from 145 to 171 percent) over the same period. A review of the data (Table C1) shows that in the year immediately preceding project implementation, cropping intensity was 200 percent in the stage I area and 182 percent in the stage II area. Thus neither of the ICR's assumptions about cropping intensity appear to be correct and the audit has adopted higher values, Table C1. Discussion with NZIDP staff indicated that 1997-98 cropping intensities have changed little since 1992-93 because of the irregular water supplies.

2. Thus the audit initially estimates that, *ceteris paribus*, project benefits are probably about 30 percent of those assumed by the ICR. However, repair of the Tilawe Weir stopped the potential loss of about 5,000 ha of supplementary irrigation during the summer monsoon. In practice, water would be available from the Tilawe weir at the same time as there are plentiful supplies of rainfall and water from India and not all this potential could be used. Thus it is reasonable to assume that about half of the potential area served by Tilawe Weir, 2,500 ha, be included in the stream of project benefits. In consequence, total incremental area is estimated to be 4,725 ha or 19 percent of the total cropped area.

3. The ICR further notes that "a significant part of these benefits, perhaps around 40 percent, is attributable to farmers' own investment in pumps and motors." And this finding was verified by the audit in the field. In consequence, only 60 percent of the incremental benefited area relies on surface water irrigation from the project works. Thus the net incremental benefited area is 2,835 ha or about 37 percent of ICR's estimate. Accordingly, the ICR's project benefit stream was reduced prorata for the reevaluation of the economic rate return, Table C2. The details are shown in Table C3 where the major assumptions are given.

Table C-1. Estimates of Pre- and Post-Project Cropping Intensity

	Stage	Cropping Intensity			Cropped Area (ha)	
		Preproject	Post Project	Increase	Total	Increase
ICR	I	150	184	34	16,000	5,440
ICR	II	140	171	26	8,500	2,210
Total	-	-	-	-	24,500	7,650
Audit	I	200	207	7	16,000	1,120
Audit	II	182	195	13	8,500	1,105
Total	-	-	-	-	24,500	2,225

Table C-2. ERR for Various Project Scenarios

Scenario	ERR Percent	
	ICR	Audit
Stage I & II	19.1	5.5
Flood Component	12.9	12.9
Stage I & II & Flood	11.9	6.7
Stage I & II & III	-	3.6
Stage I & II & III & Flood	-	5.0

Table C-3: Narayani III - Comparison of ICR and Audit Reevaluation of the Economic Rate of Return

Project Year	Financial Year	ICR Analysis Stage I & II (NRs million)				Audit Analysis Stage I & II (NRs million)				Audit Analysis Stage I, II and III (NRs)		
		Capital Costs	O&M Costs	Incremental Benefits	Balance	Capital Costs	O&M Costs	Incremental Benefits	Balance	Capital Costs	O&M Costs	Incremental Benefits
1	1986/87	17.5			-17.5	17.5			-17.5	24.0		
2	1988	46.4			-46.4	46.4			-46.4	59.3		
3	1989	103.6			-103.6	103.6			-103.6	137.8		
4	1990	112.7			-112.7	112.7			-112.7	138.9		
5	1991	130.7			-130.7	130.7			-130.7	118.2		
6	1992	87.4		38.9	-48.5	87.4		14.4	-73.0	89.7		14.4
7	1993	270.2		77.7	-192.5	270.2		28.8	-241.4	369.9		28.8
8	1994	132.8		116.6	-16.2	132.8		43.2	-89.6	172.4		43.2
9	1995	18.0	54.8	155.4	82.6	18.0	54.8	57.6	-15.2	21.2	54.8	57.6
10	1996		45.8	194.3	148.5		45.8	72.0	26.2		45.8	72.0
11	1997		42.7	233.1	190.4		42.7	86.4	43.6		42.7	86.4
12	1998		41.0	272.0	231.0		41.0	100.8	59.8		41.0	100.8
13	1999		34.3	310.8	276.5		34.3	115.2	80.9		34.3	115.2
14	2000		23.6	349.7	326.1		23.6	129.6	106.0		23.6	129.6
15	2001		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
16	2002		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
17	2003		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
18	2004		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
19	2005		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
20	2006		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
21	2007		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
22	2008		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
23	2009		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
24	2010		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
25	2011		23.4	388.5	365.1		23.4	144.0	120.6		23.4	144.0
		Economic Rate of Return 19.1%				Economic Rate of Return 5.5%				Economic Rate of Return		
		Benefits reduced to 29% of ICR's.				Benefits reduced to 29% of ICR's.				Benefits reduced to 29% of I		
		Capital Costs same as ICR				Capital Costs same as ICR				Full Project Costs less Flood		

Project Year	Financial Year	ICR Analysis Flood Benefits (NRs million)				Audit Analysis, Stage I, II and III & Flood Benefits (NRs million)				Audit Analysis, Stage I & Flood Benefits (NRs)		
		Capital Costs	O&M Costs	Incremental Benefits	Balance	Capital Costs	O&M Costs	Incremental Benefits	Balance	Capital Costs	O&M Costs	Incremental Benefits
1	1986/87	1.7			-1.7	25.7			-25.7	19.2		
2	1988	9.0			-9.0	68.3			-68.3	55.4		
3	1989	14.5			-14.5	152.3			-152.3	118.1		
4	1990	26.8		5.9	-21.0	165.7		5.9	-159.9	139.5		5.9
5	1991	74.0		11.7	-62.3	192.2		11.7	-180.5	204.7		11.7
6	1992	38.8	0.9	17.6	-22.1	128.5	0.9	32.0	-97.4	126.2	0.9	32.0
7	1993	27.4	1.8	23.5	-5.7	397.3	1.8	52.3	-346.8	297.6	1.8	52.3
8	1994	22.9	2.6	29.3	3.8	195.3	2.6	72.5	-125.4	155.7	2.6	72.5
9	1995	5.2	3.5	35.2	26.5	26.4	58.4	92.8	8.0	23.2	58.4	92.8
10	1996		4.4	35.2	30.8		50.2	107.2	57.0		50.2	107.2
11	1997		4.4	35.2	30.8		47.2	121.6	74.4		47.2	121.6
12	1998		4.4	35.2	30.8		45.4	136.0	90.6		45.4	136.0
13	1999		4.4	35.2	30.8		38.7	150.4	111.6		38.7	150.4
14	2000		4.4	35.2	30.8		28.0	164.8	136.8		28.0	164.8
15	2001		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
16	2002		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
17	2003		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
18	2004		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
19	2005		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
20	2006		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
21	2007		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
22	2008		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
23	2009		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
24	2010		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
25	2011		4.4	35.2	30.8		27.8	179.2	151.3		27.8	179.2
		Economic Rate of Return 12.9%				Economic Rate of Return 5.0%				Economic Rate of Return		
		Benefits same as ICR's.				Benefits reduced to 29% of ICR's and				Benefits reduced to 29% of I		
		Capital Costs same as ICR				Flood benefits included.				Flood benefits included.		
						Full Project Costs				Capital Costs same as ICR		

Comments from His Majesty's Government of Nepal's Ministry of Finance

Phone No.

2-15816
2-15133
2-15108
2-14866
2-11464



Office of the Financial Comptroller General

His Majesty's Government
Ministry of Finance
Office of the Financial Comptroller General

Babar Mahal,
Kathmandu, Nepal.

Ref. No.

Date July 1, 1998

Sub:—

Comments on Narayani III Irrigation II Project (Cr.1715 Nep)
Sunsari Morang Irrigation II Project (Cr.1814 Nep)
Sunsari Morang Headworks Project (Cr.2430 Nep)
Performance Audit Report.

Mr. Roger Slade,
Manager
Sector and Thematic Evaluations Group
Operations Evaluation Department
World Bank (IBRD)
International Development Association
1818 H Street N.W.
Washington D.C. 20433
USA

Dear Sir,

Thank you very much for providing us the opportunity of making comments on the Draft Performance Audit Report dated June 8, 1998 of Narayani III Irrigation Project (Cr.1715 Nep), Sunsari Morang Irrigation II Project (Cr.1814 Nep), Sunsari Morang Headworks Project (Cr.2430 Nep). We are very much impressed from the fair and independent evaluation of the above mentioned Projects, particularly in the following issues:

- Operation and Maintenance Budget.
- Evaluation on the LCB and ICB.
- Budgetary and management problems in relation to the progress of the Project.

However we felt that the Report does not clearly compare and analyse the physical and financial targets and achievements there on.

Thanking You.

Yours Sincerely,

(M.P. Aryal)
Financial Comptroller General

Comments from His Majesty's Government of Nepal's Ministry of Water Resources



His Majesty's Government
Ministry of Water Resources

Department of Irrigation

Sunsari-Morang Irrigation Project

BIRATNAGAR

2-2527
Pho. 2-2240
2-5558

13 AUG 1998

Letter No.:- Kath - 10/05/56

Date: 13. 1998

Mr. Shyam S. Rajitkar
Irrigation Specialist
The World Bank
Kathmandu Office
Hotel Yak & Yet Building Complex.

Acc :	<u>Shyam</u>
Info :	
Copy:	
File :	

Sub : Sunsari Morang Head Works Project credit 2430 Nep.
OED: Review of Implementation completion Report.

Dear Sir,

With reference to the above subject, this is to inform you that we have reviewed the OED's Evaluation Summary on the ICR prepared for Sunsari Morang Head Works Project and have no any further comments on the same.

Thanking you,

Sincerely yours

A. K. Pokharel
(A. K. Pokharel)
Project Manager

CC:

The Director General
Department of Irrigation.

DDG, Surface Division
Department of Irrigation.

Comments from His Majesty's Government of Nepal's Ministry of Agriculture



His Majesty's Government
MINISTRY OF AGRICULTURE

Department of Agriculture

{ 5-21323, 5-24224
5-21127, 5-21076
5-22449, 5-22121
5-21091

Ref. No.

Haribar Bhawan,
Pulchowk, Lalitpur.

Fax (202) 522-5123

Date: 14 July 1998

Subject:- Performance Audit Report

Mr. Roger Slade

Manager
Sector and Thematic Evaluations Group
Operations Evaluation Department
The World Bank
Washington D.C., U.S.A

Dear Mr. Slade,

This is in reference to your letter of June 18, 1998 regarding the draft performance audit report (PAR) of three irrigation projects. In this regard please find enclosed herewith the comments/suggestions on PAR for your information. We believe these comments will be helpful for effective implementation of the projects of similar nature in the future.

Best regards.

Sincerely Yours,

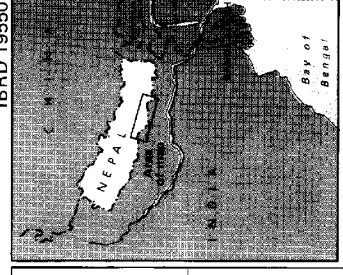
(R. B. Pradhan)
Director General

Comments

1. It is being discussed with regard to water charge/fee for operation and maintenance of tertiary canal in page nos. 14, 33 and 46. As mentioned, about 38 percent (Rs. 200) of actual water supply cost (Rs. 530) per hectare is collected and rapid increase in fees would be disincentive to the farmers. Moreover, the government is also designing a program to achieve full O & M cost recovery assisted by the recently approved Nepal Irrigation Sector Project (NISP)

In view of the above issues, it is necessary to collect water charge for the full recovery of O and M cost. However, it is imperative to assess the effect of the increase of water fee from a present level of Rs. 200/ha to Rs. 530/ha from the perspective of farmers participation.

2. The issues such as lack of coordination between irrigation and agriculture agencies at the field level, demand driven agricultural programs and difficulties for the operation and maintenance of canal have been highlighted in page No. 38. In view of this, the involvement of agricultural technicians is must from the very beginning of project design stage for effective implementation of programs. Agricultural extension and crop intensification programs should be an integral part of ties irrigation development programs and the feasible activities demanded by the farmers should be implemented. It is believed that NISP has considered such issues.
3. The agri. extension workers could also play an important role in onfarm water management and water utilization. The technical capability of these workers at present is inadequate to cater the need. In this regard the provision of study tours and training should be made in the in coming irrigation projects in order to strengthen the technical capacity of extension workers in the said fields.

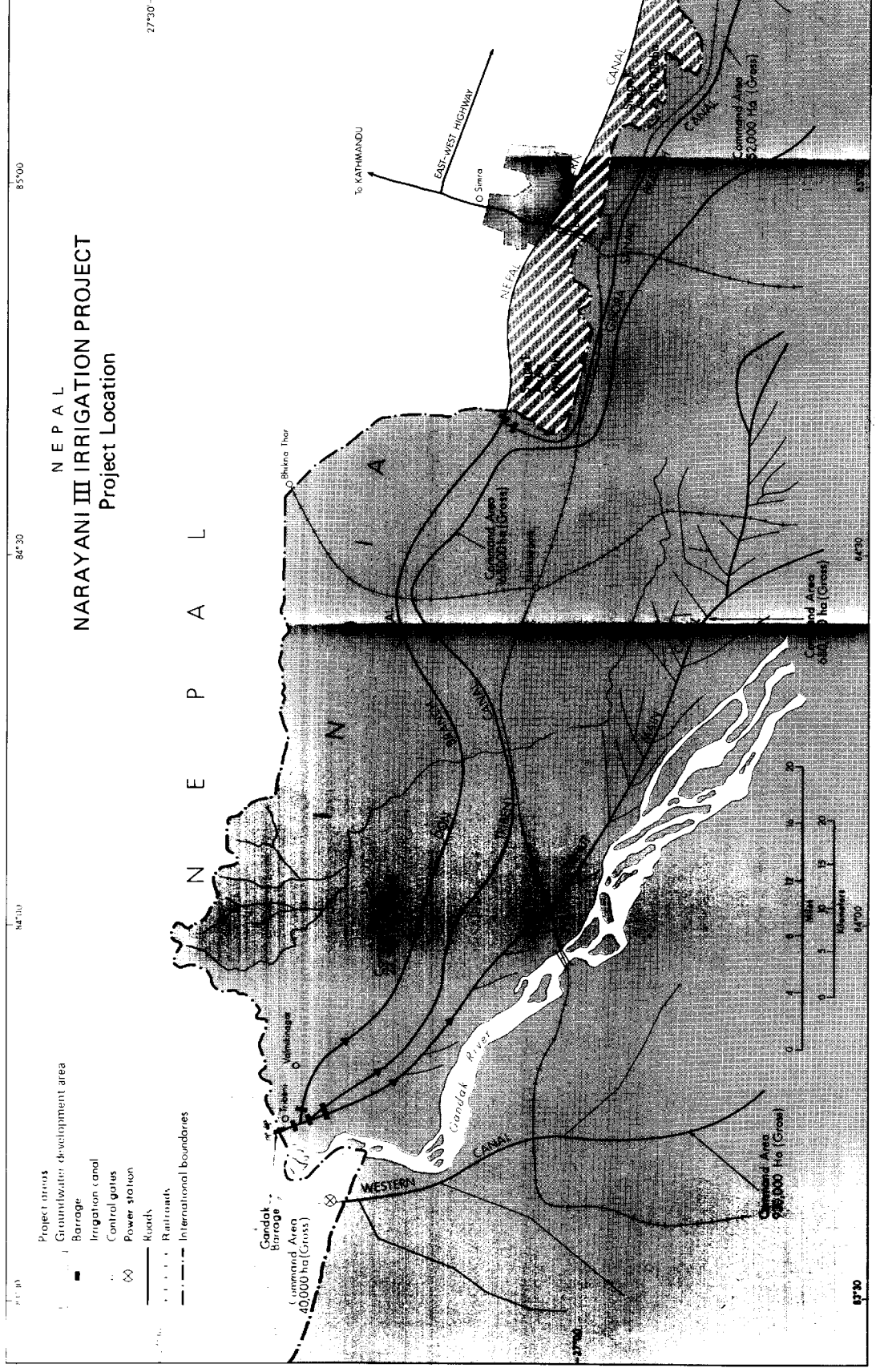


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











N E P A L

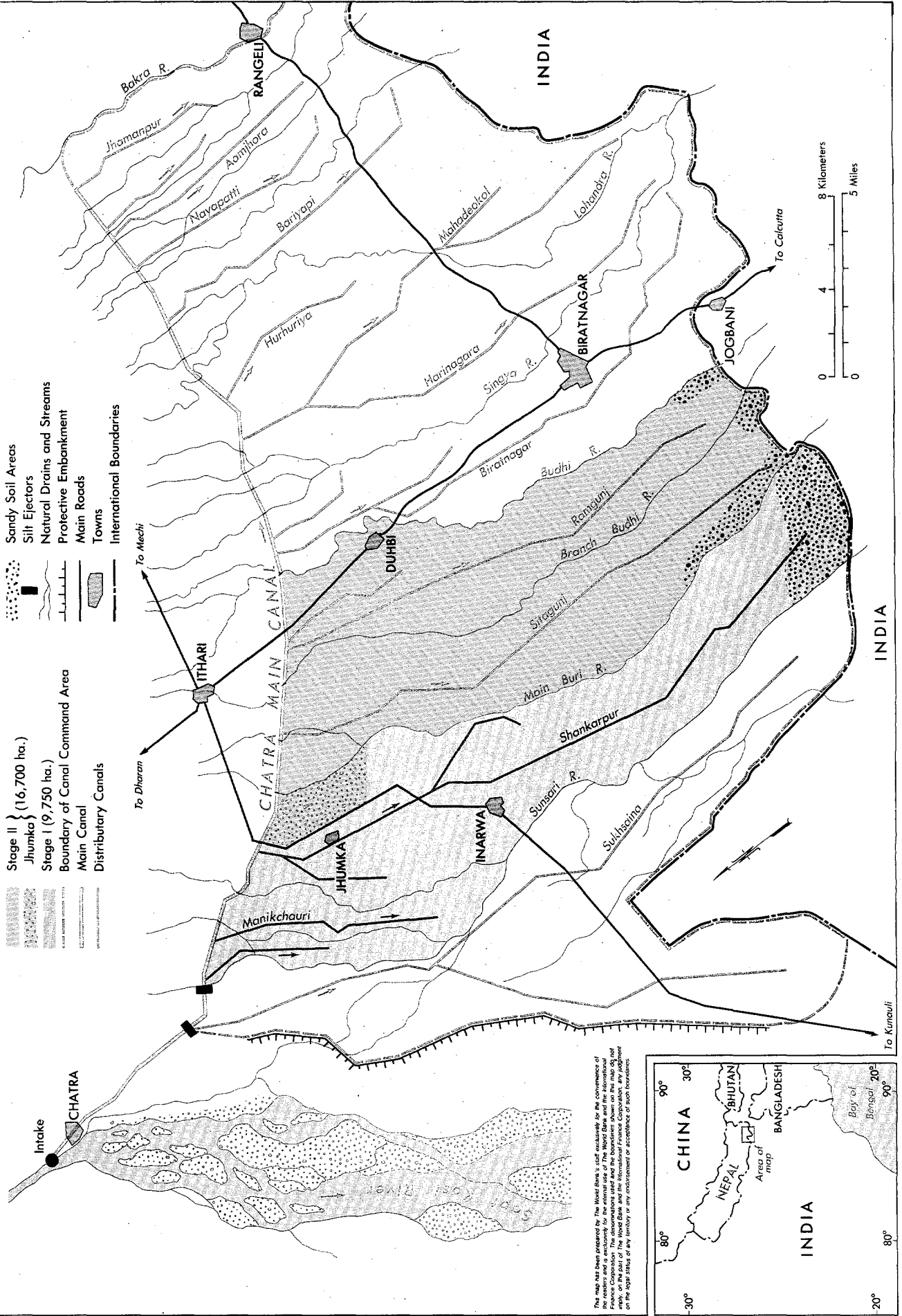
NARAYANI III IRRIGATION PROJECT

Project Location

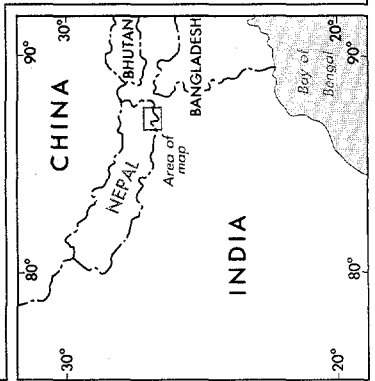


NEPAL SUNSARI MORANG IRRIGATION II PROJECT CHATRA MAIN CANAL COMMAND AREA

-  Stage II (16,700 ha.)
-  Stage I (9,750 ha.)
-  Boundary of Canal Command Area
-  Main Canal
-  Distributary Canals
-  Sandy Soil Areas
-  Silt Ejectors
-  Natural Drains and Streams
-  Protective Embankment
-  Main Roads
-  Towns
-  International Boundaries

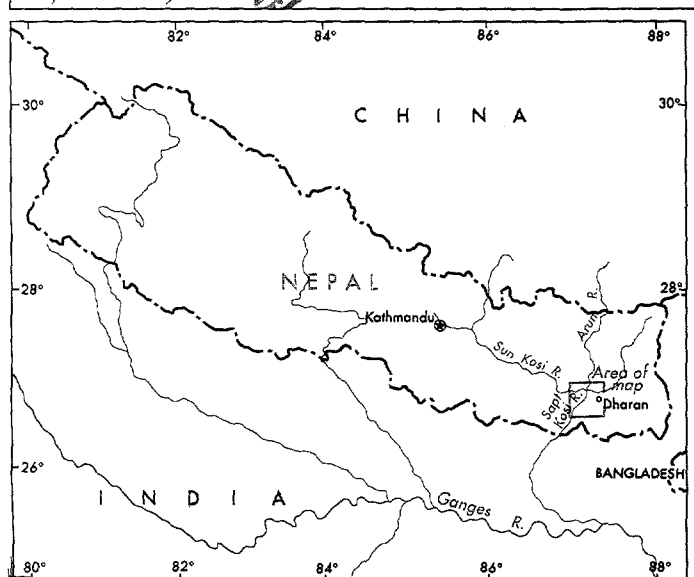
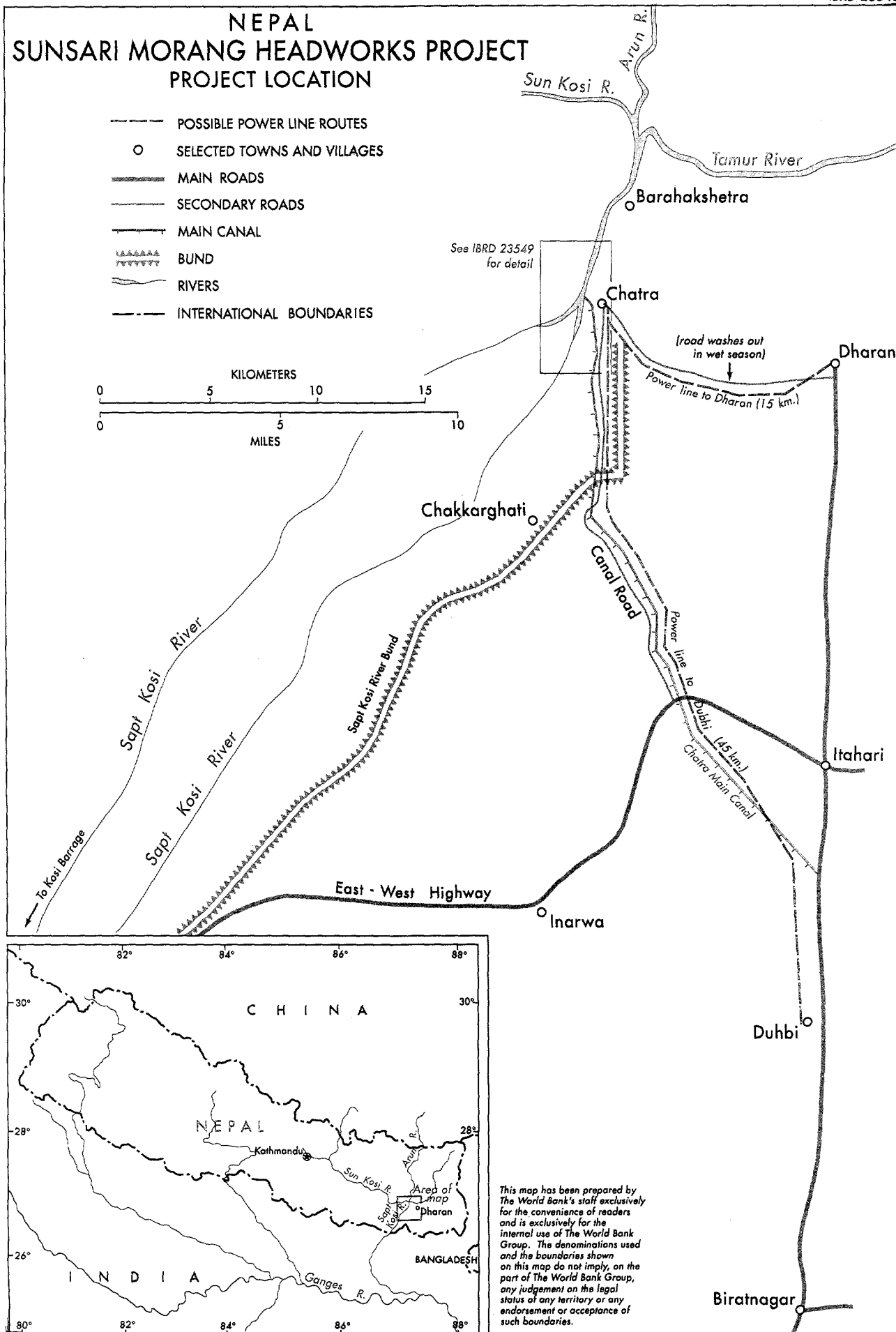
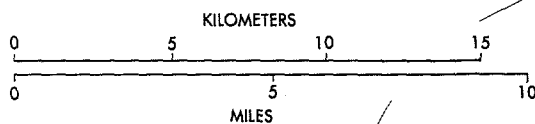


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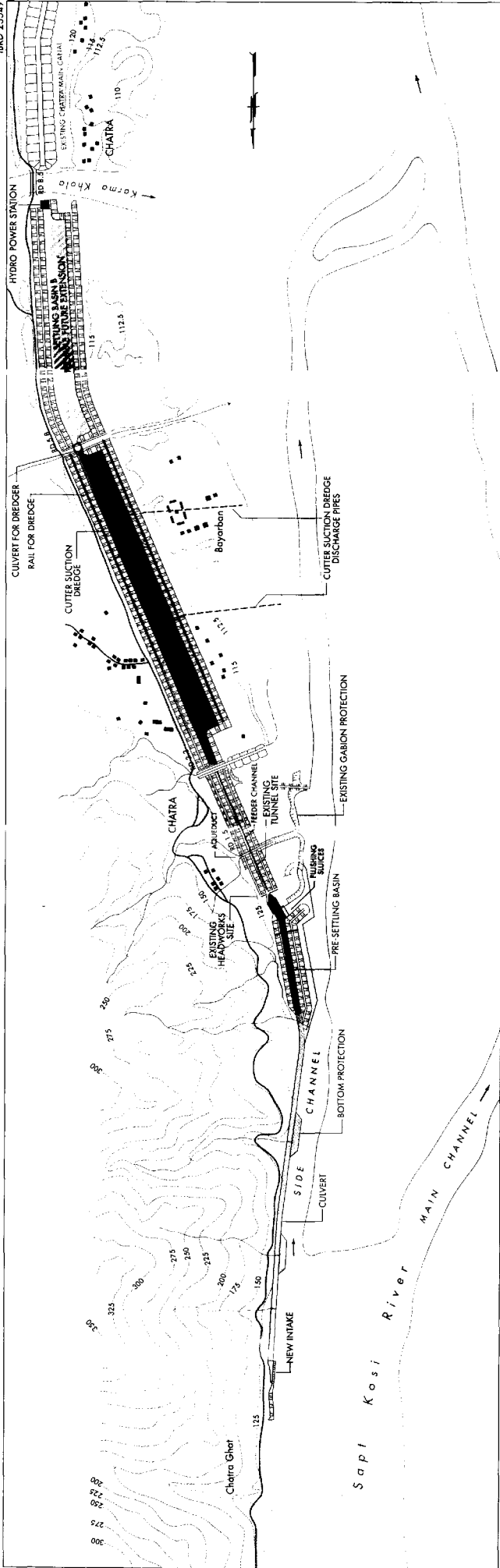


NEPAL SUNSARI MORANG HEADWORKS PROJECT PROJECT LOCATION

- POSSIBLE POWER LINE ROUTES
- SELECTED TOWNS AND VILLAGES
- == MAIN ROADS
- SECONDARY ROADS
- MAIN CANAL
- ▲▲▲▲▲ BUND
- ~~~~ RIVERS
- - - INTERNATIONAL BOUNDARIES



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NEPAL SUNSARI MORANG HEADWORKS PROJECT PROJECT AREA

- | | | | |
|--|---|--|---|
| | NEW WORKS | | DREDGING FACILITIES: |
| | PRE-SETTLING BASIN | | DISCHARGE PIPES FOR CUTTER SUCTION FACILITIES |
| | SETTLING BASIN | | CULVERT FOR CUTTER SUCTION FACILITIES |
| | POSSIBLE FUTURE EXTENSION OF SETTLING BASIN | | RAIL FOR DREDGE |
| | HYDRO POWER STATION | | |
| | CULVERT | | |
-
- | | |
|--|--------------------------|
| | PERMANENT BUILDINGS |
| | ROADS |
| | 1:50 CONTOURS IN METERS |
| | RIVERS (KHOLAS) |
| | INTERNATIONAL BOUNDARIES |

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