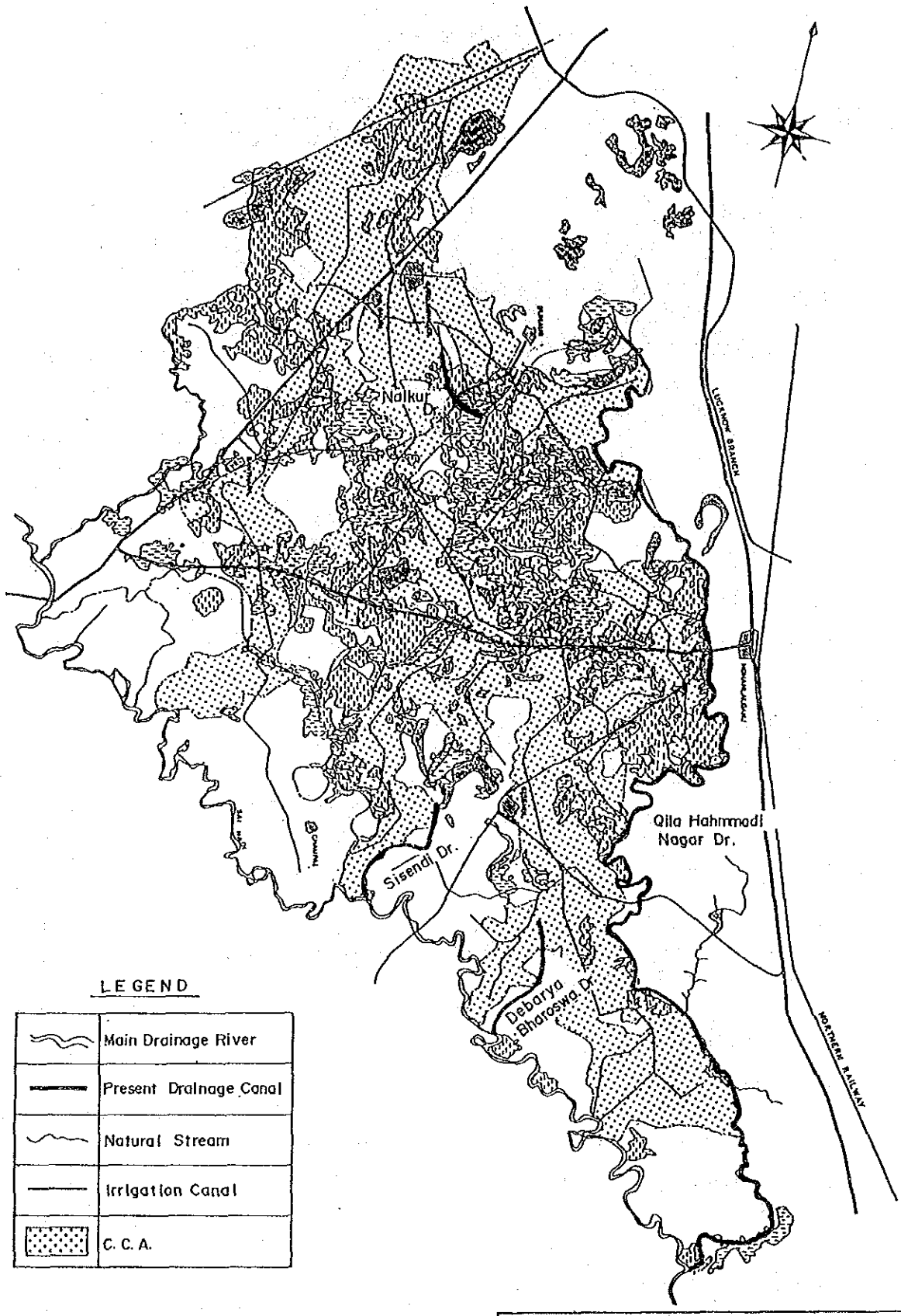



Fig. G.2 Existing Drainage System in Sarojini Nagar Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

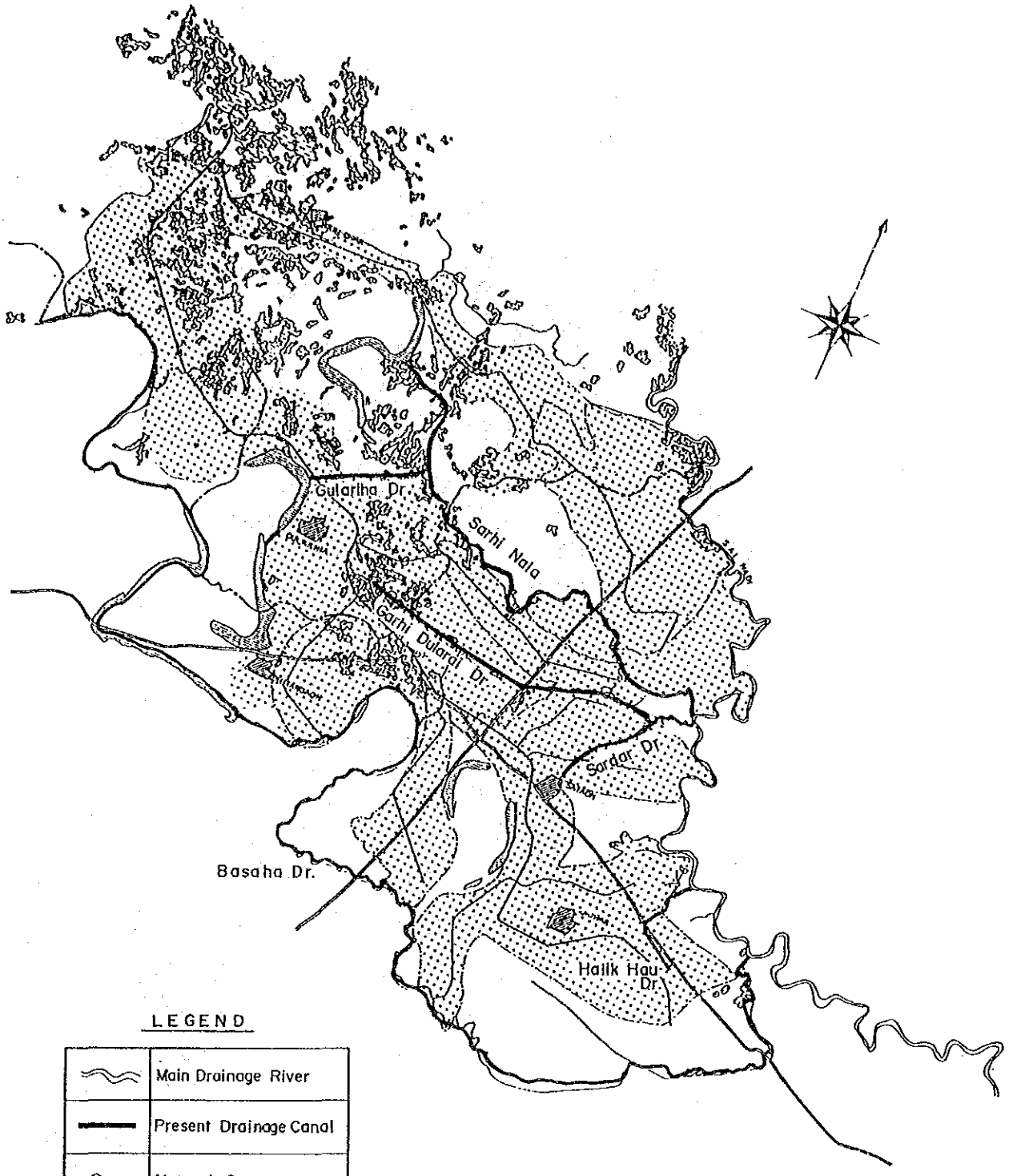



Fig. G.3 Existing Drainage System in Sataon Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

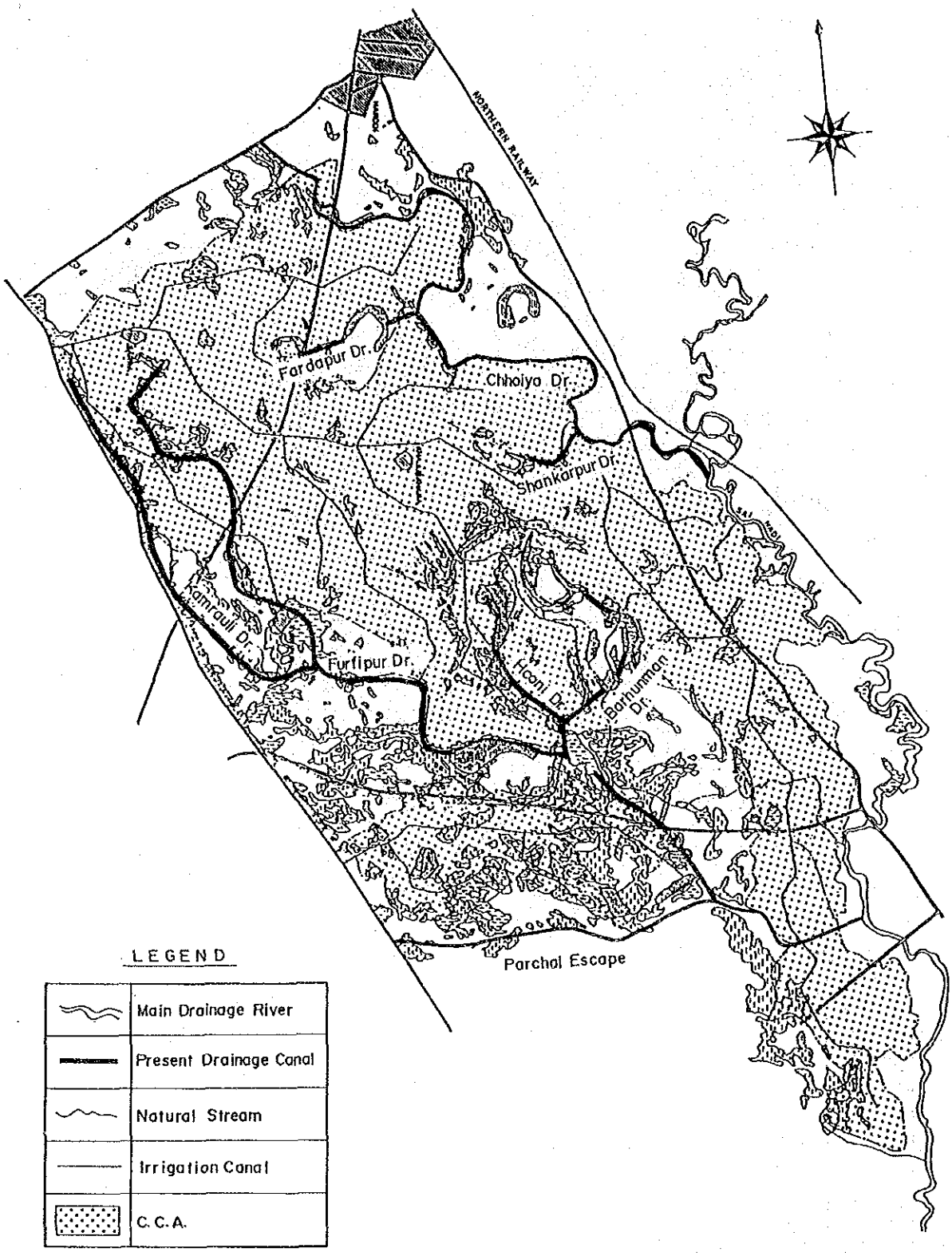



Fig. G.4 Existing Drainage System in Sursa Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

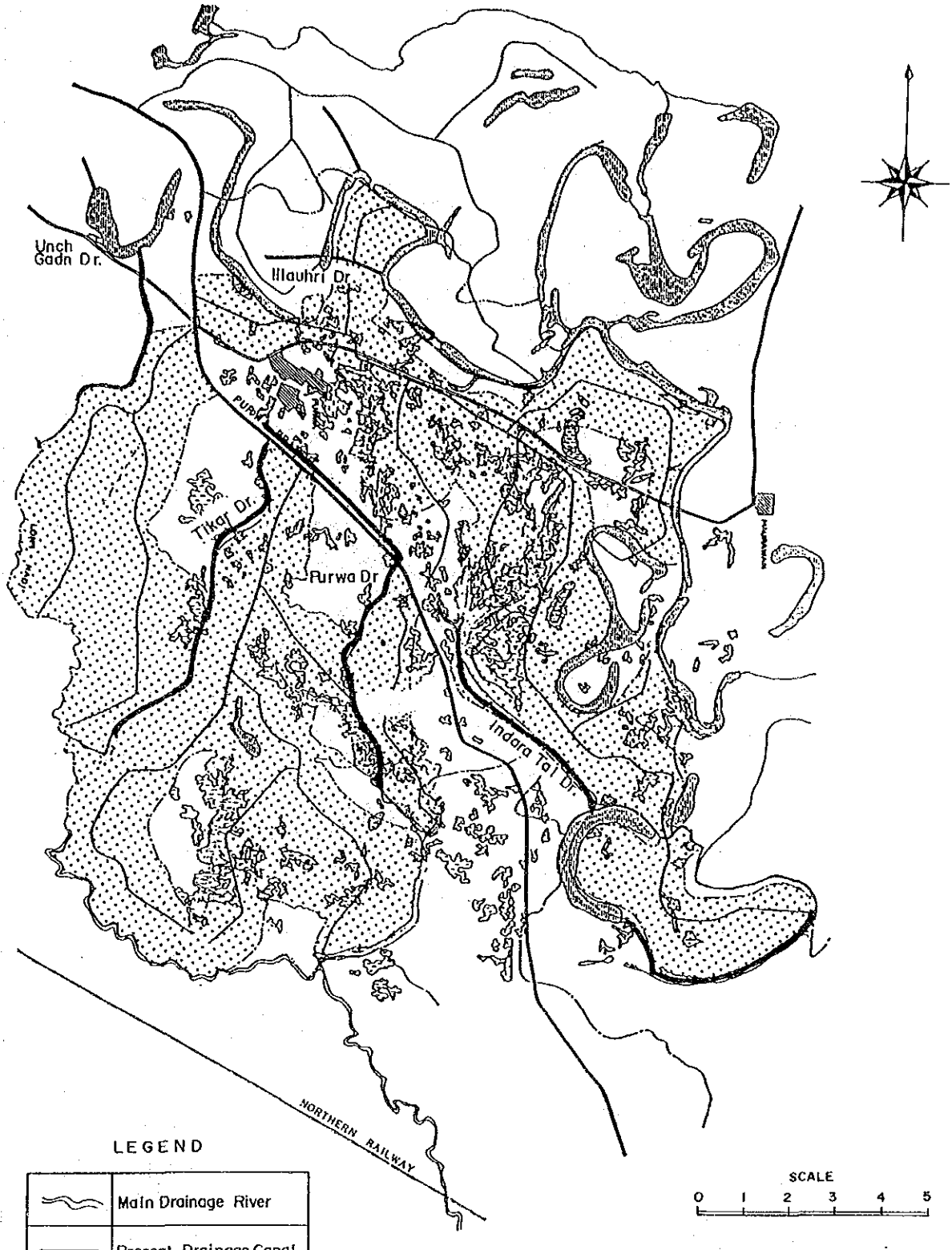



Fig. G.5 Existing Drainage System in Purwa Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

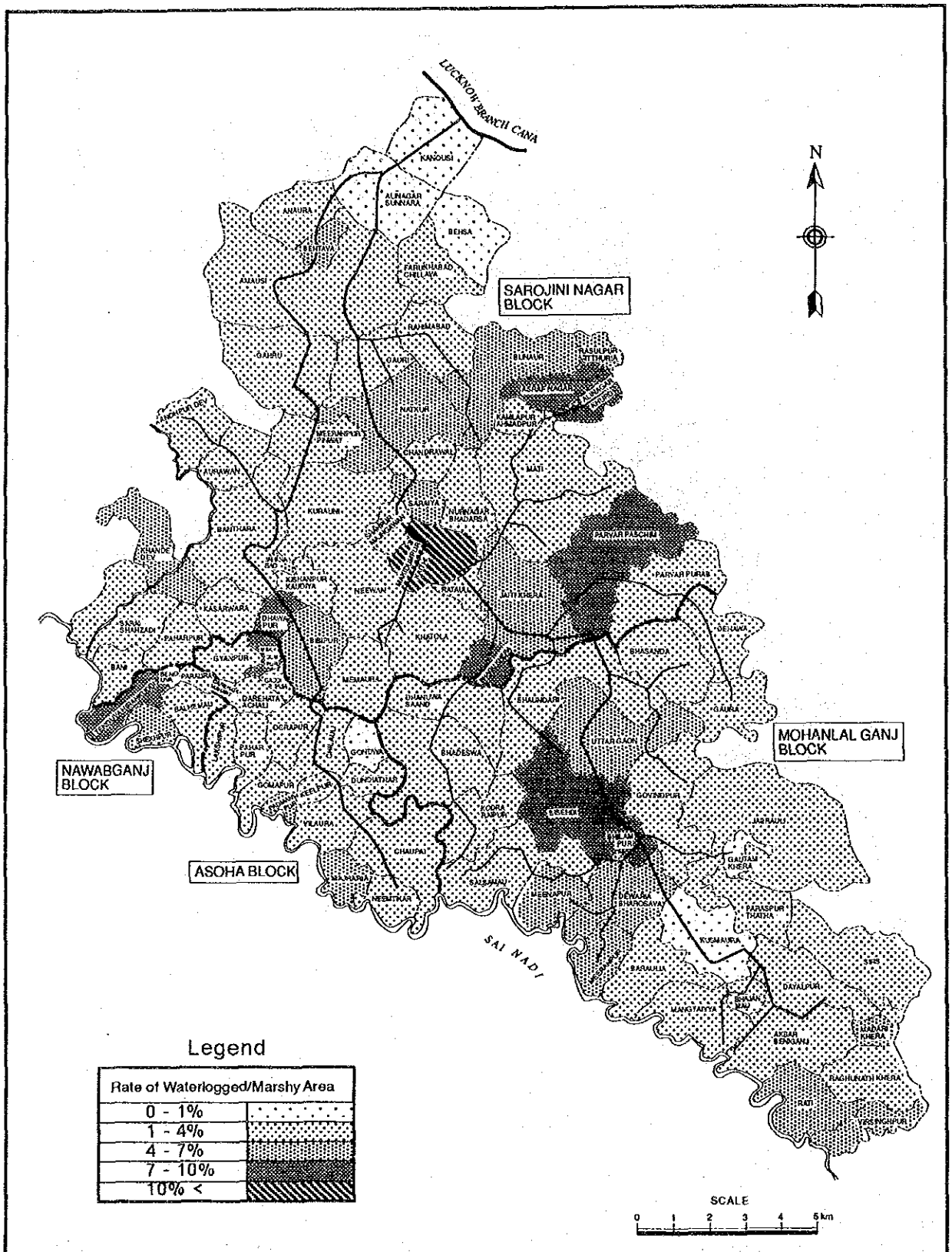



Fig. G.6 Condition of Waterlogged/Marshy Area in Sarojini Nagar Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

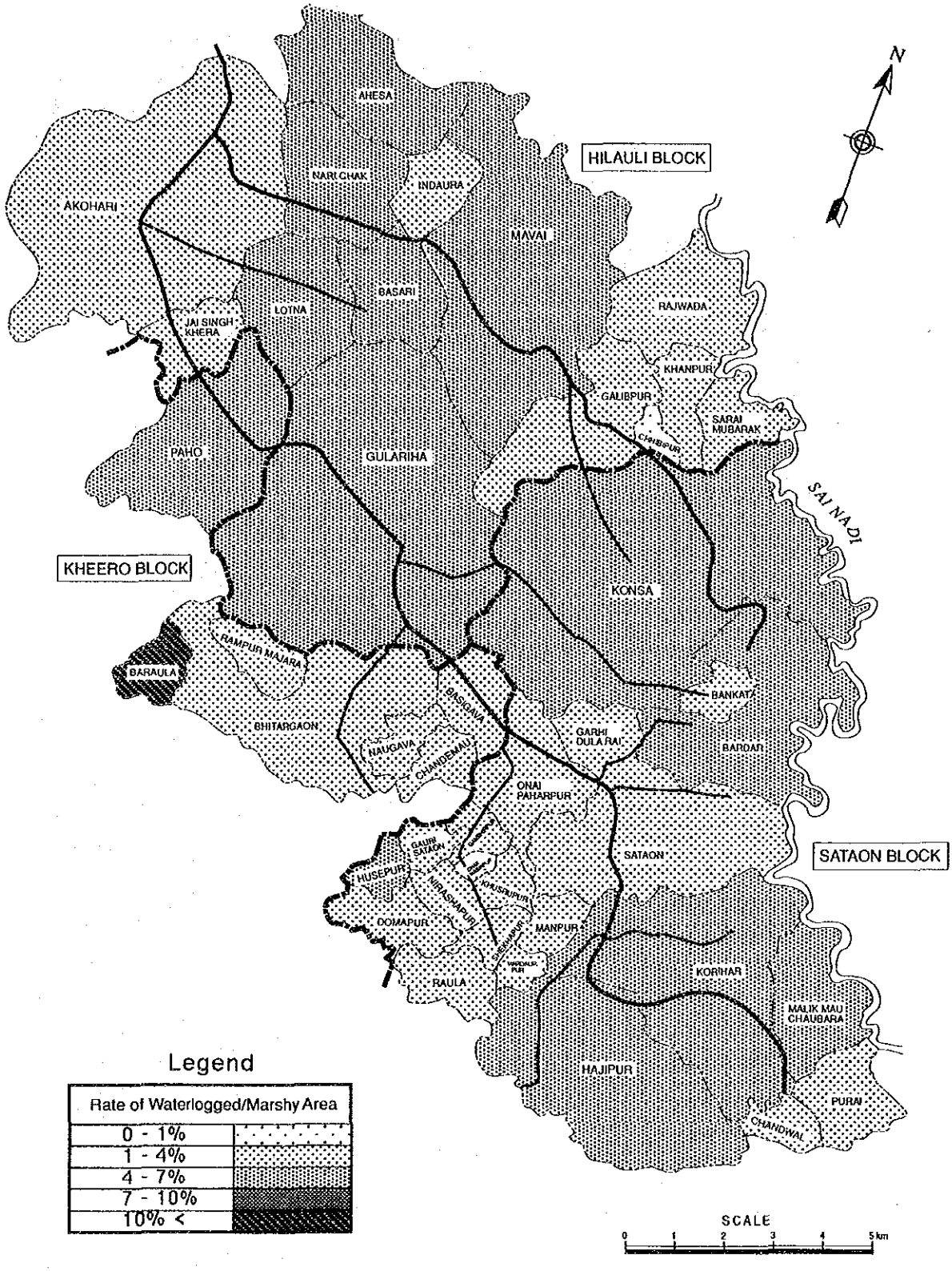



Fig. G.7 Condition of Waterlogged/Marshy Area in Sataon Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

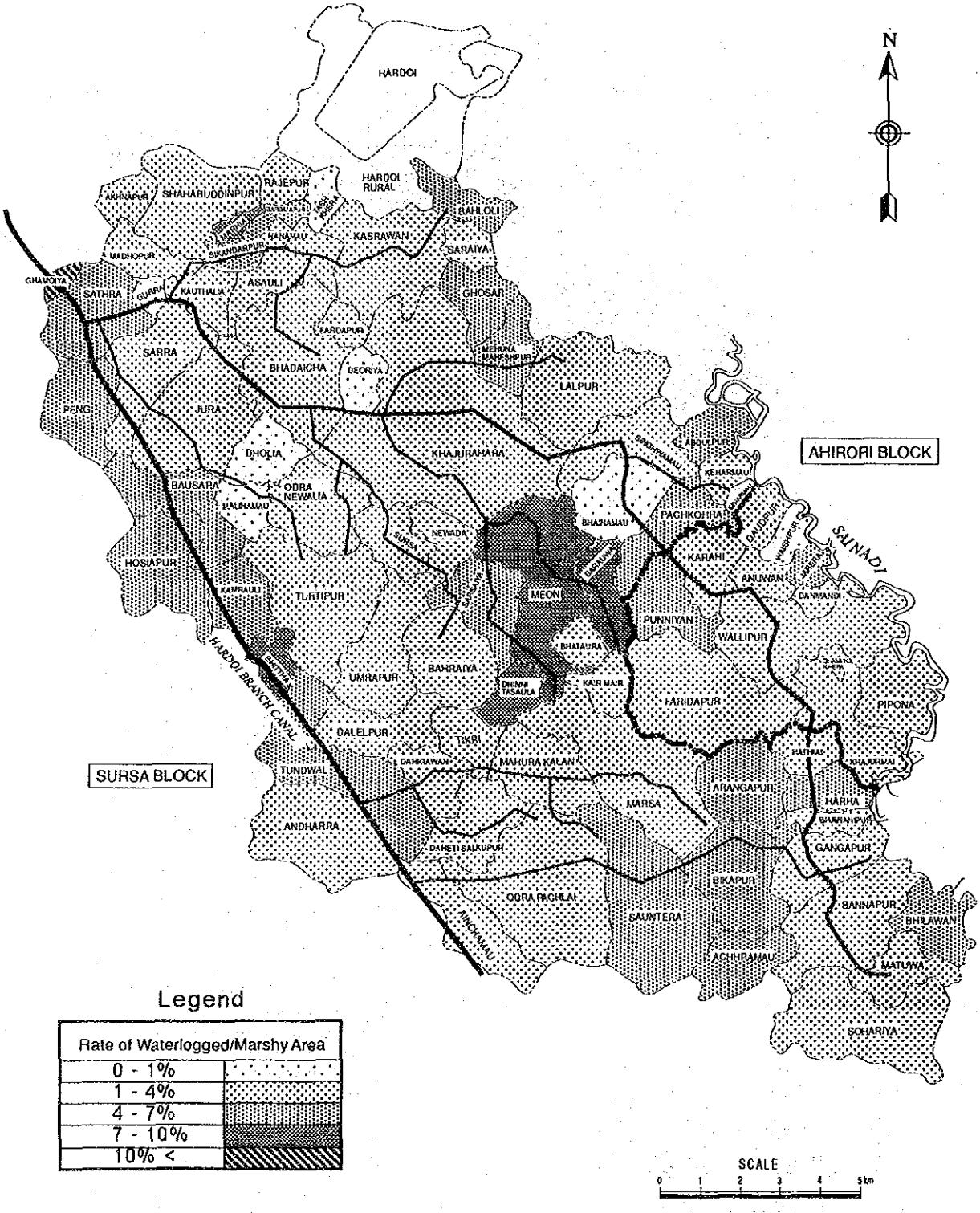
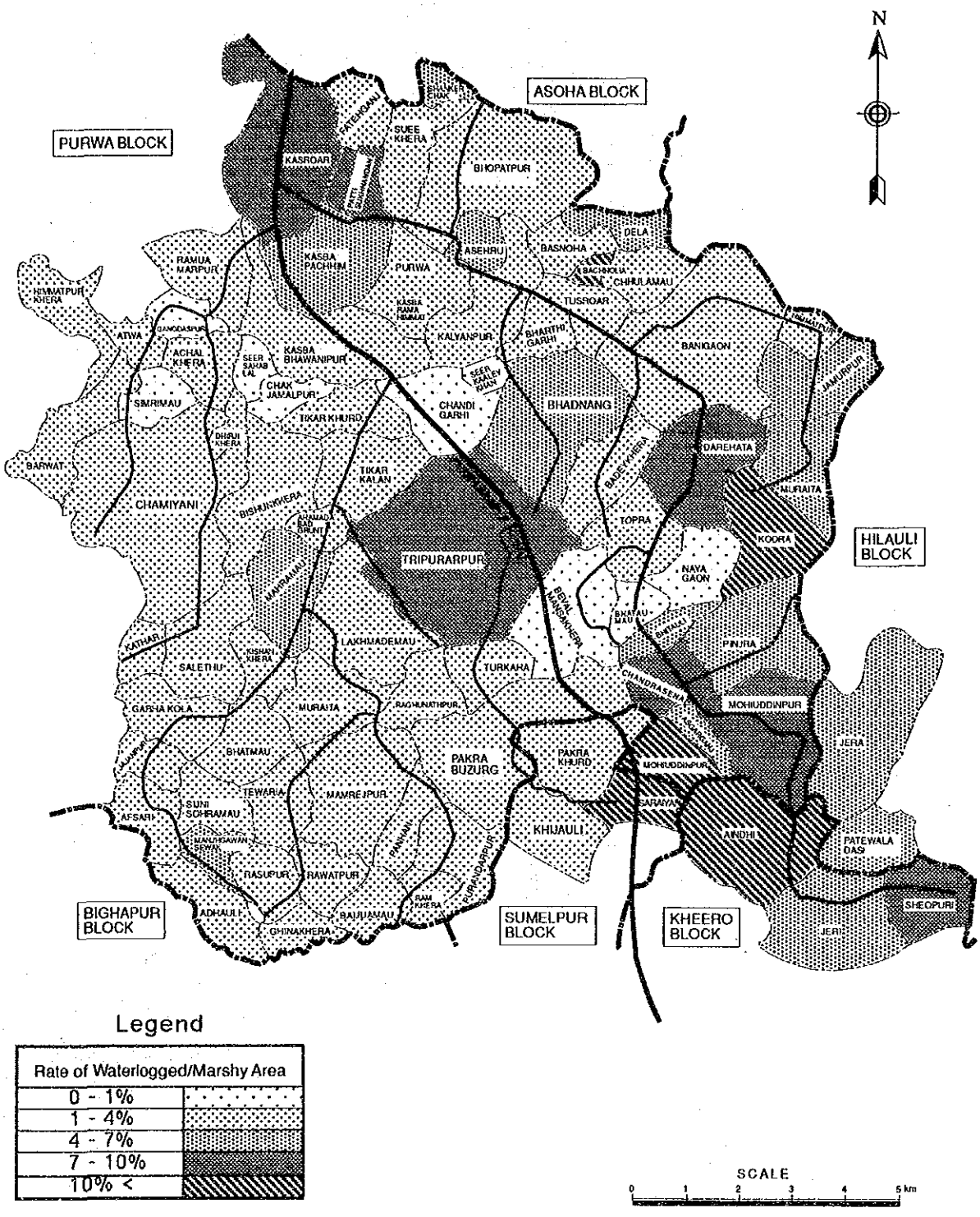



Fig. G.8 Condition of Waterlogging/Marshy Area in Sursa Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |




Legend

| Rate of Waterlogged/Marshy Area | |
|---|---|
| 0 - 1% | |
| 1 - 4% | |
| 4 - 7% | |
| 7 - 10% | |
| 10% < | |

Fig. G.9 Condition of Waterlogging/Marshy Area in Purwa Study Area

| INDIA |
|---|
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

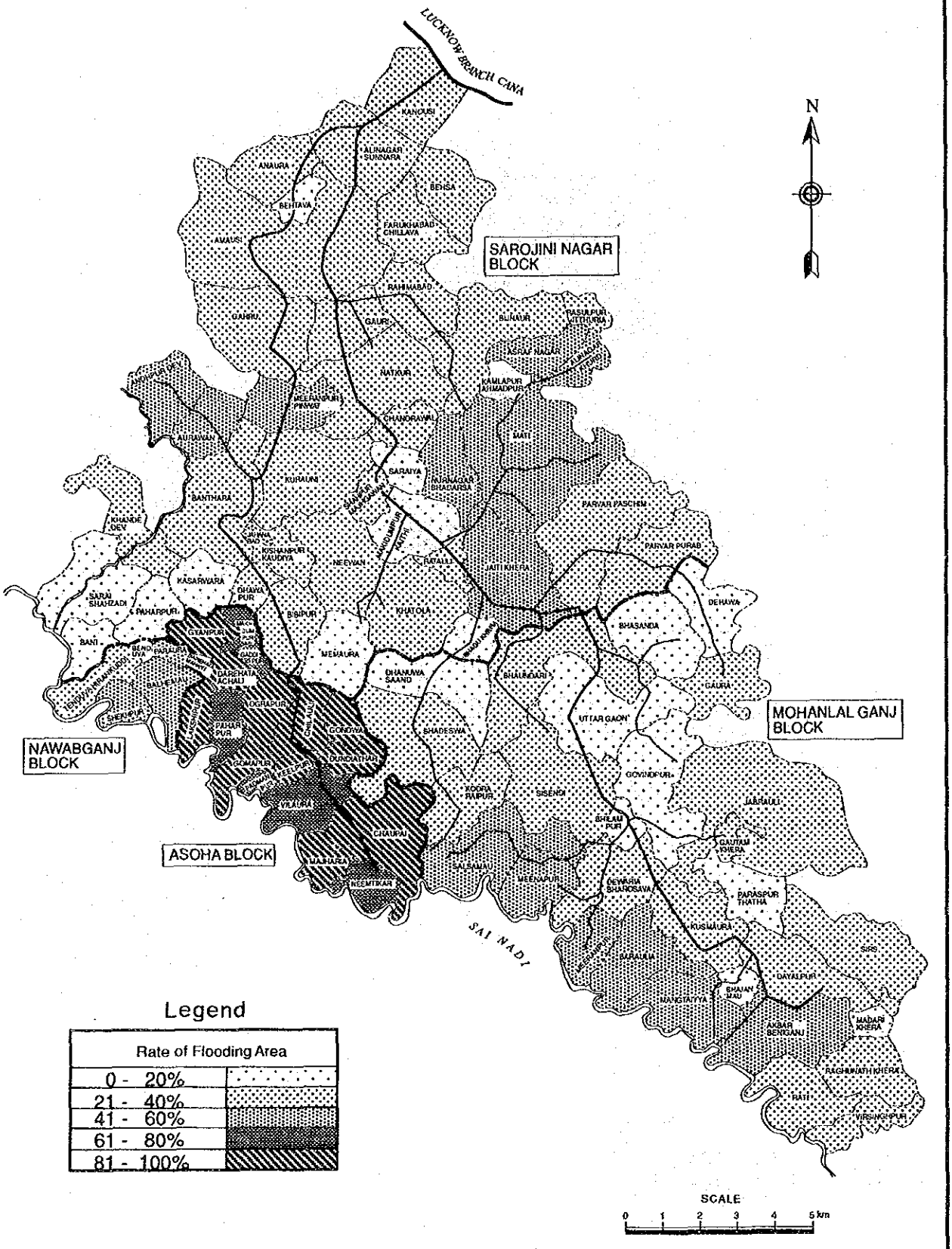



Fig. G.10 Condition of Flooding Area in Sarojini Nagar Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

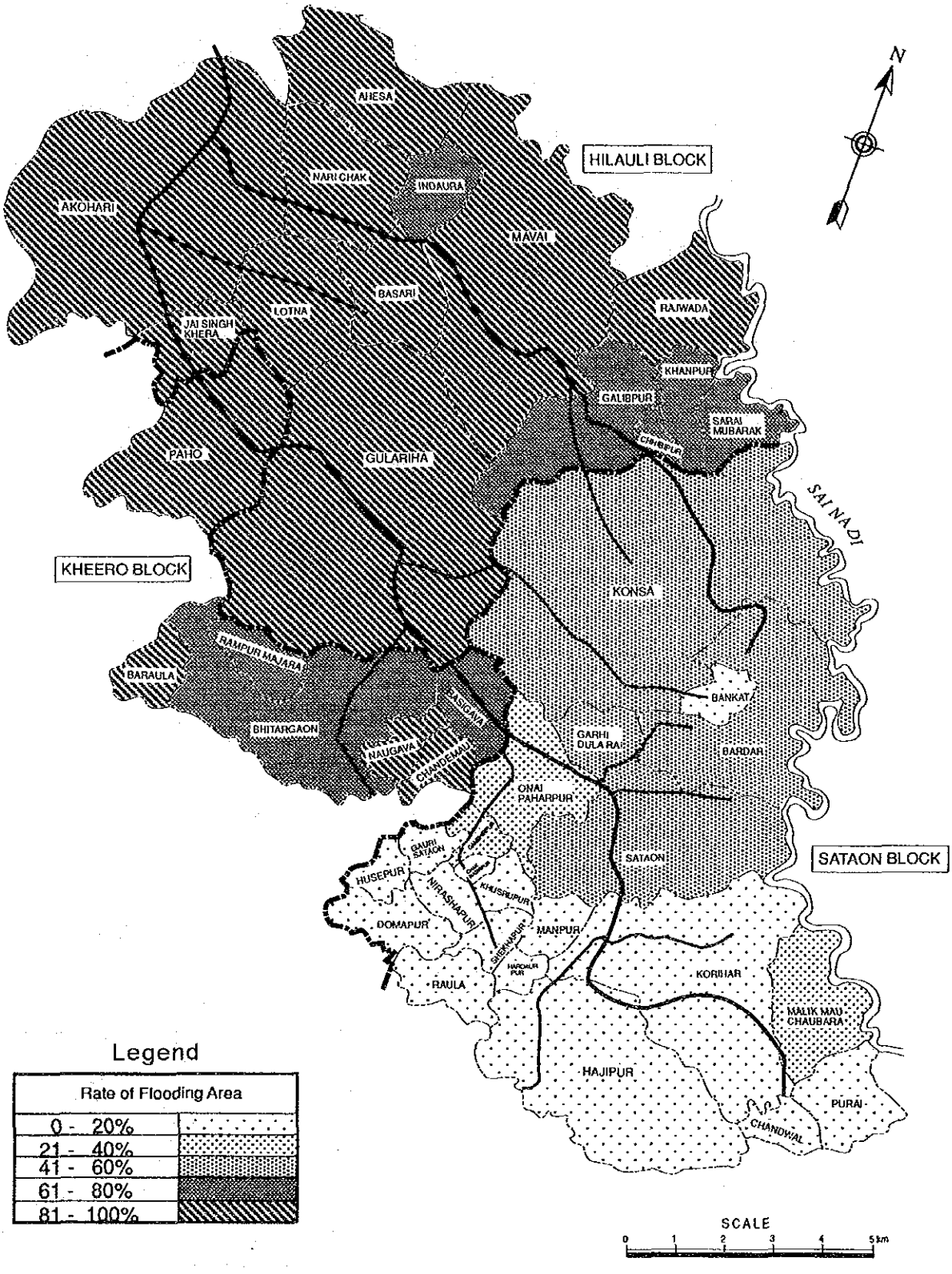



Fig. G.11 Condition of Flooding Area in Sataon Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

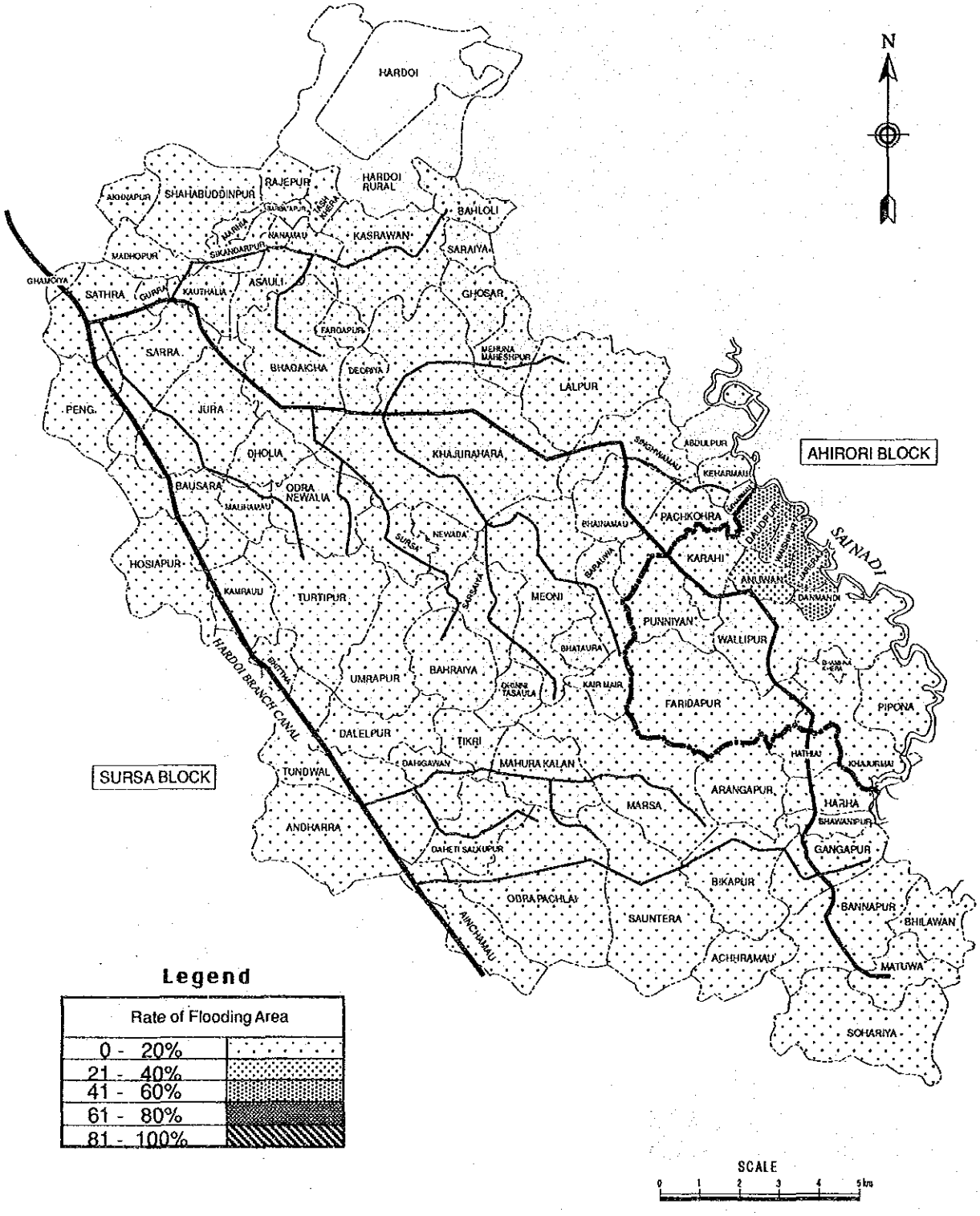
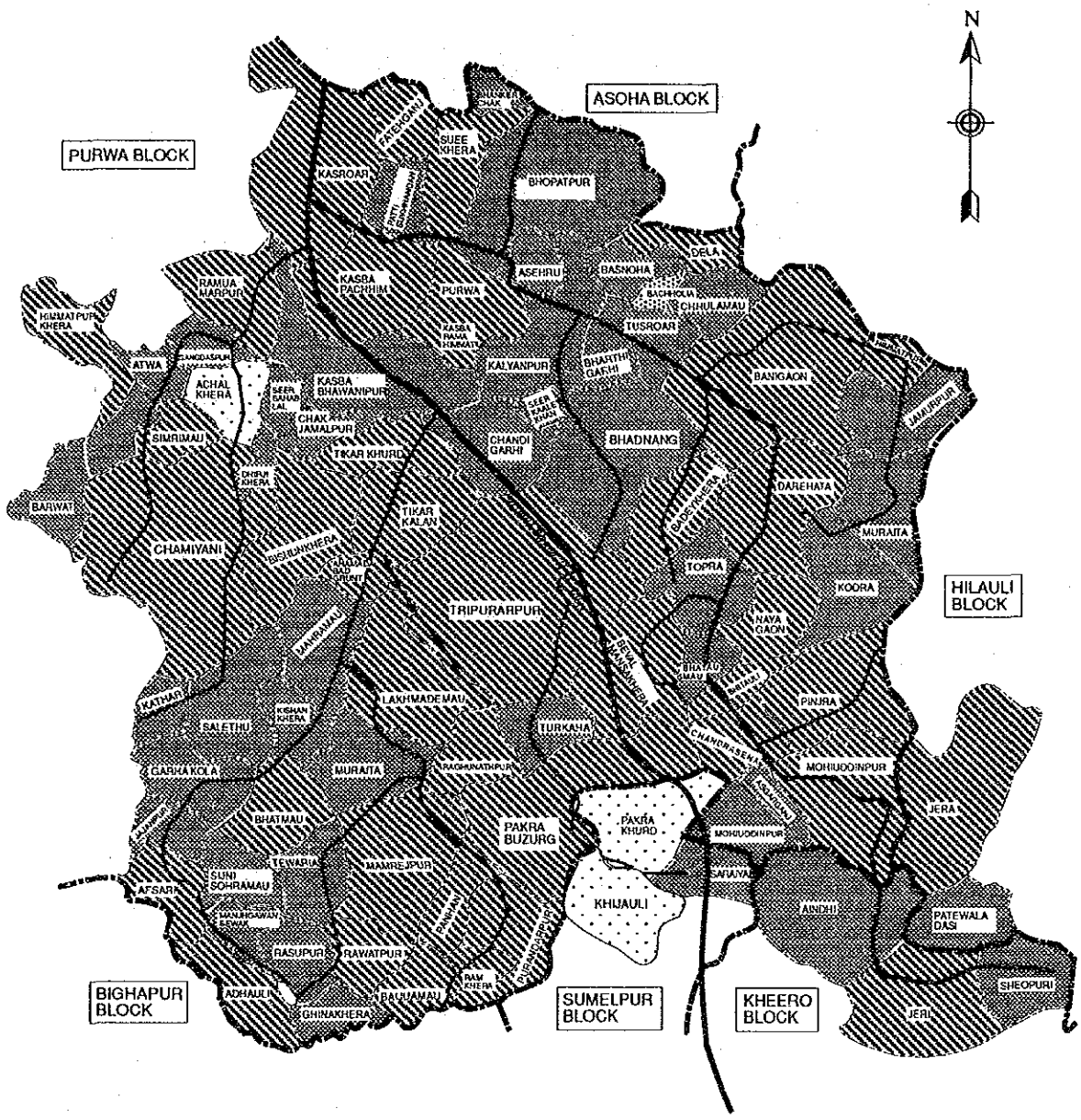



Fig. G.12 Condition of Flooding Area in Sursa Study Area

INDIA

FEASIBILITY STUDY ON
IRRIGATION AND DRAINAGE DEVELOPMENT OF
SHARDA CANAL CAD PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY




**Legend**

| Rate of Flooding Area | |
|---|---|
| 0 - 20% | |
| 21 - 40% | |
| 41 - 60% | |
| 61 - 80% | |
| 81 - 100% | |

Fig. G.13 Condition of Flooding Area in Purwa Study Area

| INDIA |
|---|
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

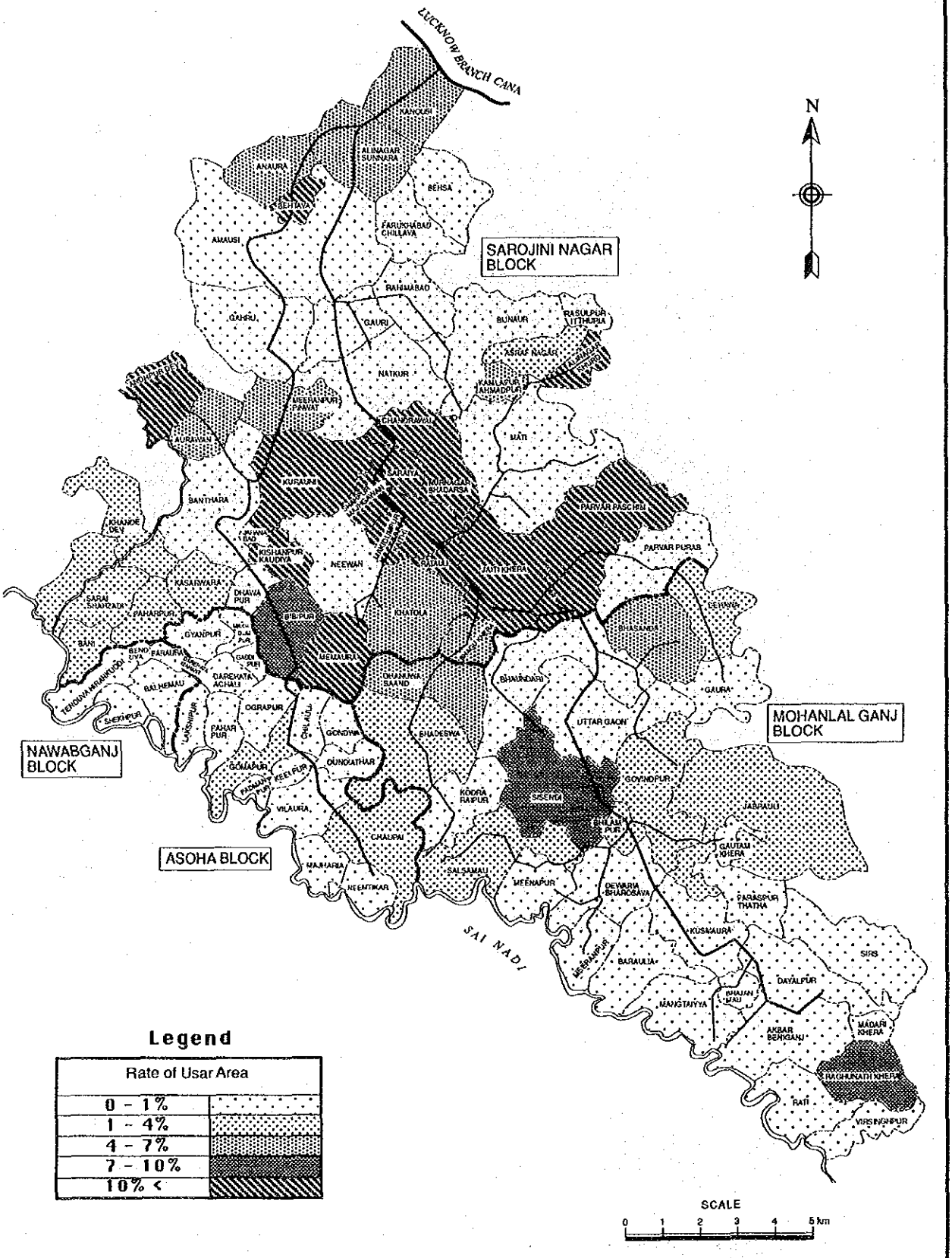



Fig. G.14 Condition of Usar Area in Sarojini Nagar Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

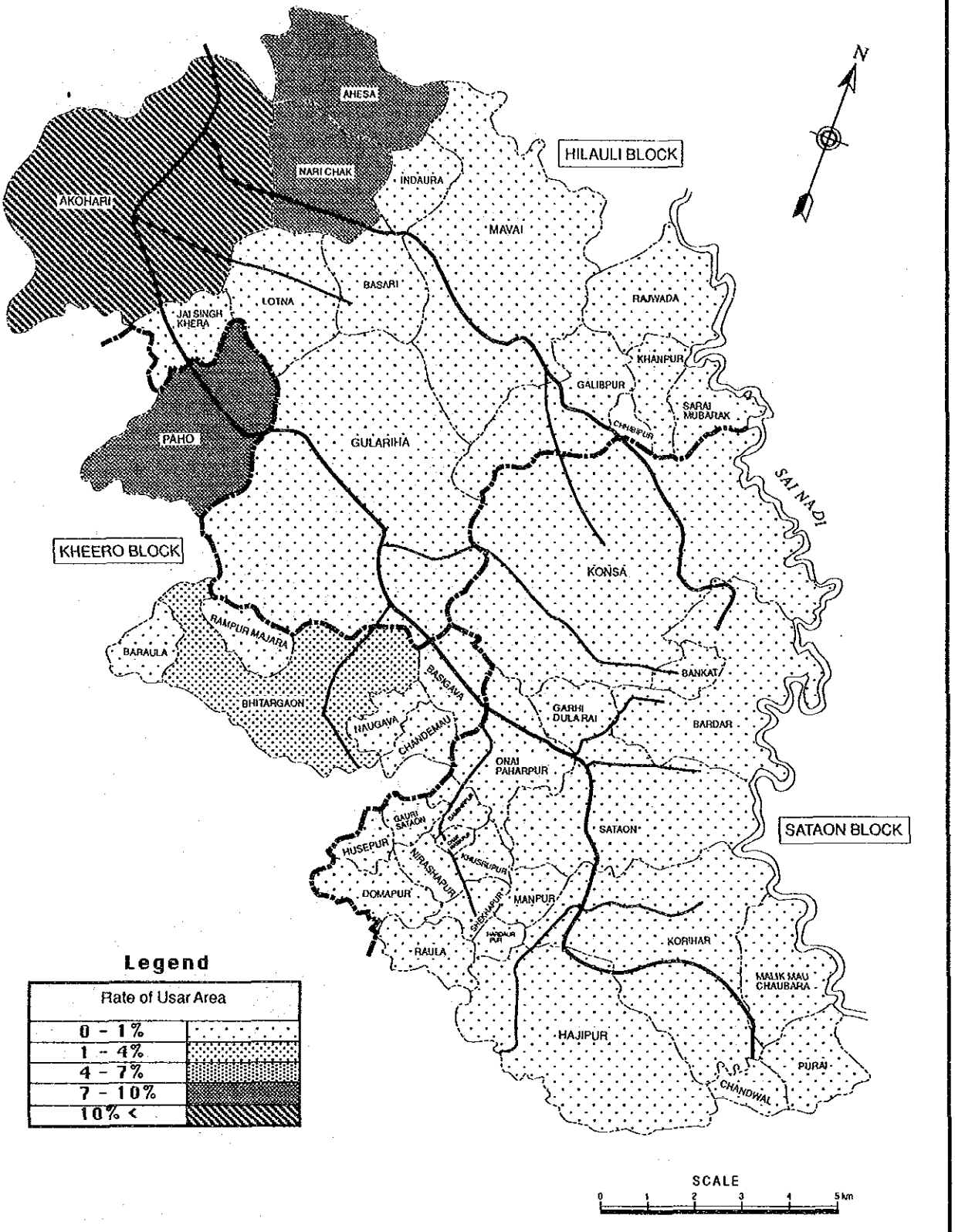



Fig. G.15 Condition of Usar Area in Sataon Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

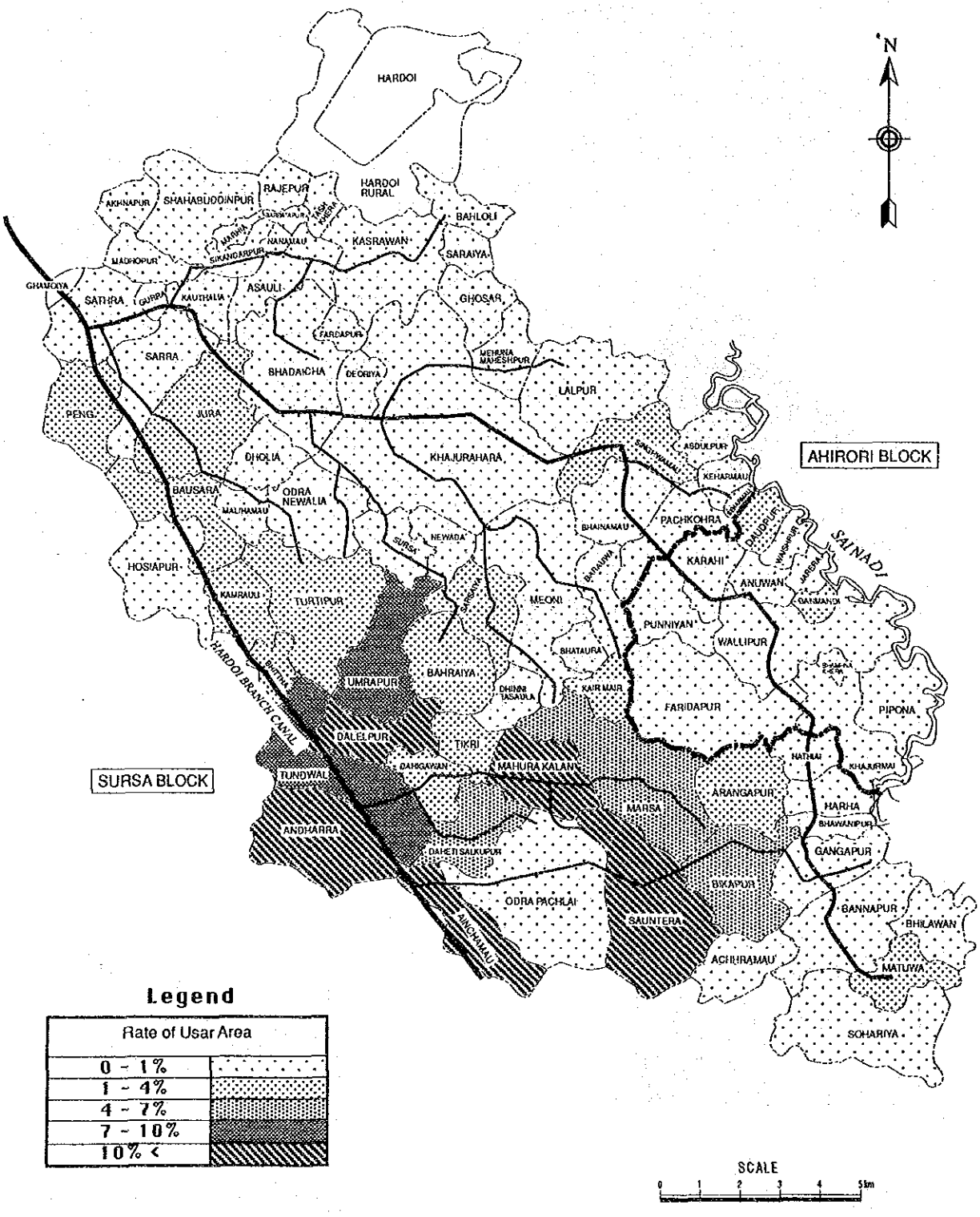
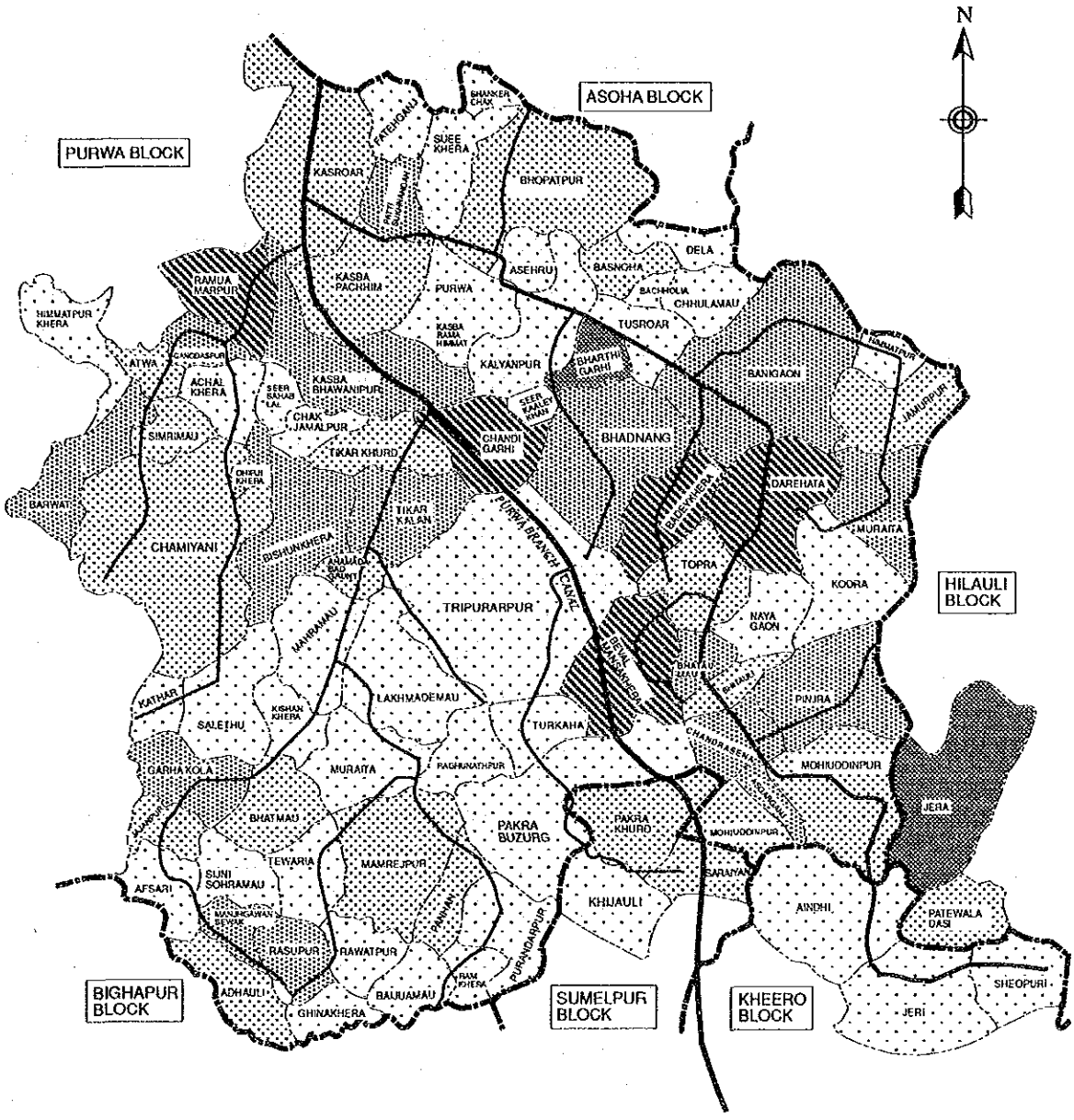



Fig. G.16 Condition of Usar Area in Sursa Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |




**Legend**

| Rate of Usar Area |
|---|
| 0 - 1% |
| 1 - 4% |
| 4 - 7% |
| 7 - 10% |
| 10% < |

Fig. G.17 Condition of Usar Area in Purwa Study Area

| INDIA |
|---|
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

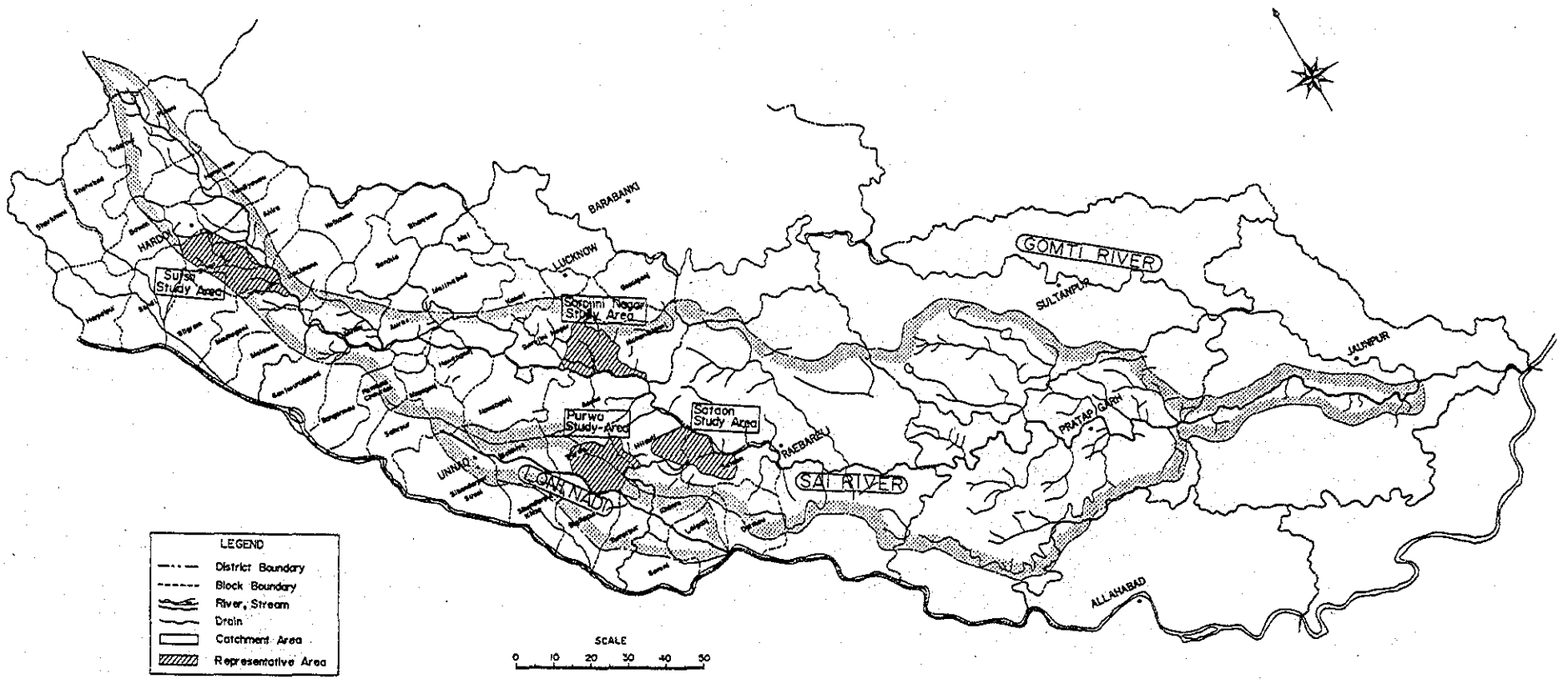
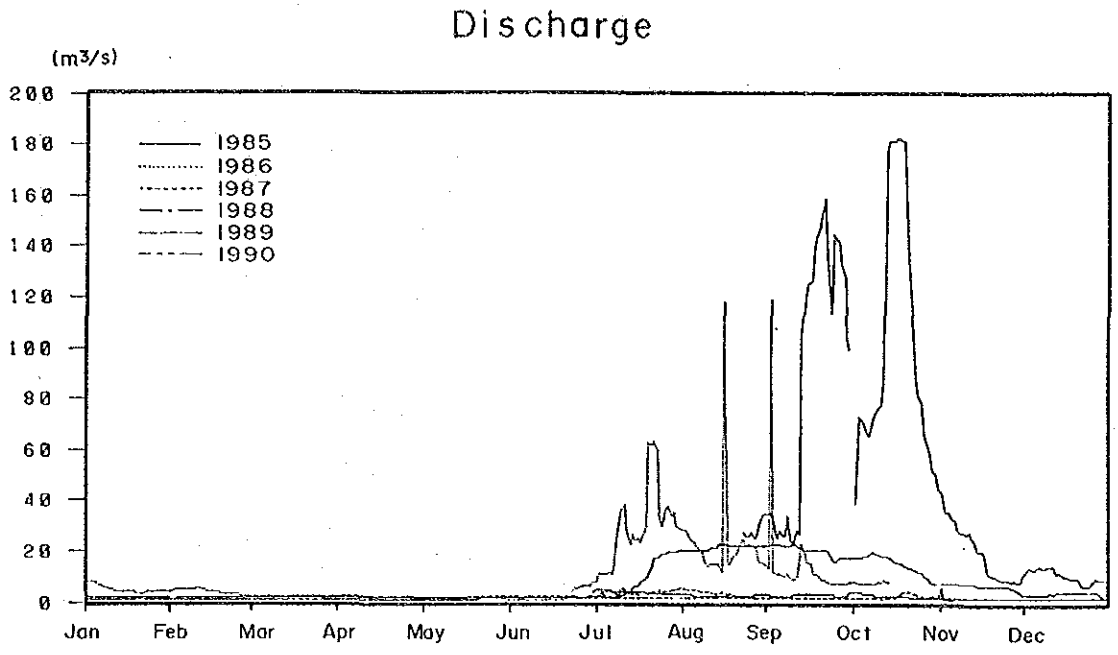



Fig.G.18 Catchment Area of Main Drainage River in The Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON<br>IRRIGATION AND DRAINAGE DEVELOPMENT OF<br>SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |



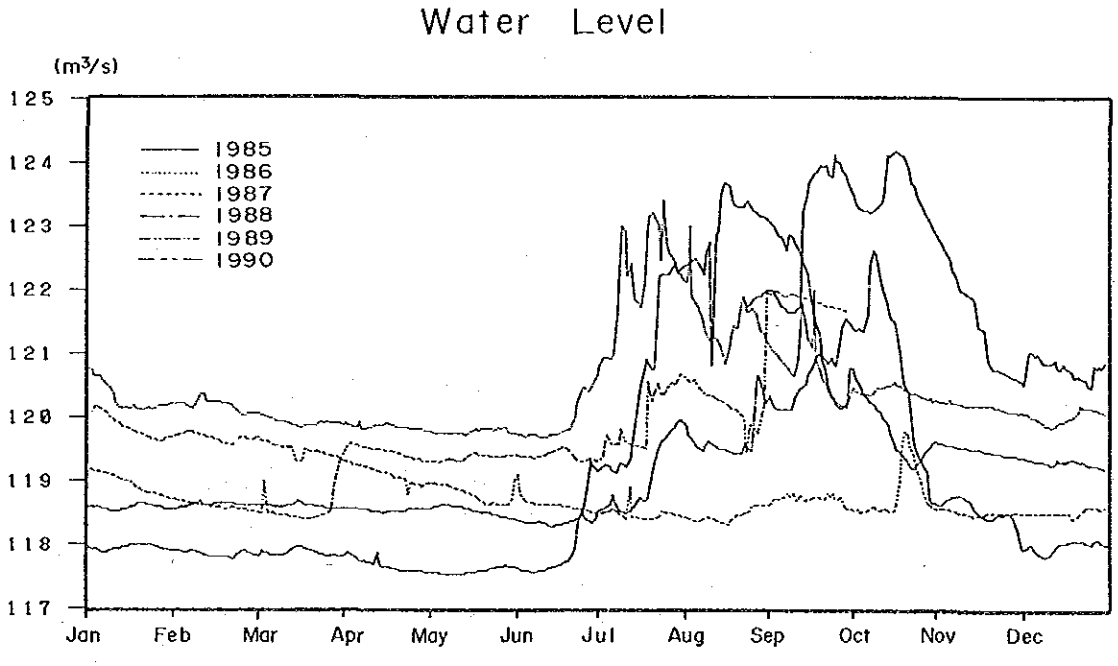
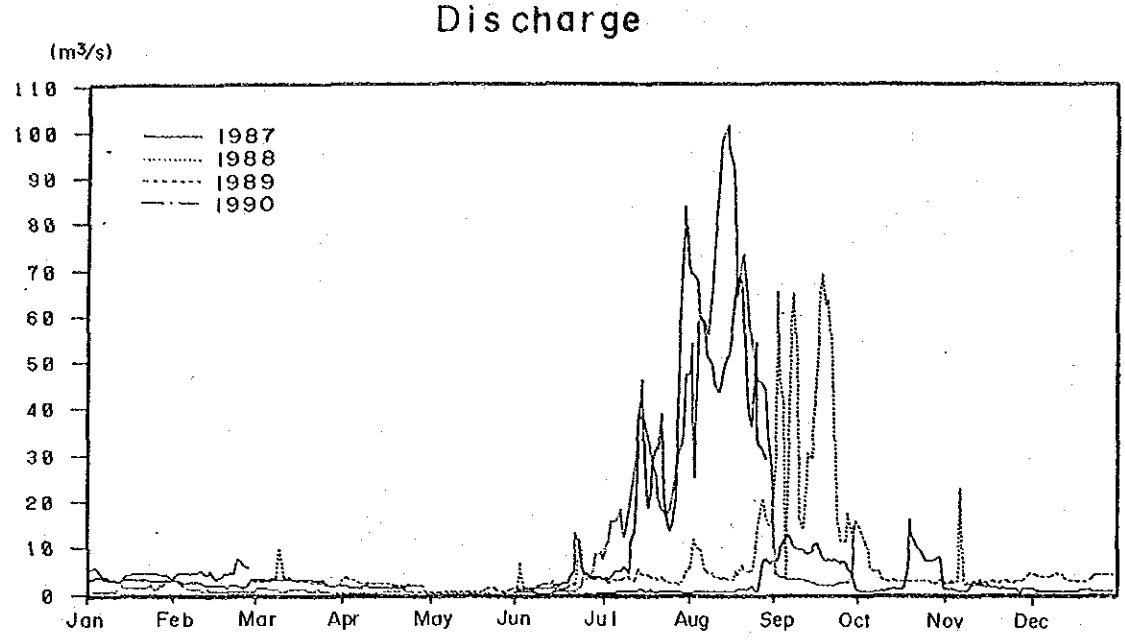




Fig.G.19 Discharge and Water Level of The Sai River

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |



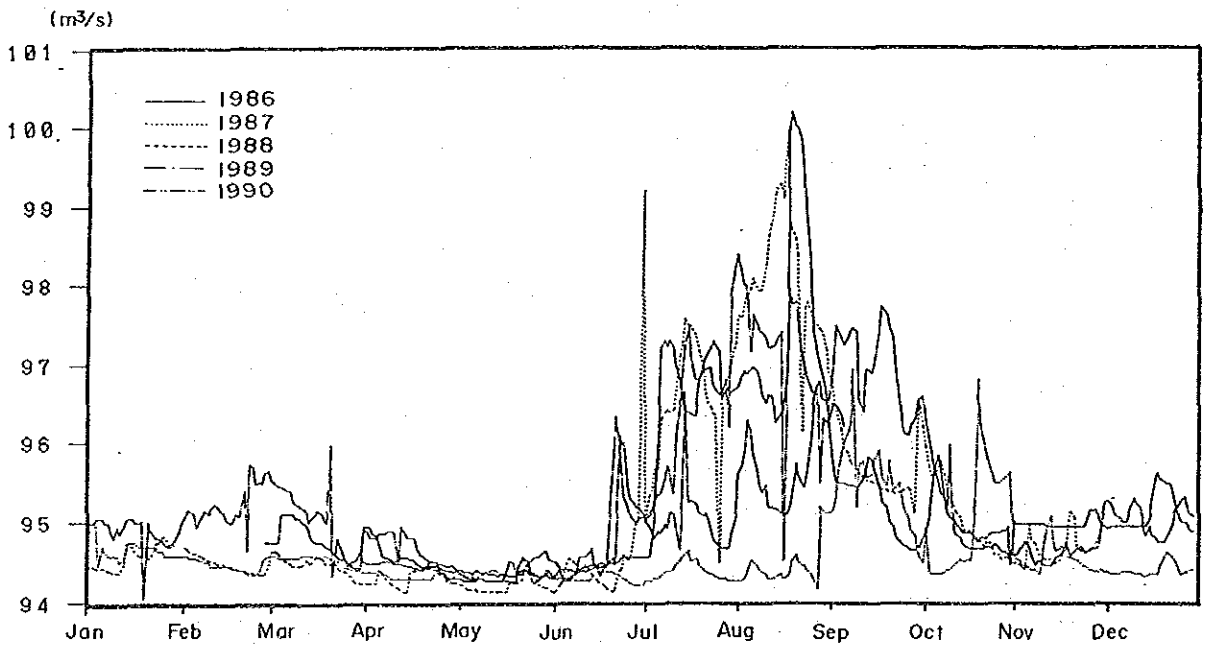




Fig.G.20 Discharge and Water Level of The Loni Nadi

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

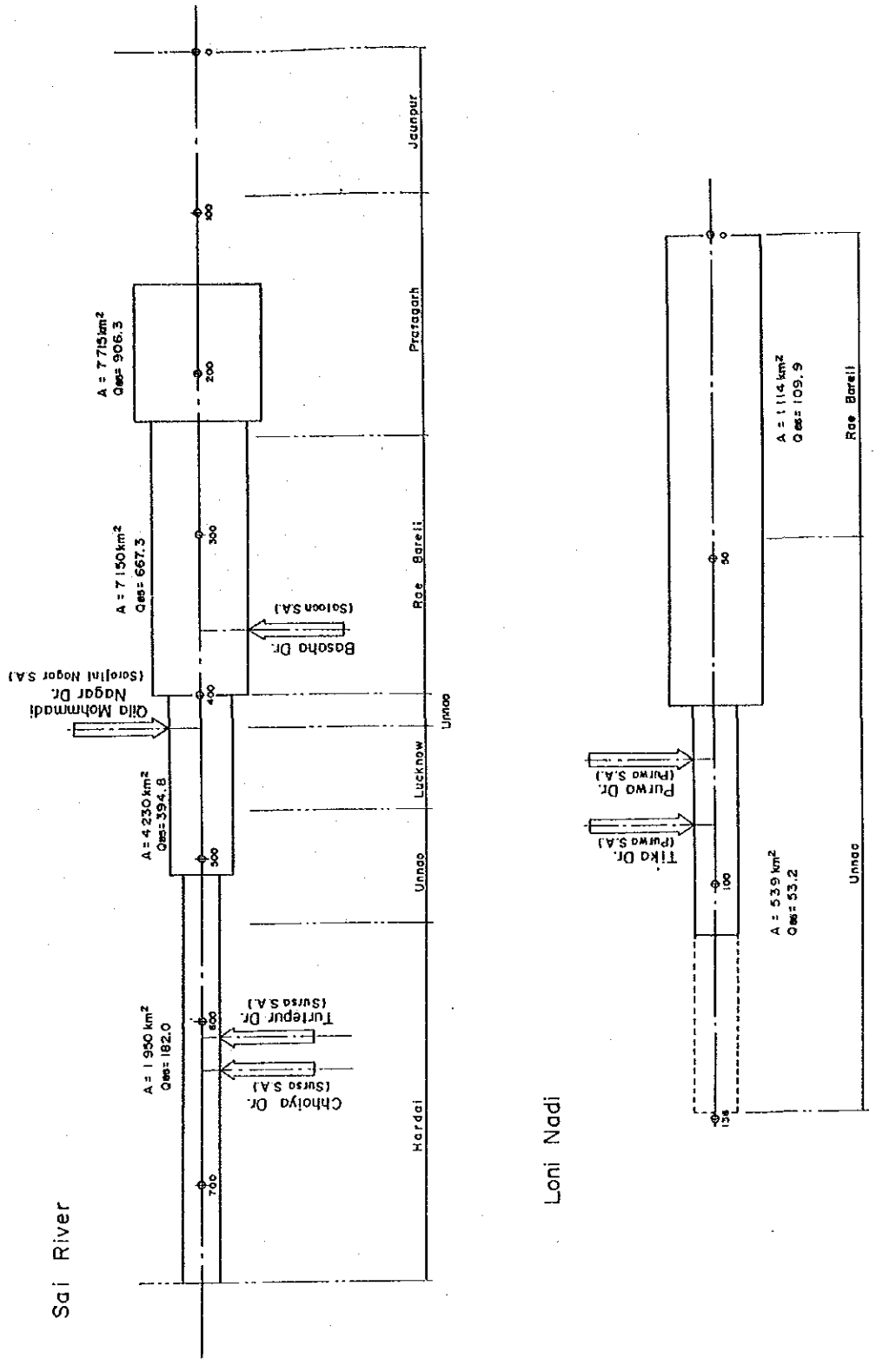



Fig.G.21 Topographic Divide and Distribution of Flood Discharge

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

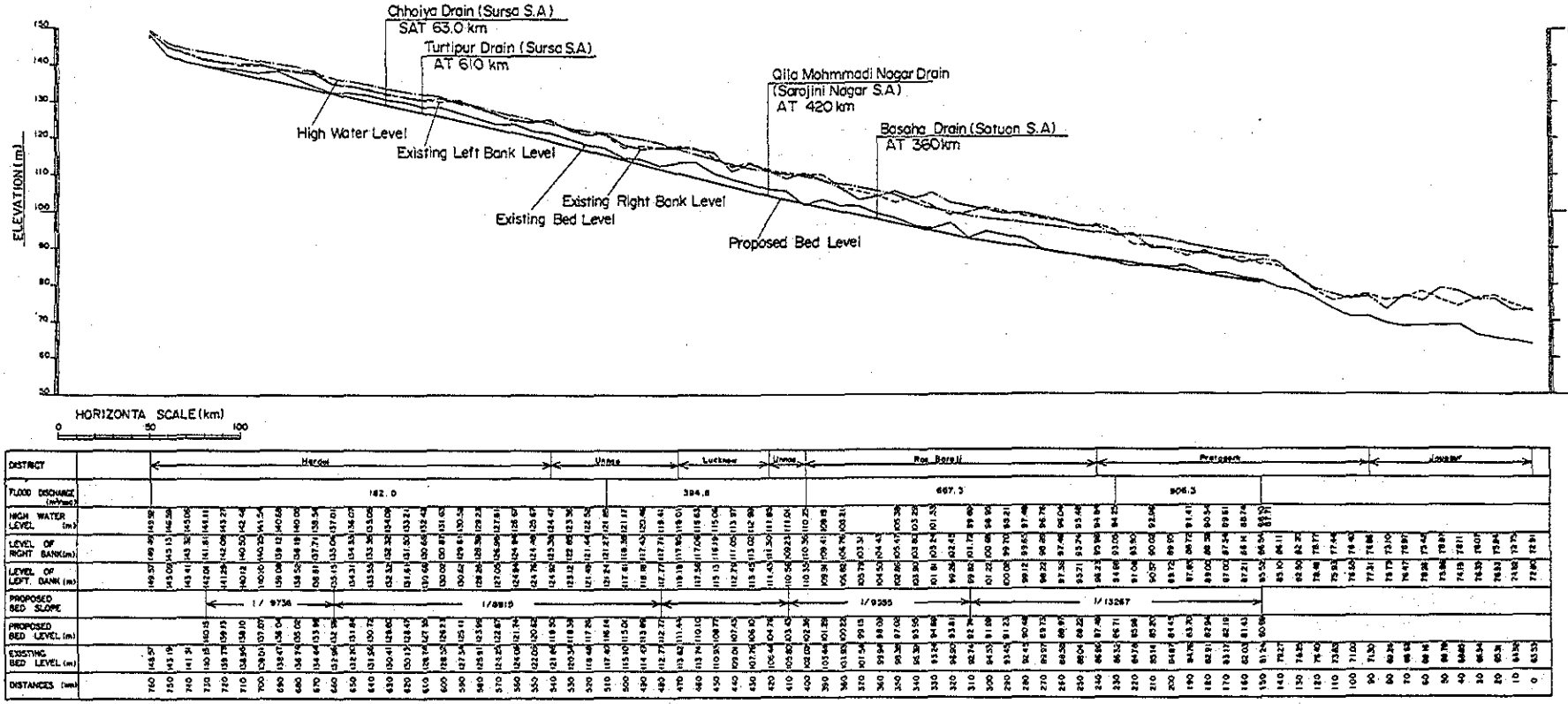



Fig.G.22 Flood Routing of The Sai River

| INDIA |
| --- |
| FEASIBILITY STUDY ON<br>IRRIGATION AND DRAINAGE DEVELOPMENT OF<br>SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

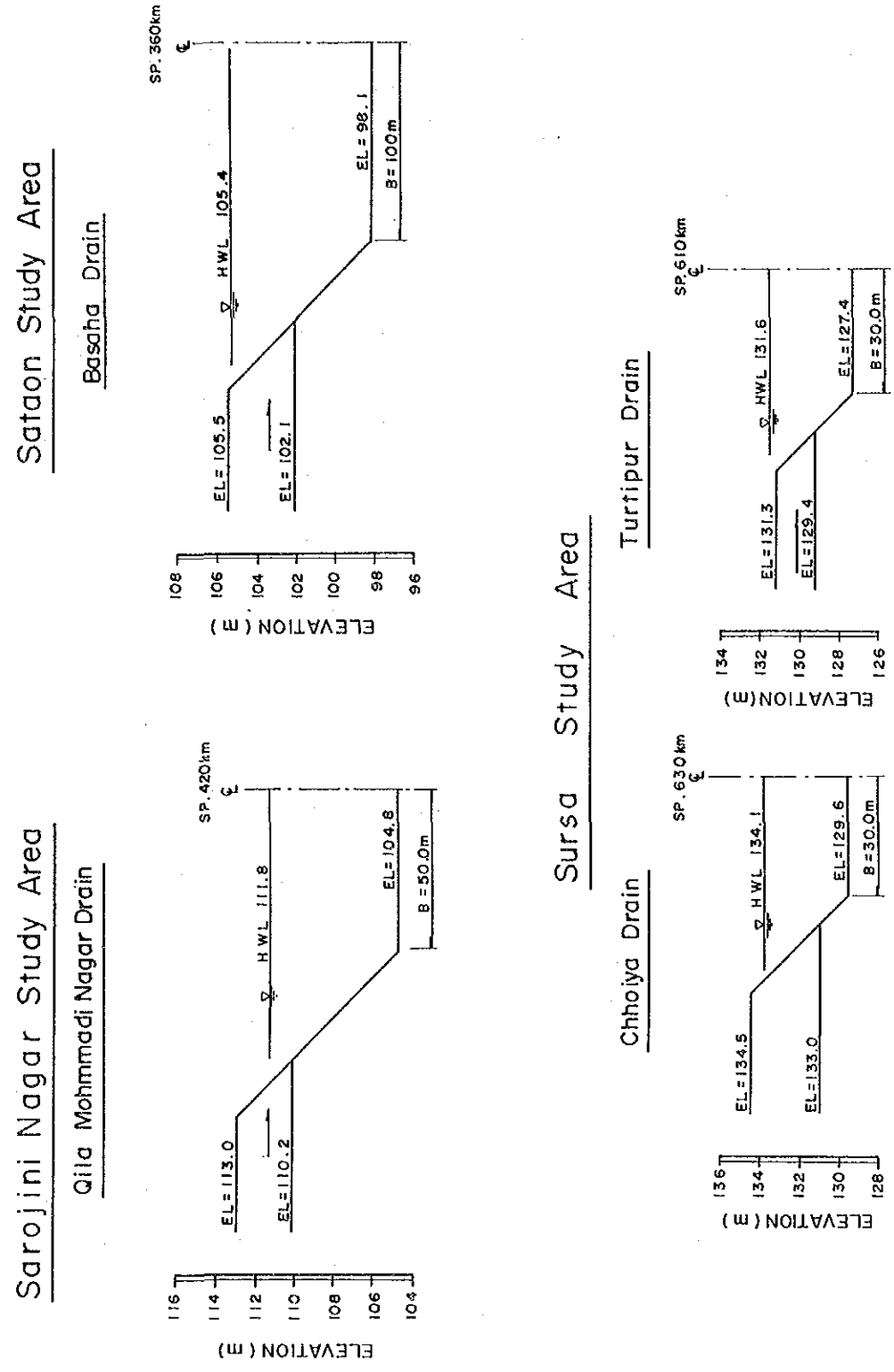



Fig.G.23 Check of The Existing Drainage Canal for The Sai River

| INDIA |
| --- |
| FEASIBILITY STUDY ON<br>IRRIGATION AND DRAINAGE DEVELOPMENT OF<br>SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

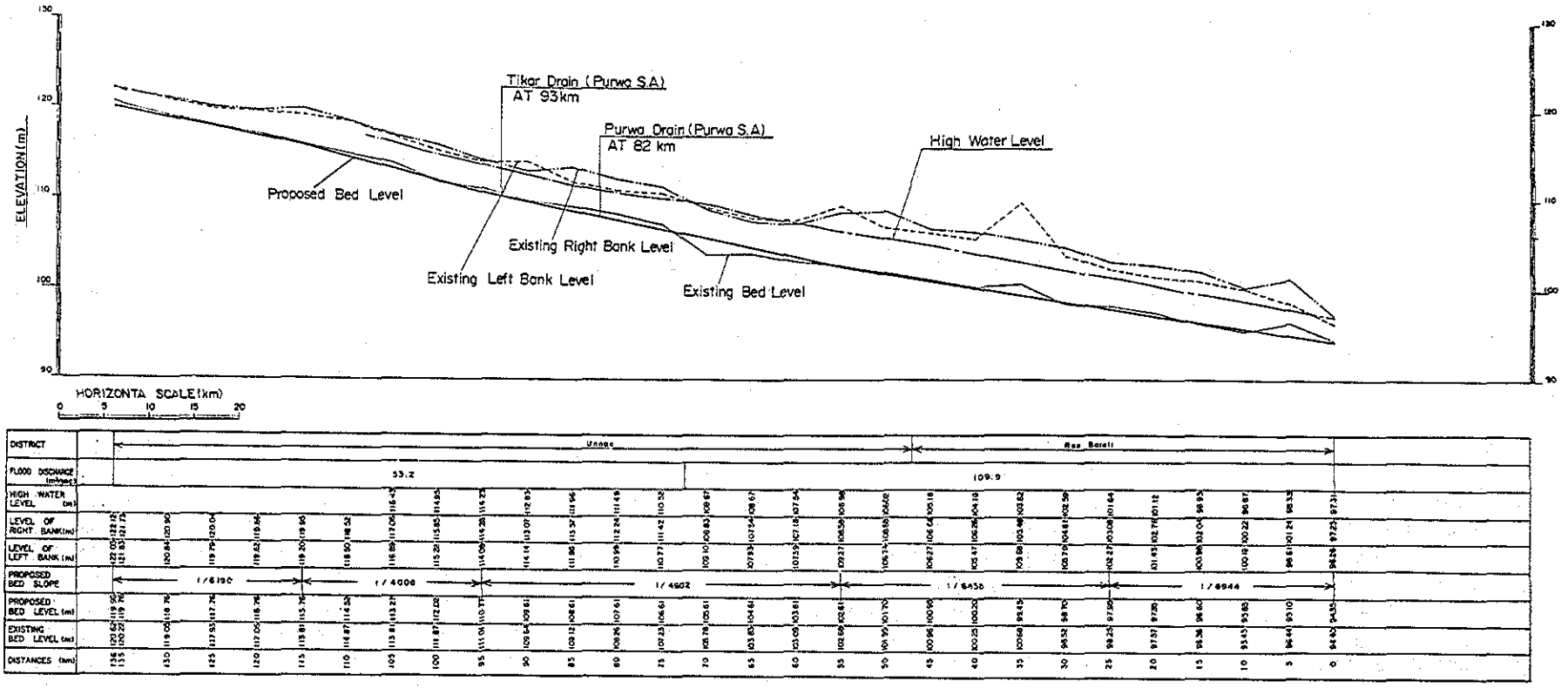
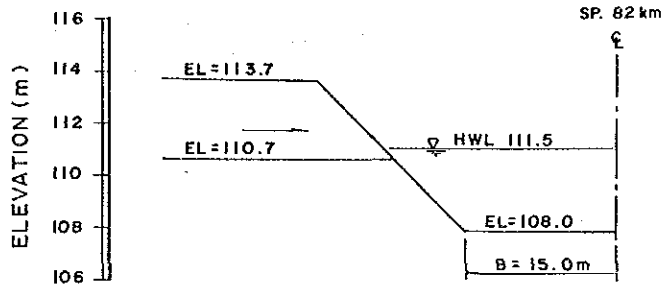



Fig.G.24 Flood Routing of The Loni Nadi

| INDIA |
| --- |
| FEASIBILITY STUDY ON<br>IRRIGATION AND DRAINAGE DEVELOPMENT OF<br>SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

## Purwa Study Area

### Purwa Drain




### Tikar Drain

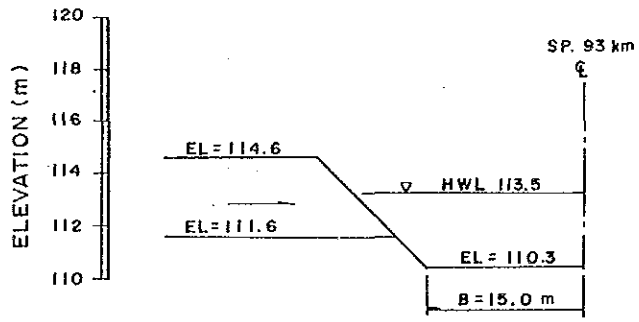



Fig.G.25 Check of The Existing Drainage Canal for The Loni Nadi

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

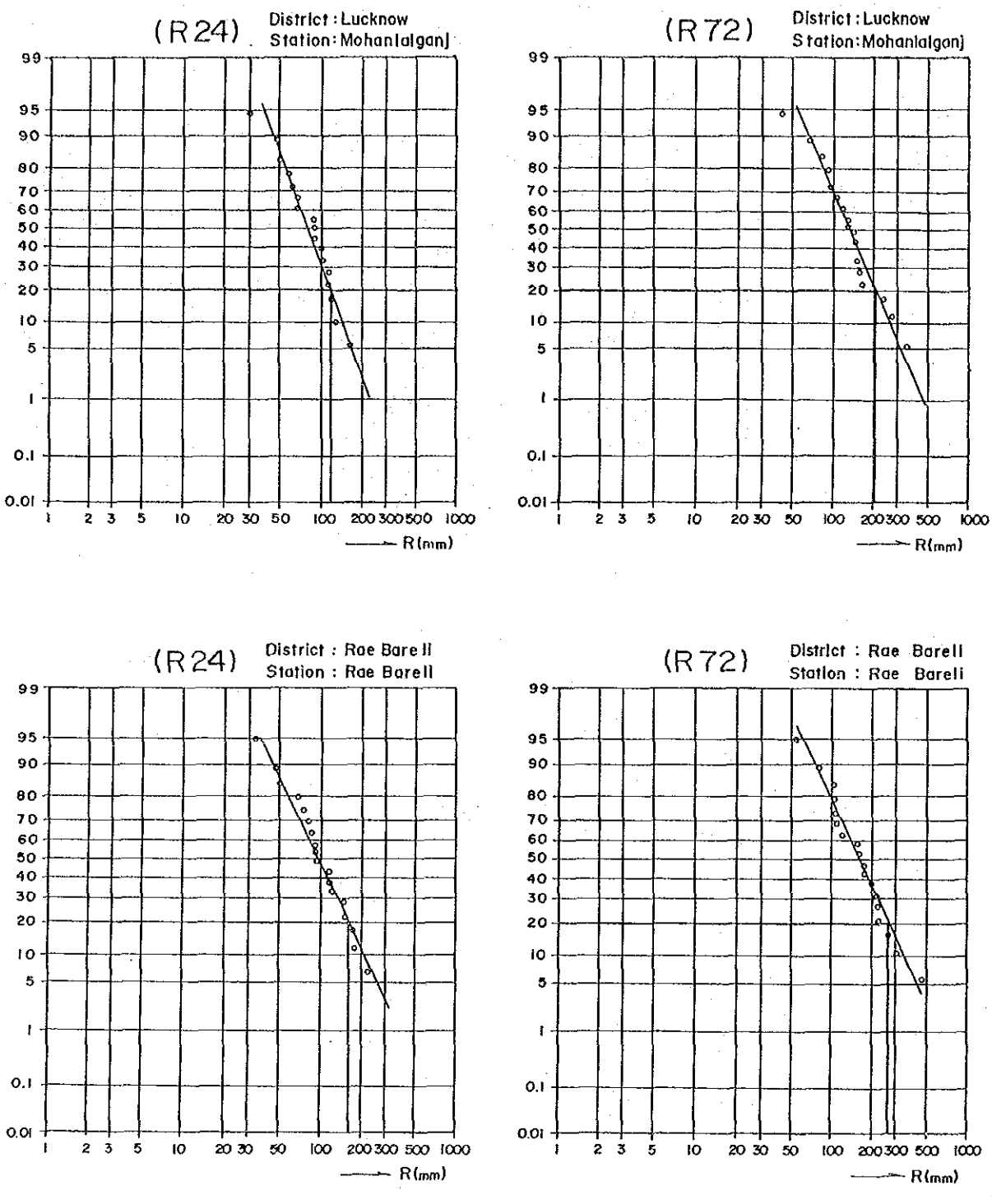
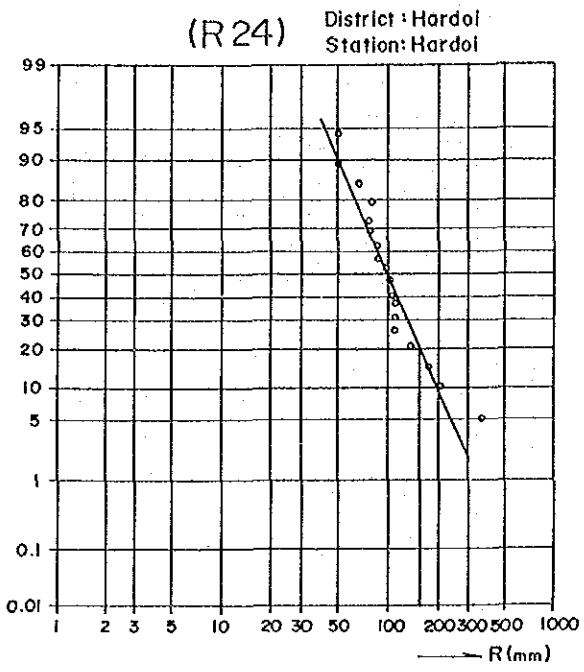
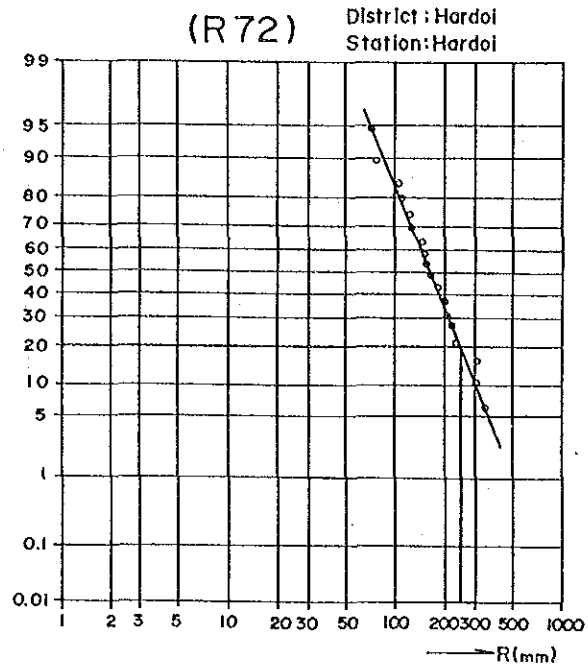
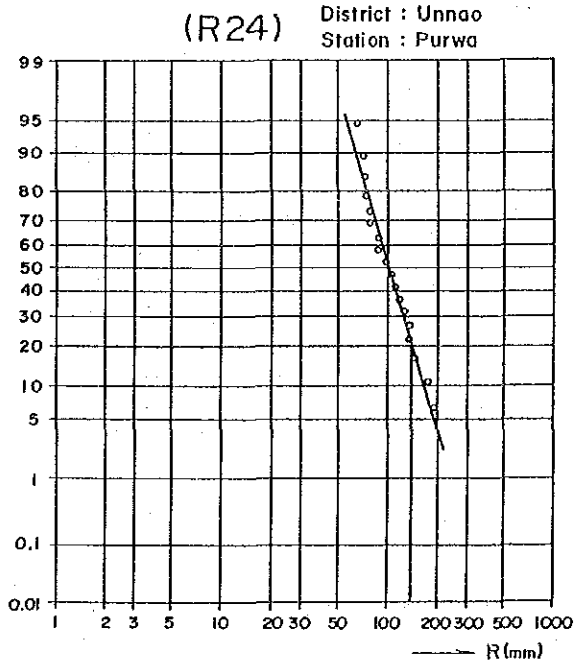



Fig. G.26 Rainfall Probability in Lucknow and Rae Bareli District

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |



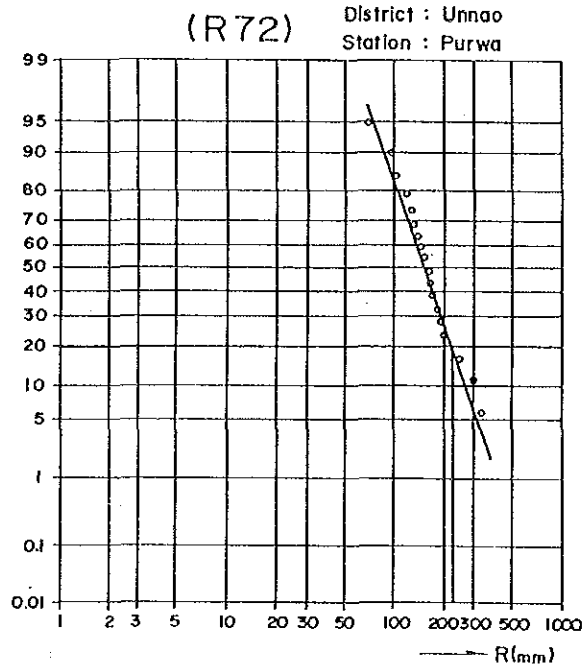
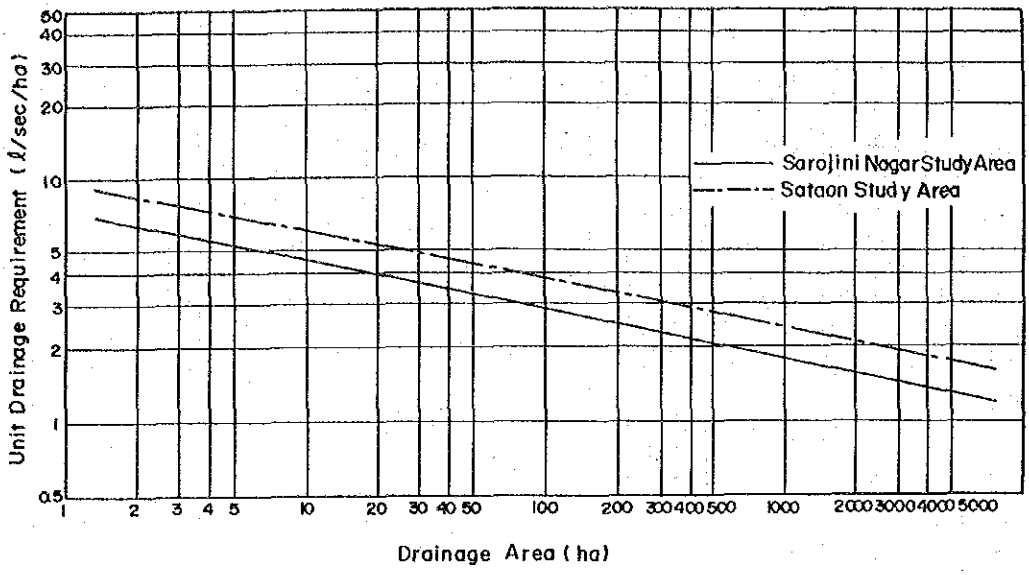




Fig. G.27 Rainfall Probability in Hardoi and Unnao District

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |



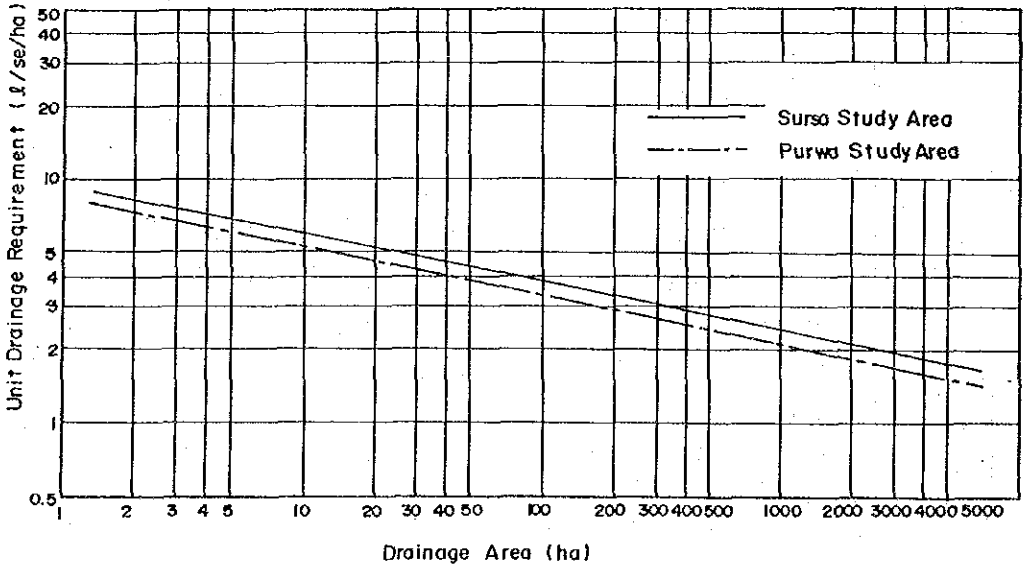




Fig.G.28 Unit Drainage Water Requirement

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENGY |

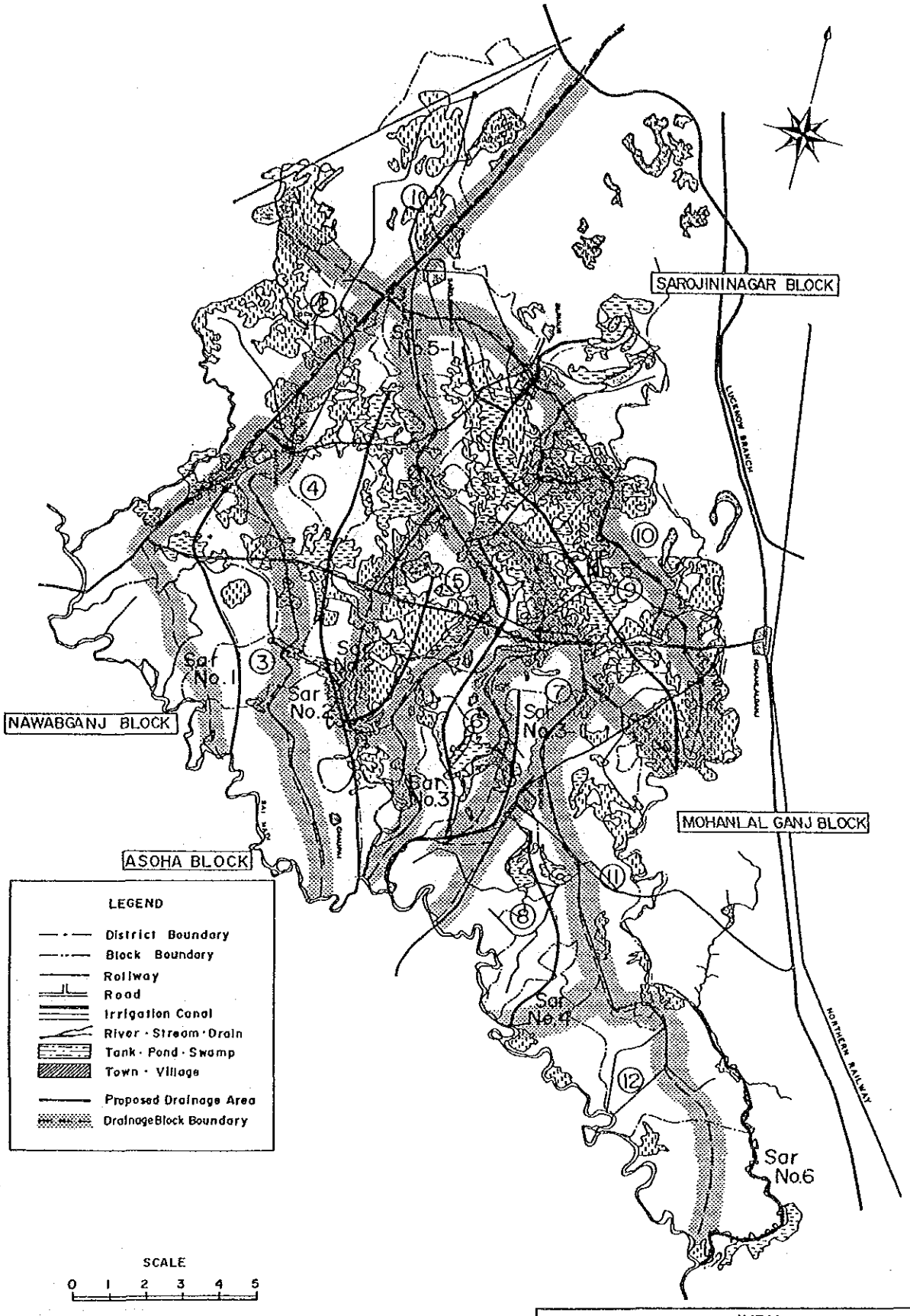



Fig. G.29 Drainage Area in Sarojini Nagar Study Area

| |
|---|
| INDIA |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

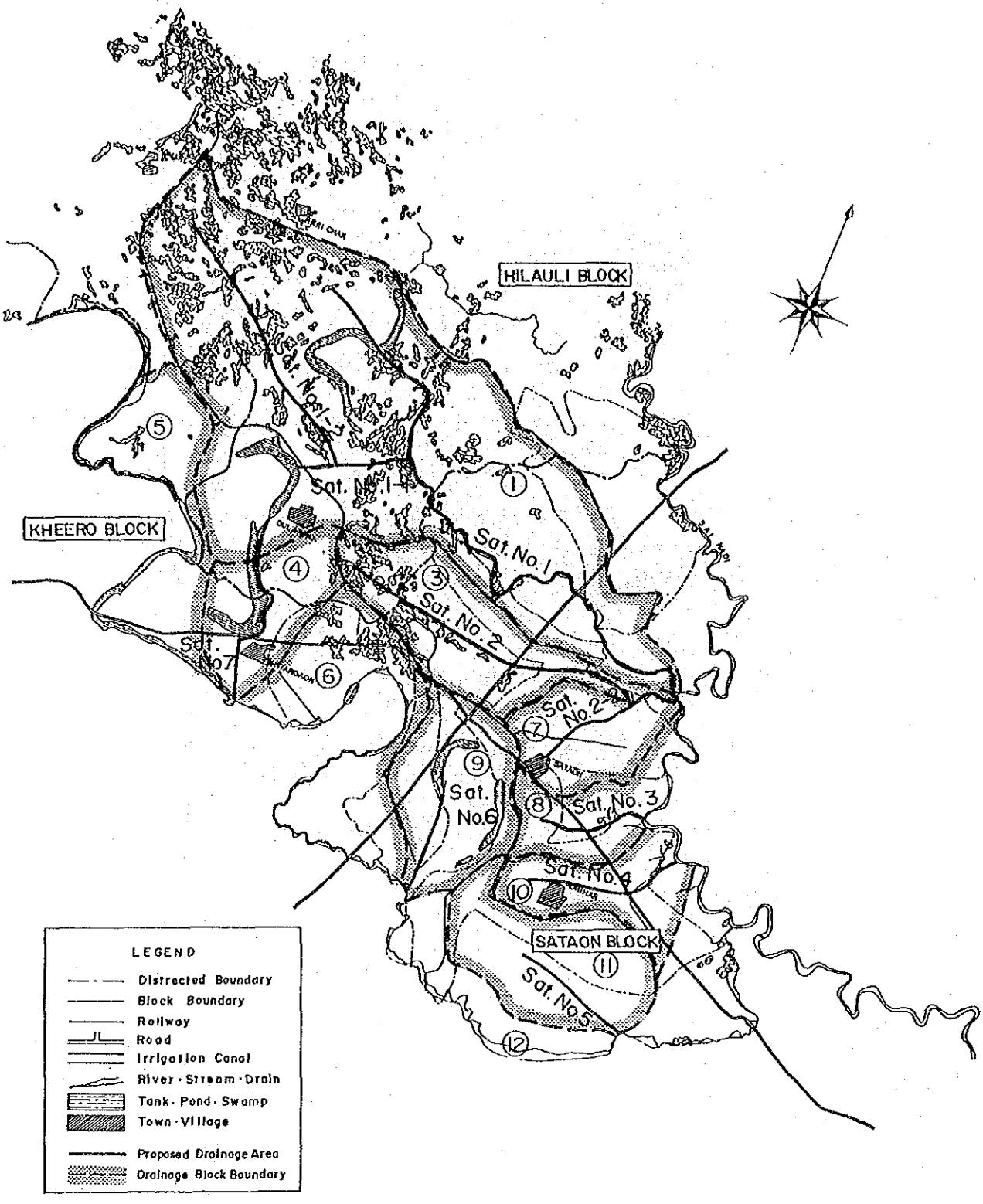



Fig. G.30 Drainage Area in Sataon Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

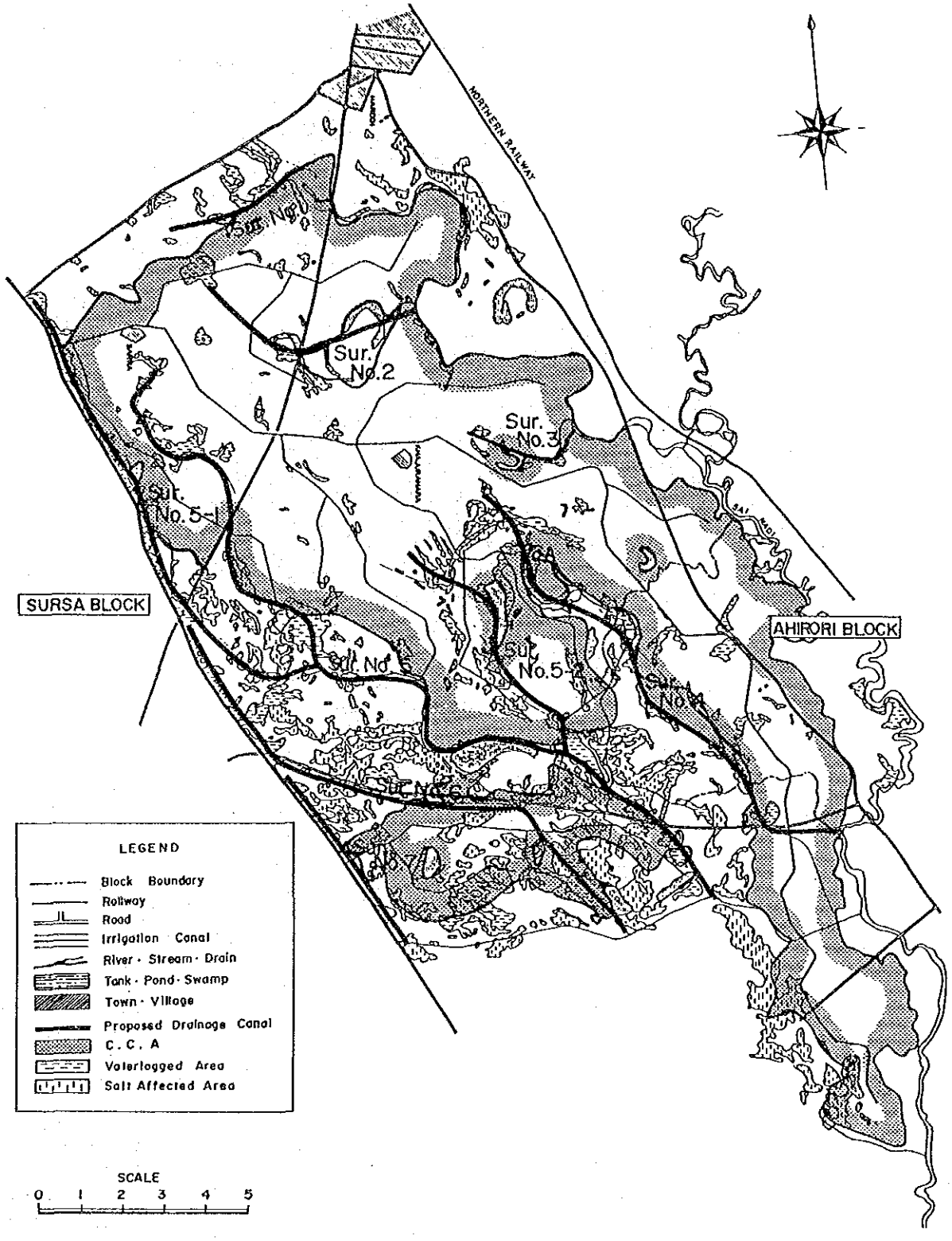



Fig. G.31 Drainage Area in Sursa Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON<br>IRRIGATION AND DRAINAGE DEVELOPMENT OF<br>SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

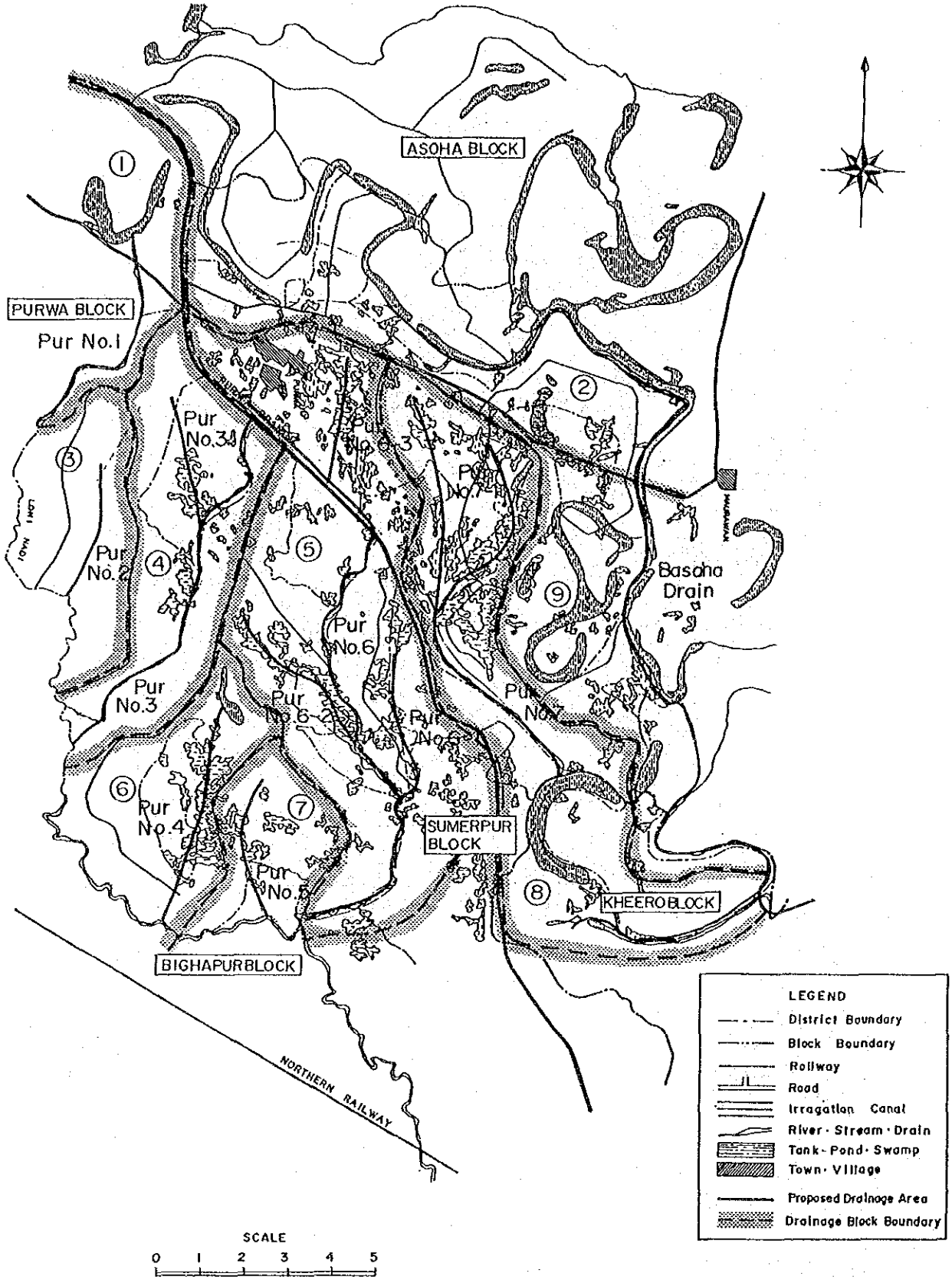



Fig. G.32 Drainage Area in Purwa Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

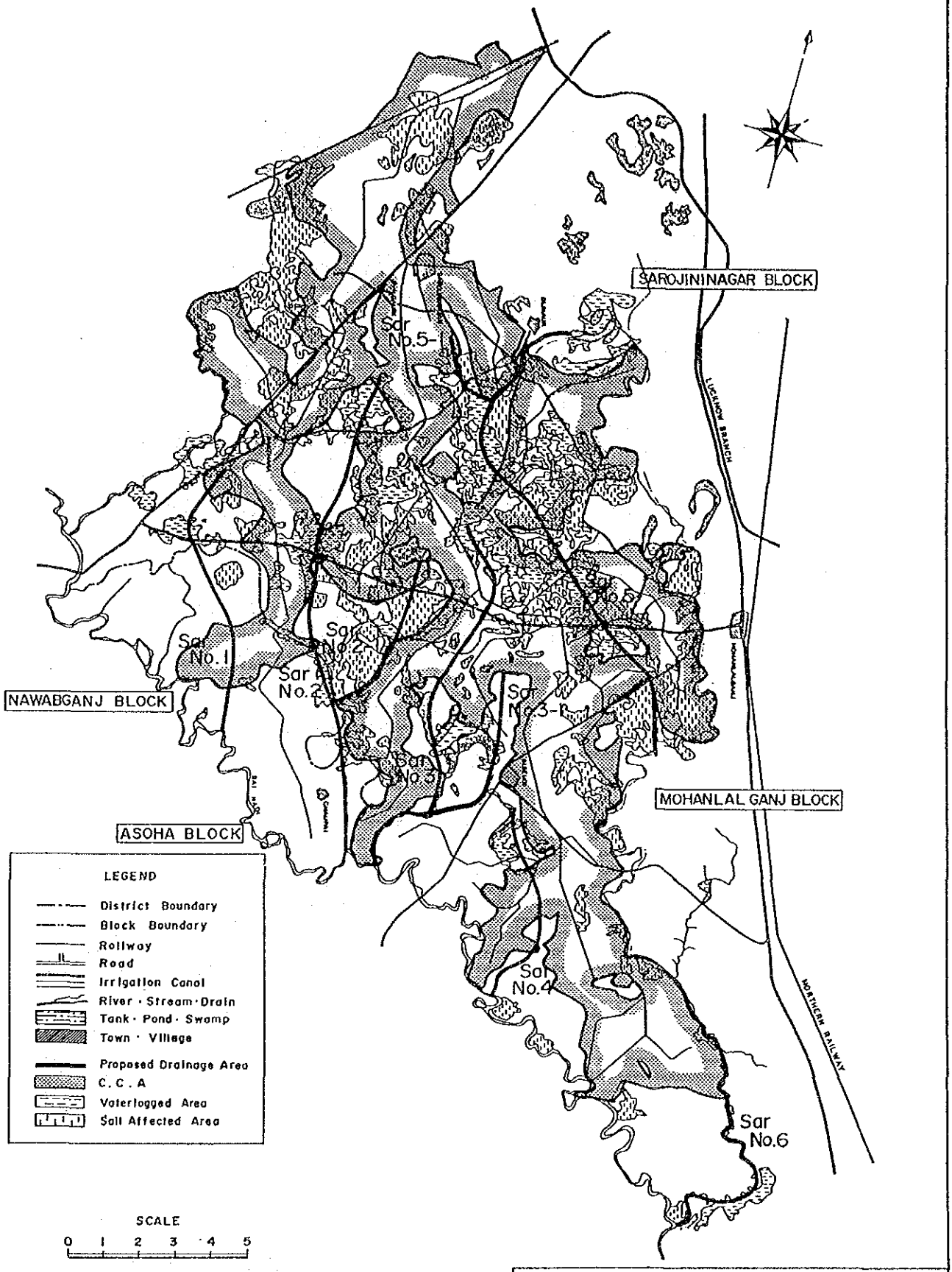



Fig. G.33 Proposed Drainage System in Sarojini Nagar Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

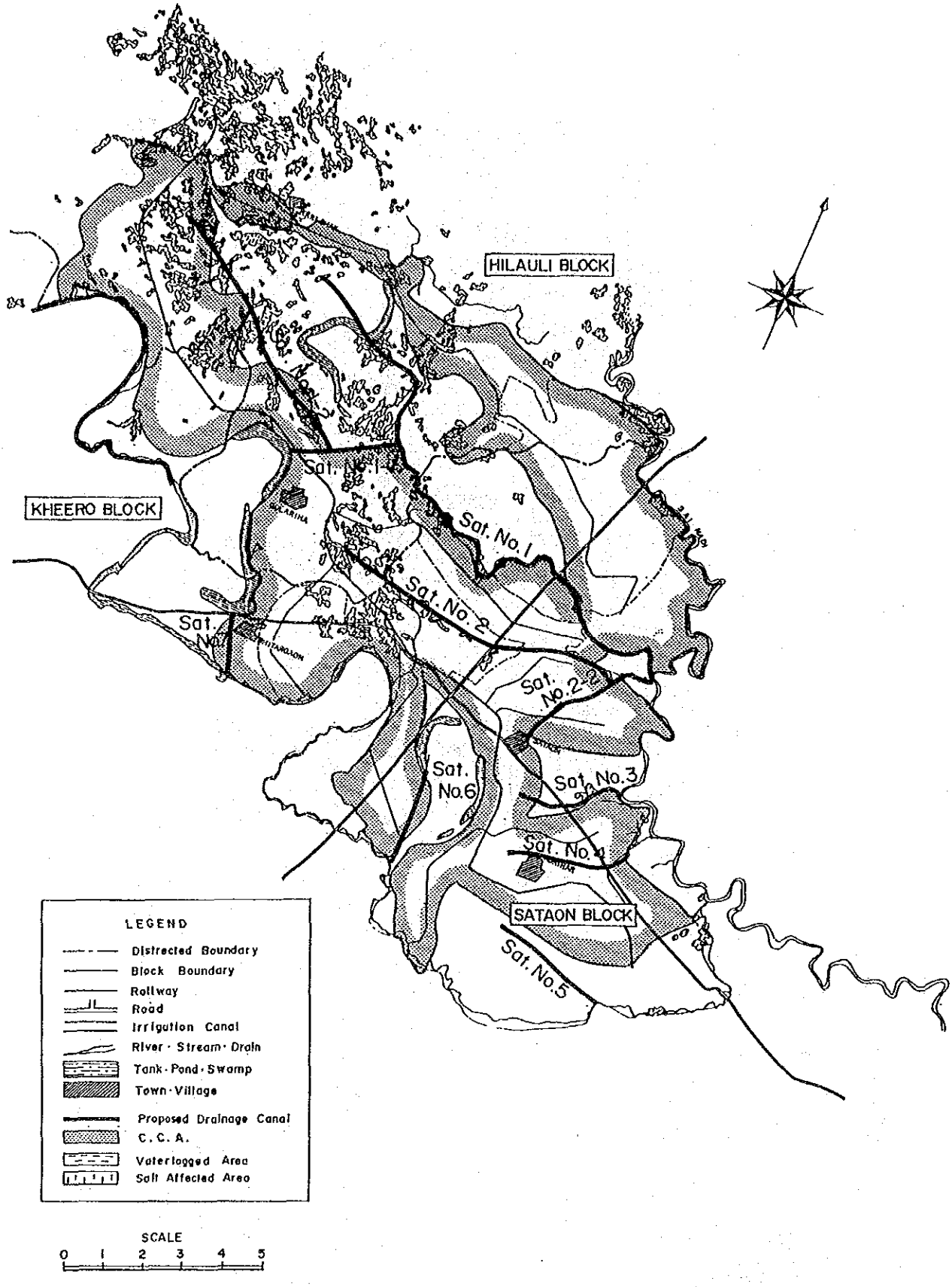
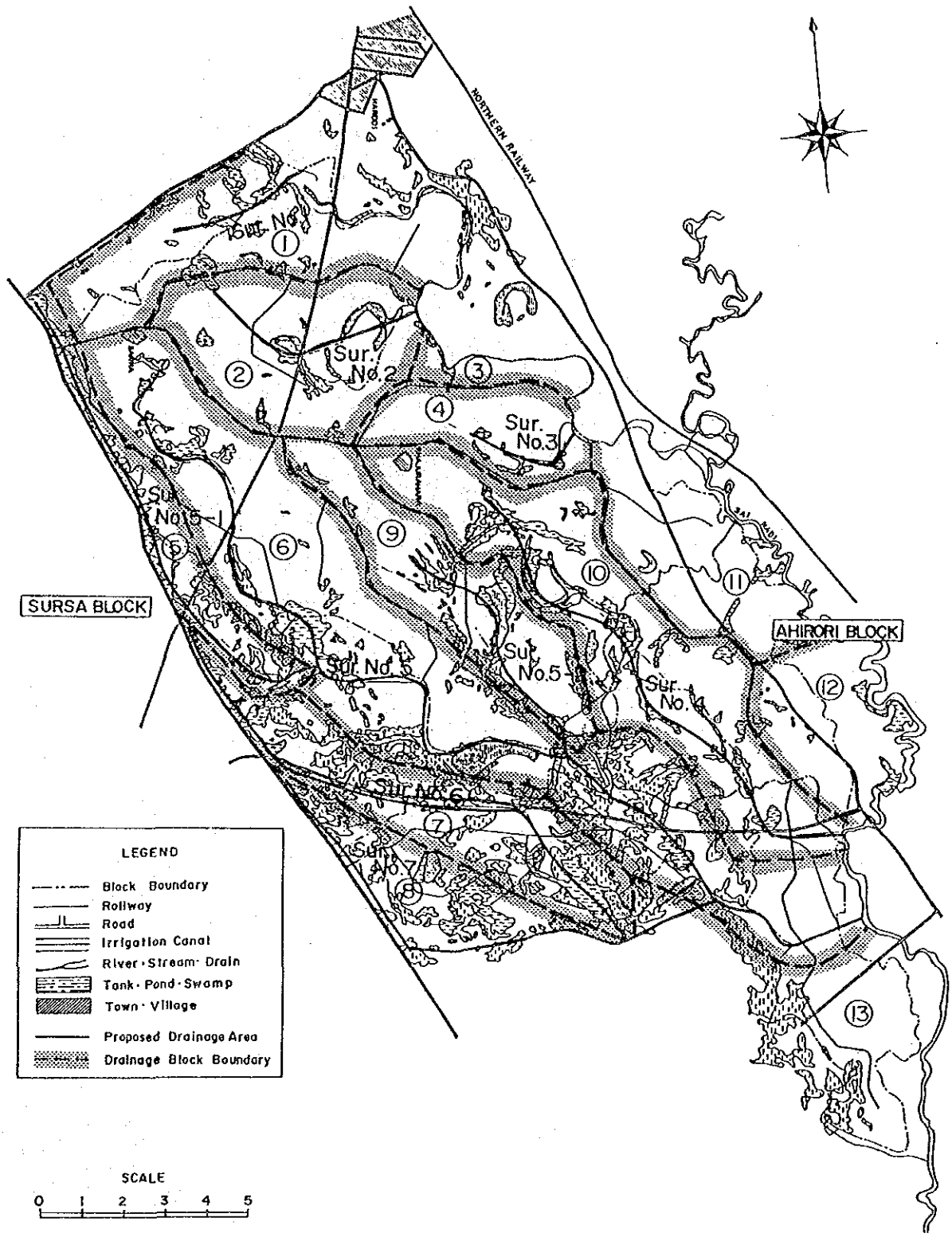



Fig. G.34 Proposed Drainage System in Sataon Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |




| INDIA |
|---|
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

Fig. G.35 Proposed Drainage System in Sursa Study Area

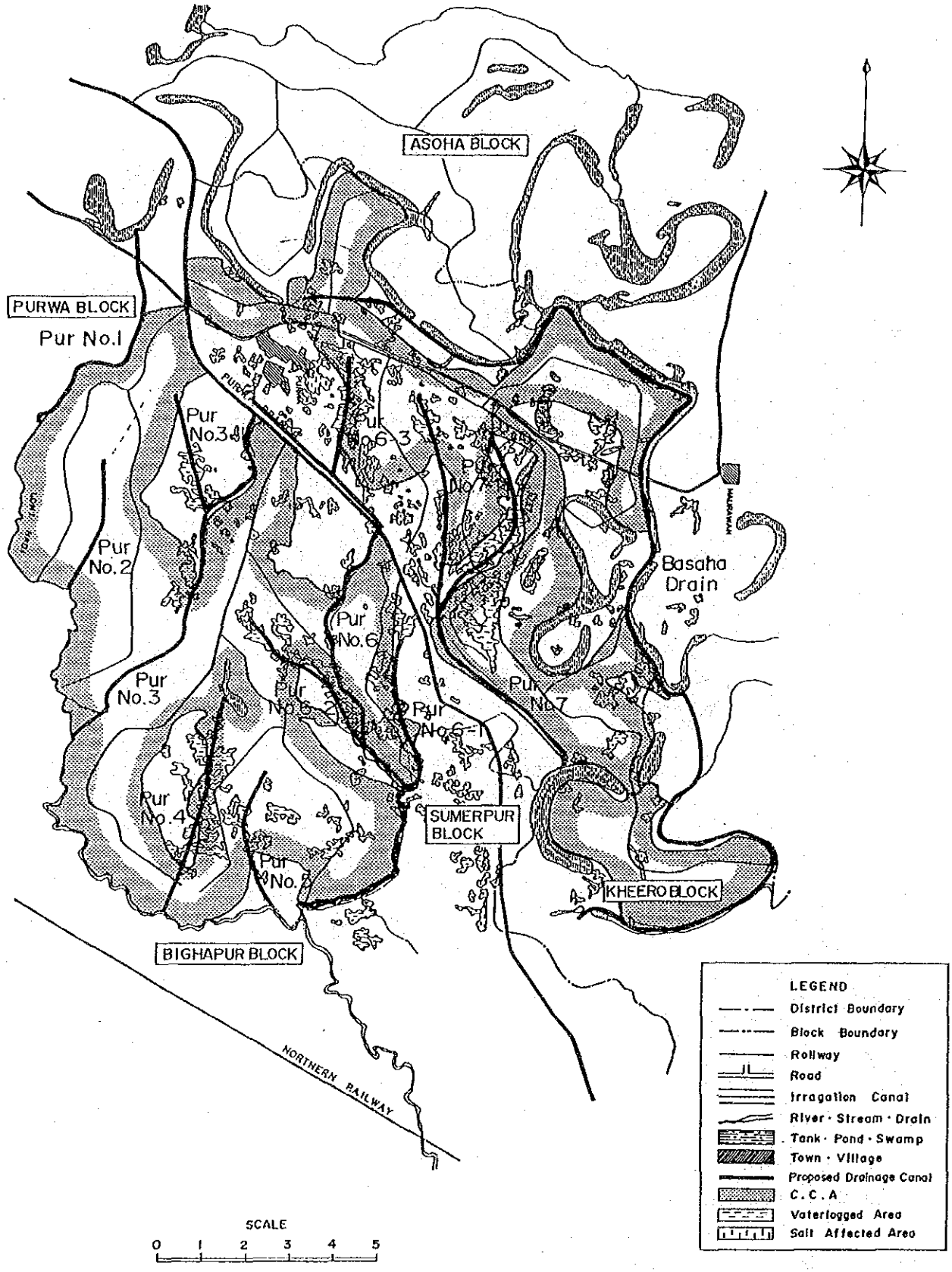



Fig. G.36 Proposed Drainage System in Purwa Study Area

INDIA

FEASIBILITY STUDY ON
IRRIGATION AND DRAINAGE DEVELOPMENT OF
SHARDA CANAL CAD PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

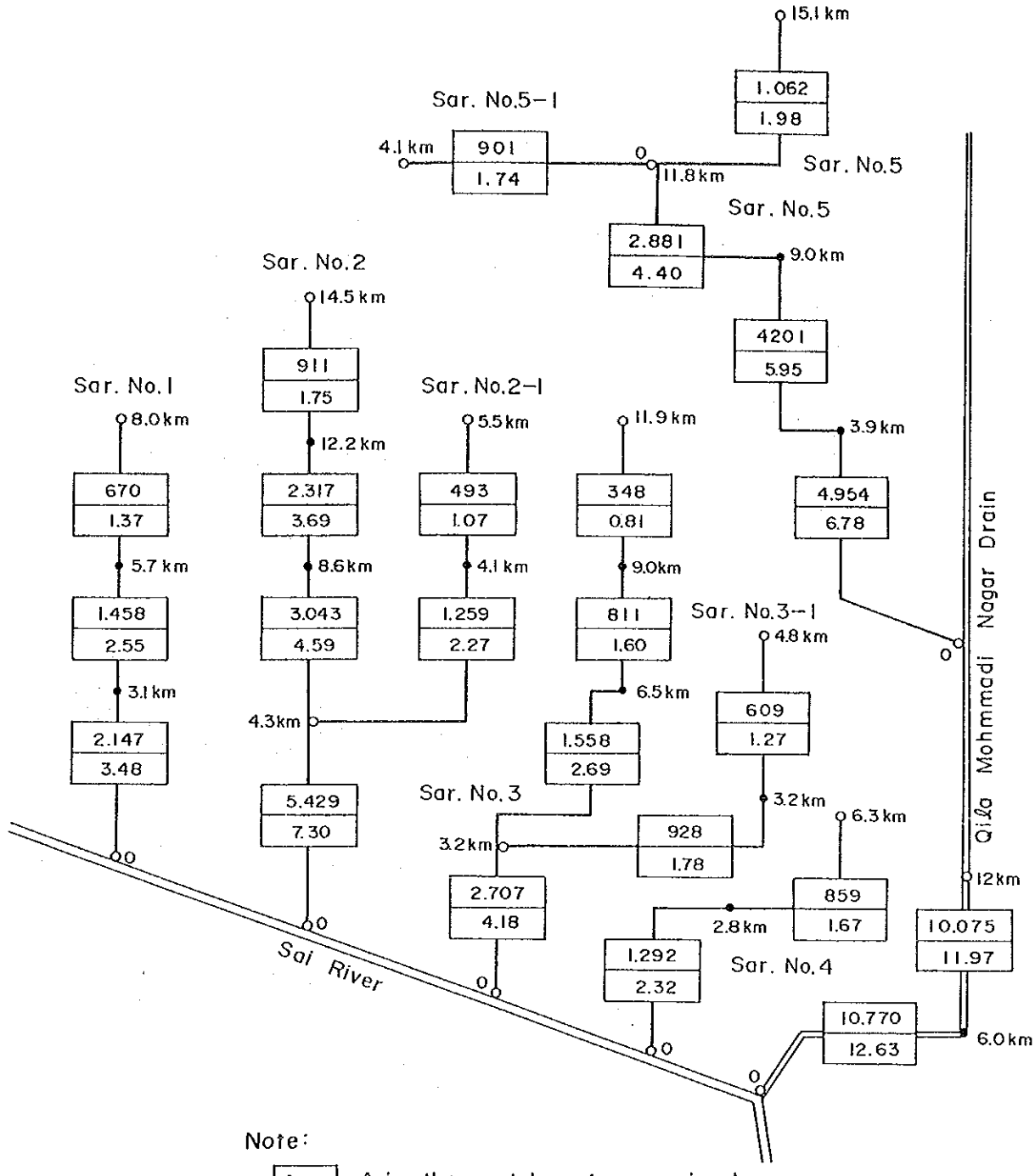



Fig. G.37 Proposed Drainage System in Sarojini Nagar Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

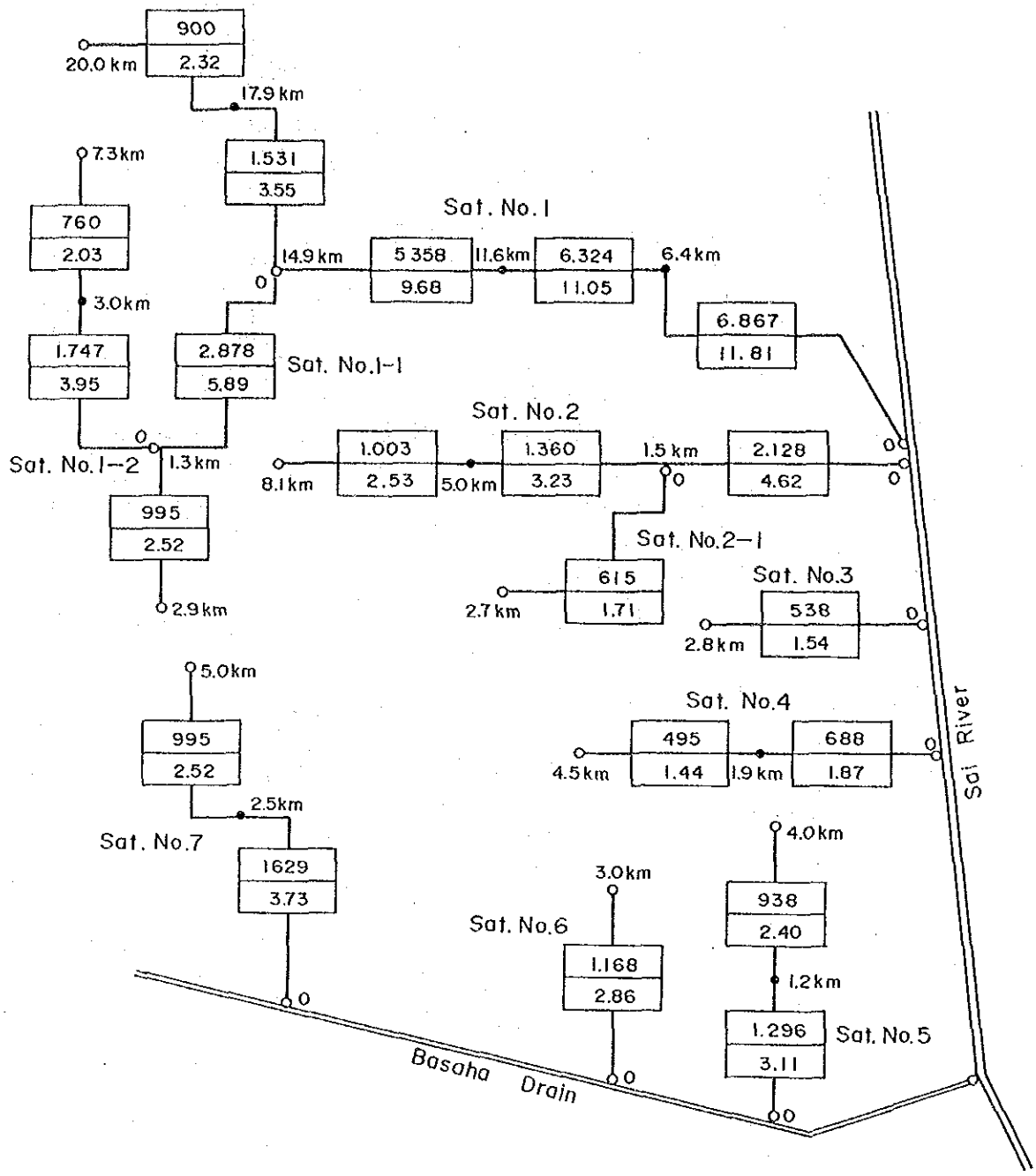



Fig. G.38 Proposed Drainage System in Sataon Study Area

| INDIA |
|---|
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

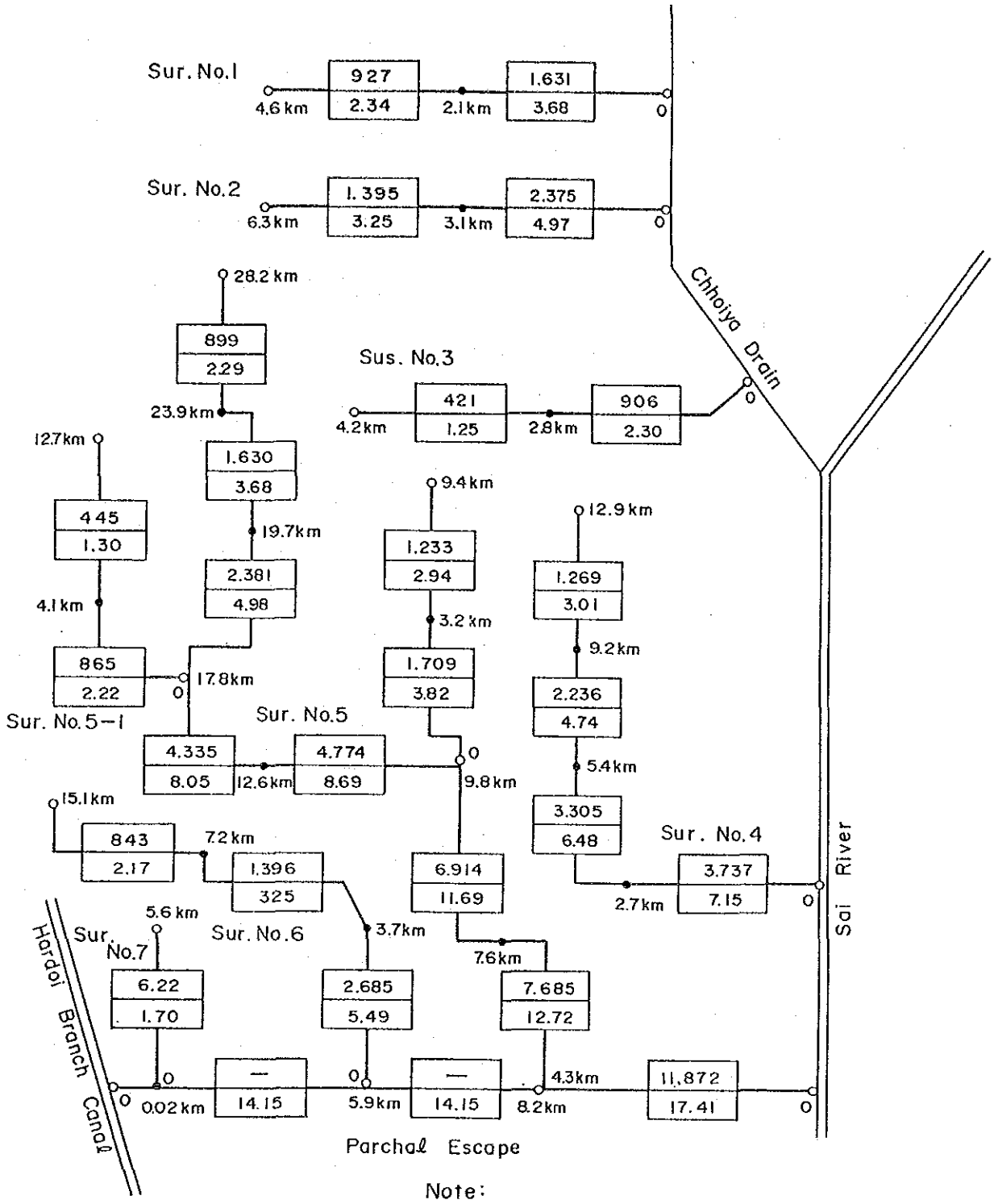



Fig. G.39 Proposed Drainage System in Sursa Study Area

| INDIA |
| --- |
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

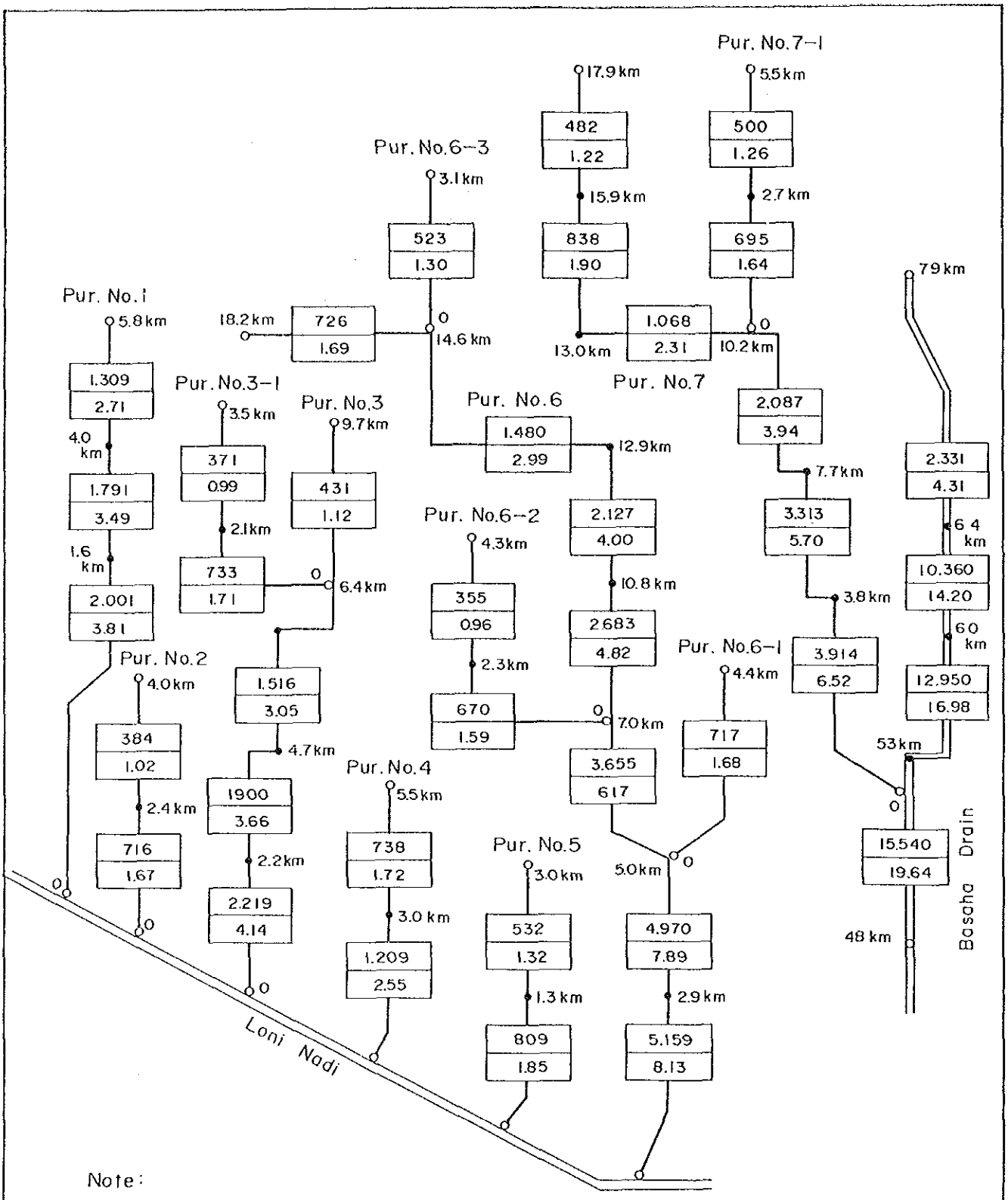



Fig. G.40 Proposed Drainage System in Purwa Study Area

| INDIA |
|---|
| FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

# *ANNEX-H*

# *COMMAND AREA DEVELOPMENT*

FEASIBILITY STUDY ON
IRRIGATION AND DRAINAGE DEVELOPMENT OF
SHARDA CANAL CAD PROJECT

ANNEX - H
COMMAND AREA DEVELOPMENT

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES

# ANNEX H COMMAND AREA DEVELOPMENT

## 1. Present Status of Command Area Development Programme

### 1.1 Objectives and Concept of CAD Programme

Expansion of irrigation has been the main element of the strategy of the Government of India for increasing food crops production. To realize the above, development of irrigation facilities has been undertaken. The approach has been to expand irrigation to the newly needed areas and ensure efficient use of the available irrigation facilities. Despite undertaking irrigation developmental measures, there was much gap between irrigation potential created and utilization thereof,and agricultural production under irrigated lands was much lower than the anticipated.

Under this condition, the Irrigation Commission, which was organized under the Government of India in 1972, proposed the programme of integrated command area development to optimize the benefits of irrigated agricultures. Further, the committee of Ministers set up by the former ministry of Irrigation and Power, Government of India,in 1972 recommended the early completion of on-farm works, provision of farm inputs, and other infrastructure setting for solving the problems connected with low utilization of irrigation potentials created.

Through a series of discussions on aiming at achievement of improved water utilization in the command area by means of improvement of water delivery and drainage system, and the execution of on-farm development, a CAD programme and the Command Area Development Authority to deal with the CAD programme were visualized.

The setting up of CAD Authority was proposed with its objectives, jurisdiction, constitution and powers by the Ministry of Agriculture in communication to the States in September 1973. In the circulation, it was suggested that the Command Area Development Authority should be ready for functioning from the 1st April, 1974, the beginning of 5th Five Year Plan with the following functioning and responsibilities.

(1) Modernization, maintenance and efficient operation of the irrigation system up to the outlets of 1 cusec capacity

(2) Development and maintenance of the main and intermediate drainage system

(3) Development of field channel and field drains within the command of each outlet

(4) Land levelling, on an outlet command basis for the types of irrigated crop that is to be grown

(5) Consolidation of holding and redrawing of field boundaries on an outlet command basis

(6) Enforcement of proper system of Osrabandi and fair distribution of water to individual fields

(7) Development of groundwater to supplement surface irrigation

(8) Selection and introduction of suitable cropping pattern

(9) Supply of all inputs and services, including credit

(10) Development of marketing and processing facilities and communications

(11) Preparing individual programmes of action for small farmers, marginal farmers and agricultural labour as part of the master plan

(12) diversification of agriculture and development off activities like animal husbandry, farm, forestry poultry,etc.

(13) Soil conservation and afforestation, where necessary

(14) Town planning

However, through the implementation of the Command Area Development Programme, it is suggested by the Ministry of Agriculture in September 1976 that the Scope of the Command Area Development Programme as above mentioned should be modified to the following items:

(1) On-farm development

(a) Development of field channels and field drains within the command of each outlet

(b) Land levelling, on an outlet command basis

(c) Realignment of field boundaries where necessary (where possible consolidation of holdings should also be combined)

(d) Enforcement of proper system of Osrabandi and fair distribution of water to individual fields

(e) Supply of all inputs and services, including credit, and

(f) Strengthening of extension services

(2) Selection and introduction of suitable cropping patterns

(3) Development of groundwater to supplement surface irrigation (conjunctive use under minor Irrigation Sector)

(4) Development and maintenance of the main and intermediate drainage system (Irrigation Sector)

(5) Modernization, maintenance and efficient operation of the irrigation system up to the outlet of 1 cusec capacity (Irrigation Sector)

## 1.2 Present Progress

(1) Programme Development

In 1974 /1975, Command Area Development Authorities have been established by the state governments. In the initial stage, 38 CADA have been established for 60 irrigation projects in 13 states with CCA of about 15 million ha. The following summarizes the presently operating CAD projects, of which the state wise development is as shown in Table H-1.

| No.of State and Union Territories | No.of CAD Projects | No.of CAD Authorities | Culturable Command Area |
|---|---|---|---|
| 22 | 131 | 54 | 18,491 |
| (Uttar Pradesh) | (3) | (3) | (4,308) |

Data: Status Report on the Centrally Sponsored Command Area Development Programme, June 1990

The CAD works are financed from three sources:

(1) Central assistance for certain selected activities
(2) State outlays
(3) Institutional finances

The central assistance for activities taken up under the CAD programme consists of grant, ordinary loans and special loans, with the central financial assistance of 50% for the most activities as detailed in Table H.2.

(2) Physical Progress of CAD works

The main works of the CAD programme are field channel construction, introduction of osrabandi and land levelling and shaping. The target and anticipated physical progress of those main works up to the 7th Plan are as shown in Table H.3 and summarized below.

| | | |
|---|---|---|
| No.of CAD projects | (nos) | 131 |
| Total CCA | (1,000ha) | 18,480 |
| Field channel | (1,000ha) | 10,500 |
| Osrabandi | (1,000ha) | 4,200 |
| Land levelling | (1,000ha) | 1,880 |

Data : Status Report on the Centrally Sponsored Command Area Development Programme, June 1990

The physical achievement was less than the target by the various reasons depending on the states conditions, among which major items are raised by the Government of India as follows:

(1) Reduction of budget compared with the original plan

(2) Lack of control of CADA on the department executing construction of field channel

(3) Lack of availability of areas for CAD works execution

(4) Unwillingness of farmers to provide land for CAD works

(5) Low progress of consolidation of land

(6) Unwillingness of farmers for land levelling due to low economical nature

The financial achievement in 7th Plan period is as shown in Table H.4 and summarized below.

Unit : Million Rs.

| Item | State | Central | Total |
|---|---|---|---|
| Total Expenditure in 7th plan period | 9,619.1 | 4,968.8 | 14,587.9 |
| (Uttar Pradesh) | 884.5 | 947.0 | 1,831.5 |
| (%) | (9.2%) | (19.1) | (12.6%) |

(3) Other Activities

The CAD programme includes the software activities other than the improvement of infrastructures, of which are adaptive trial, demonstration, farmers training, establishment of wireless communication, farmers' participation in irrigation water management,and training of staff involving CAD works. The present status of those activities are described as follows:

(a) Adaptive trial

An adaptive trial aims at development of suitable crop-water-soil management method to be applicable to the farmers for the aspects of land treatment, crop variety, fertilizer application schedule and irrigation practices, etc. The adaptive trials have been recently taken up in the CAD projects in the states of Assam, Gujarat, Haryana, Maharashtra, Karnataka and Rajastan

(b) Farmers' participation in irrigation water management

High priority has been given for involving farmers in the management and distribution of irrigation water below the outlets. The increase in effective utilization and equitable distribution of irrigation water, and increase in farm production is achieved on sustainable basis with participation of farmers in the water management in the command. The achievement of formation of water users' association is as shown below.

| No. of Projects | No. of Outlet Covered | Association Formed | Area Covered | No. of Farmers' Beneficiaries |
|---|---|---|---|---|
| All India | | | | |
| 10 | 199 | 300 | 6,573 | 6,039 |
| Uttar Pradesh state | | | | |
| 1 | 5 | 1 | 274 | -no data- |

(c) Wireless communication system

The reliable and quick information on the availability of irrigation water and crop growing stages is recognized as a vital tool to manage the timely supply of water as per needs of crops within the availability of water. For that purpose, it is required to collect, analyze and store various information from the command area,such as sowing time, growing stages, precipitation, flow of irrigation water in the distributary and minor canal systems up to the outlets. This necessitates establishment of wireless communication system. The wireless communication systems have been set up in some projects in the states of Haryana and Maharashtra.

(d) Training of farmers and staff of CADA

To successfully implement the CAD programme, training of farmers in the irrigated agriculture and well water management is considered as essential items. The training of farmers is recently commenced in the some projects. Training of senior level staff of CADA is provided through the training course organized by the Ministry of Water Resources.

## 1.3 Past Study on Evaluation of CAD Programme

The CAD programme has been commenced since 1974 and considerable financial assistance has been rendered by the government to the CAD Programme. A number of the evaluation studies on the impact of the various activities taken up under the Programme has been carried out by various agencies. In-depth study on the selected six CAD projects under the centrally sponsored CAD Programme has been carried out by the Indian Institute of Management, Ahmedabad (IIM) in 1987. On the basis of the IIM report, the following have been recommended in the National Workshop held in 1987:

The removal of uncertainty in irrigation water supply is the key element in executing the CAD programme. The following system and operational inadequacies are the main reasons of the unreliable supply of water:

- Lack of unified control of water management from the head to the outlets
- Lack of control structures, measuring devices and distribution canal system
- Lack of proper operation and maintenance of the water distribution system
- Lack of farmers' participation in irrigation management

In consideration of the above, the following items are confirmed to be the main elements of the CAD works:

(1) Removal of uncertainty in the supply of irrigation water is a core element of CAD programme

(2) Unified control of irrigation water management is vitalnecessity and its management should vest with CADA.

(3) Active participation of farmers in water management should be secured

(4) Closer interaction of agricultural research and extension of CADA should be promoted

(5) Conjunctive use of surface and ground water should be made as an integral part of CAD programme to enhance water availability,decrease deleterious effects such as water logging and salinity problems and promote harmonized development of ground water.

(6) Efficient drainage networks should be established to alleviate the water logging and salinity problems.

(7) Canal lining and land levelling should be carefully studied and execution of them can be made only where the benefits substantially exceed the costs.

(8) Training of CADA staff as well as farmers should be strengthened through reviewing the training programme.

(9) Water rates of surface and groundwater in case of conjunctive use should be rationalized to be able to cover the operation and maintenance cost of the canal system.

## 2. Sharda Canal CAD Project

### 2.1 Establishment of Sharda Sahayak CAD Authority

Under the U.P. Area Development Act,1976, three Command Area Development Authorities have been set up in U.P.,i.e. Ramganga Reservoir Project,Gandak Canal Project and Sharda Sahayak Project. The CAD Authority was established having a multi-disciplinary function consisting of the following main objectives:

(1) On-farm development works: This involves land levelling shaping and re-alignment of field boundaries and construction of field channels and field drains to ensure an efficient and equitable water distribution system from the main channel to each field

(2) Conjunctive use of surface and ground water and maintenance of water distribution system from the main channel to the fields

(3) Scheduled supply of water for irrigation through adoption of osrabandi

(4) Selection and adoption of suitable cropping pattern through improved soil and water management practices and techniques

(5) To ensure timely availability of better agricultural input including credit through a well-knit agriculture extension service programme

(6) Selection, identification and establishment of growth centers for integrated area development

(7) Development of necessary infrastructure within the command area

## 2.2 Schedule and Progress of Sharda Canal CAD Project

In Sharda Sahayak Canal Command, CAD Works were completed for the area of 1.4 million ha in 1988-89. The Government of India decided to extend the implementation of CAD Program to the Sharda Canal Command of 1.612 million ha lying in 11 districts. The original implementation plan was programmed with two phases,i.e., Phase-I and Phase-II. The CAD in Phase-I were commenced in 1989,concentrated mainly in on-farm works.

The entire schedule of the CAD works of Sharda Canal CAD Project, however, has been revised to be completed by 1995-96, in so far as on-farm development works are concerned.

The present progress of the area development works are as shown in Table H.5. The locations of the units and progress of the CAD works are as shown in Fig. H.1. The summary of the progress is as shown below.

Unit: ha of CCA

| Description | Sharda Command Area | Hardoi Branch Command Area |
|---|---|---|
| Completed unit area | 125,250 | 0 |
| On-going unit area | 642,400 | 128,300 |
| (Executed area) | 85,100 | 13,700 |
| (Surveyed area) | 138,500 | 54,600 |
| (Planned area) | 115,300 | 42,500 |

The facilities completed as of December 1990 are as follows:

(1) Field irrigation channels
- Earth canal : 7,778 km
- Lining canal : 12 km

(2) Related structures : 339 nos.

(3) Field Drains : 419 km

The overall implementation schedule has been recently revived to be completed by 1995 - 96 in so far as on-farm development (OFD) works are concerned. According to the general schedule of the Authority, the OFD works will be provided for 550 thousand ha as shown below.

| | | |
|---|---|---|
| 1989-1990 | 102,750 ha | (completed) |
| 1990-1991 | 194,000 ha | (completed) |
| 1991-1992 | 145,000 ha | (scheduled) |
| 1992-1993 | 110,000 ha | (scheduled) |
| Total | 551,750 ha | |

## 2.3 Organization Structure

The organization chart of the existing Sharda Canal CAD Authority is as shown in Fig. H.2. The general features and activities are described below.

(1) Head Office Organization

The CADA is headed by a Commissioner cum Administrator who is assisted by a Joint Administrator and Head of Agriculture, Cooperative, Animal Husbandry, Engineering Administrative and Accounts divisions, who are all drawn from their respective departments.

(2) Field Staffing of on-farm works

The field works are executed by the soil conservation units under the control of the Agriculture division. In the beginning of the year 1991 of the field survey period, there ere 56 soil conservation units headed by Soil Conservation Officers under 9 Deputy Directors of Agriculture. Each Unit consists of the following staff in its office:

Soil Conservation head office
- 1-technical assistant
- 1-junior engineer
- 1-draftsman
- 2-tracers

Soil conservation field office
- 2-soil conservation inspectors
- 10-assistant soil conservation officers
- 4-survey mates

and other some ministerial staff

The primary work of this unit is the execution of on-farm works. The soil conservation officers are also provide agricultural extension services to the farmers in the command areas.

(3) Soil survey staff

The soil scurvy is executed by 8 soil survey units headed by assistant soil survey officer under the supervision by 2 project officers from the Agriculture Department. Each unit consists of

- 4-senior soil chemical assistants
- 4-junior soil chemical assistants
- and other ministerial staff and workers

(4) Osrabandi field unit

The formulation of osrabandi and its required documentation are executed by 6-osrabandi field units each of which is supervised by the deputy revenue officers. Each unit consists of:

4-ziledars
16-amins
16-patrols
and some ministerial staff

(5) Extension staff

There is no staff for agricultural extension services. The extension services on village level is rendered by the village development officers. The limited agricultural extension services are presently undertaken by the soil conservation units by the CADA.

## 2.4 Command Area Development Works

The CADA is concentrating on the construction of on-farm works as the high priority works. The following shows the general features of the construction of on-farm works. Those figures were obtained from the Annual Report of Sharda Sahayak CAD Project for 1988-1989 since the available report of Sharda Canal CAD Project was not available in the field survey period.

(a) General design consideration of field channel
  (i) The lining of field channel is proposed to be about 10% of the total length of channel.
  (ii) The typical channel section is adopted with 0.5, 1.0 and 1.5 cusec depending on the command area of the channel.
  (iii) Brick masonry type lining is applied with the fixed bottom width of 38 cm.

(b) Density of channel and structures per ha

| Item | Per ha |
|---|---|
| Field irrigation channel | |
| earth | 75 m/ha |
| lined | 7.5 m/ha |
| Field drain | 9 m/ha |
| Structure | 1/9 no./ha |

(c) Unit construction cost of channel and structure

| Item | Rs./km or no. | Rs./ha |
|---|---|---|
| Field irrigation channel | | |
| earth | 2,000 | 150 |
| lined | 80,000 | 600 |
| Field drain | 4,000 | 36 |
| Structure | 1,800 | 200 |

At the present time, the unit cost of 985 Rs/ha will be increased due to the increased material costs and wages.

## 3. Approach to Command Area Development Works

### 3.1 Development Frame Work

(1) General

Water delivery with respect of adequacy and timing is not necessary achieved in the Sharda Canal Command. Extensive use of water has widely prevailed in the upstream area in Sharda Canal command and accordingly the scarce delivery has occurred in the downstream areas. Those delivery conditions induce conspicuous environmental degradation such as, water logging and salinity or depletion of groundwater table. It suggests there exist considerable scopes for resource distribution improvement that could enhance productivity by means of the integrated area development approach.

Accelerated area development will require effective development strategies for agricultural as well as non-agricultural sectors, emphasizing the complementary of inter-

sectoral linkages. Within the context of the CAD programme, integrated management of agricultural inputs and outputs, so as to maximize rural income generation, remains as the primary objective. The critical elements of the approach include:

- reliable water supply
- sufficient supply of other agricultural inputs such as fertilizers, seeds, extension services, marketing, storage, processing of farm outputs

The proposed plan of the above-mentioned elements is described in detail in the respective ANNEXES.

(2) Institutional Set-up

(a) Farmers Organization

Below the outlet, farmers are responsible for water distribution. So long as the water flows are adequate, farmers' cooperation to adjust flows to take into account local variations in water requirements is normally maintained, but as the flows decline, the cooperation breaks down and conflicts result.

The uneven distribution caused by the upstream water users induces a demotivating factor in farmers organizations of water management. The reliable water delivery at the farm level is obviously needed to improve production efficiency as well as equity distribution. From a micro-economic view point, it may be noted that the uncertain water deliveries affects efficient allocation of other complementary inputs such as efforts to minimizing water losses rather than maximizing profit, and hence significantly lower agricultural output.

The farmers in the upstream reach enjoy more than their proportionate share of water for their farms. Under such situation, there is little incentive for farmers to work as group to ensure the supply of canal water under the existing canal system. Similarly, in the tailend of canal system where the probability of receiving irrigation water is very low, there is little to achieve as there is hardly any water to be received. It is also clear that the incentive to form water user group is simply built on the marginal principle, i.e., incremental costs of such efforts should be less in relation to incremental benefits of the same to the water user groups. It is not easy to have the common objectives to get the benefits of group formation, as the group formation requires preparedness of

the individual members to incur necessary financial as well as non-financial costs that might be required for effective functioning of the group.

Under these situation, the most effective approach is to actually demonstrate the adaptive development of water user association in the respective representative areas. The adaptive trial is proposed as a prerequisite for efficient organization of the water users as well as for successful implementation of the relevant programs.

The proposed organization for implementation of the Project (CAD Authority) should include a division/sub-division responsible for providing guidance in formulation of water users association and operation of osrabandi. The services of such division/sub-division of the CADA should be rendered to the farmers from the beginning stage of the Project works.

(b) Interaction between Water Users and Government O&M Staff

The operation, maintenance and water delivery up to the outlets is directly under the control of the Irrigation Department. There is a operational conflict between the water users and the government O&M staff in addition to the conflict among the farmers in the upstream reach and the tail end. The water delivery problems that the water users confront are not reflected to the O&M staff for their water delivery operation. It is still a long way for some of the O&M staff to recognize that an end product of efficient irrigation water delivery is directly relevant to agricultural productivity. A need exists greater interaction of water users and water deliveries management staff.

To this context, the following committees are required on the basis of participation of the representatives of the water users at the respective levels of water supply system:

(1) The outlet committee: It will be organized for every chak and will consist of farmers from the head reach and tail end in the chak, an irrigation canal O&M staff and an agricultural extension staff.

(2) The water utilization committee: It will be organized for every command area of the minor canal and will consist of the farmers representing the respective farm holding sizes and the locations in the canal system, an canal operation staff and a junior engineer concerned of the minor canal. The primary responsibility of the committee is the even distribution within the minor canal command.

(3) Canal advisory committee: It will be organized for the jurisdiction the executive engineer of the canal O&M office, and will consist of the executive engineer, the representatives of the water utilization committees,agricultural extension officer,assistant engineer and other representatives of the concerned areas.

## 3.2 General Design Considerations

(1) On-farm works

(a) Field Channel

The field channel serves one or two chaks which are rotational unit, which consists of or is divided into 7 sub-chaks. The field channel will be so lined that the conveyance loss does not exceed 15% of the outlet full supply discharge.

To attain the above target, the lining will be provided to the extent of 50% to 60% of the reaches of the field channel according to the economic comparison. The lining is of brick masonry construction with typical sections, selection of which will be made depending on the gradient and discharges of the channel.

(b) Field drains

The field drain to be constructed within the command area will collect drain water from sub-chaks and convey it to the collector drain which is conveyed to the main drain in turn.

The field drain will have the capacity to remove the consecutive 3-day rainfall excess water within 3 days.

(2) Development of groundwater for conjunctive use of canal water

The shortage of canal water and water logging and salinity problems due to excessive use of water, insufficient drainage systems,etc. are emerging in the canal command. Ground water development is much effective to remove uncertainty of canal supply, not only to supplement the total supply to the command area falling in less availability of canal water.

Besides, in order to alleviate water logging and salinity problems, the control of water table lying within 2 meters below the ground surface is an effective measure. Groundwater development will be executed for such shallow groundwater table areas, on the basis of the present conditions of the present groundwater draft, usable groundwater recharge, water logging and salinity, groundwater table, availability of canal supply and geo-hydrological conditions.

(3) Osrabandi and Participation of farmers

Improvement of on-farm system in the command area is crucial prerequisite for introduction of osrabandi.. According to the fact that introduction of osrabandi without participation of farmers results in falling into disuse as soon as the government works are finished, participation of farmers through establishment of water users' association on chak command basis should be strongly regarded.

The water users' association should be involved in CAD project from planning stage. The scope of such association should be expanded to construction and maintenance of on-farm works, equitable water distribution of distribution systems and inputs arrangement and farm produce marketing, etc.

(4) Adaptive trial

Adaptive trial should be introduced to each of the project areas to establish the new farming practices and water management method to suit varied conditions of the fields such as agro-climatic conditions, crops grown, fertilizer application irrigation deliveries, etc. The main items to be executed in trial farms are as follows:

(a) to identify cropping system and cropping sequence suitable to the physical environment, water availability and farmers' skills

(b) to identify farming practices that may fall short of optimum recommendation

(c) to devise and demonstrate irrigation practice

(d) to induce the farmers for group action for maintenance of on-farm facilities, deciding the cropping pattern and distribution of equitable water

(e) to analyze the results obtained and modify the programme

(f) to device suitable recommendations for adoption by the water management, research and extension staff

(5) Training

Training of the personnel engaged in CAD programme should be given to refresh and update the knowledge and ensure the opportunities to gain the new technologies. Training courses prepared by the Central and State governments should be effectively utilized for respective classes of the officers. Besides, the canal operation staff such as canal inspectors, patrol,and other operation staff should also be trained. The project should have the training programme and provide the facilities to training.

# *TABLES*

Table H.1 Number of CAD Projects, CAD Authorities and Command Area

| No. | State/Union Territory | No. of CAD project | No. of CAD Authorities | Culturable Command Area(1,000ha) |
|---|---|---|---|---|
| 1 | Andra Pradesh | 7 | 3 | 1,340.0 |
| 2 | Assam | 3 | 2 | 52.3 |
| 3 | Bihar | 6 | 4 | 2,393.6 |
| 4 | Goa | 2 | 1 | 6.5 |
| 5 | Gujarat | 21 | 4 | 953.2 |
| 6 | Haryana | 4 | 1 | 443.4 |
| 7 | Himachal Pradesh | 3 | 0 | 10.1 |
| 8 | Jammu and Kashmir | 7 | 2 | 61.9 |
| 9 | Karnataka | 5 | 4 | 1,920.8 |
| 10 | Kerala | 10 | 1 | 92.2 |
| 11 | Madhya Pradesh | 22 | 7 | 1,500.8 |
| 12 | Maharashtra | 16 | 11 | 1,279.3 |
| 13 | Manipur | 2 | 1 | 29.0 |
| 14 | Meghalaya | 1 | 0 | 0.9 |
| 15 | Orissa | 4 | 5 | 601.6 |
| 16 | Rajasthan | 4 | 2 | 972.7 |
| 17 | Tamilnadu | 5 | 0 | 664.5 |
| 18 | Tripura | 1 | 0 | 4.5 |
| 19 | Uttar Pradesh | 3 | 3 | 4,308.0 |
| 20 | West Bengal | 4 | 3 | 1,832.4 |
| 21 | Daman & Diu | 1* | 0 | 3.4 |
| 22 | Dadra & Nagar Haveli | 1* | 0 | 8.3 |
| | Total | 131 | 54 | 18,479.4 |

Source: Report on the Centrally Sponsored Command Area Development Programme, Ministry of Water Resources, 1990

Note: * under the same project

Table H.2 Financial Pattern of Central Assistance and Total Release from Government of India 1985-89

| No. | Item/Activity | Centrally assistnce (from 1986 Apr.) | Central release 1985-89 (10x6 Rs) | (%) |
|---|---|---|---|---|
| A. GRANTS | | | | |
| 1 | CAD Establishment | 50 % | 576.39 | 14.8 |
| 2 | Survey and Planning | 50 % | 682.49 | 17.5 |
| 3 | Osrabandi | 50 % (This will also cover expenditure on wireless communication system) | 204.54 | 5.2 |
| 4 | Crop compensation | 50 % of value of crop | 5.40 | 0.1 |
| 5 | Adaptive trials | 50 % | 39.38 | 1.0 |
| 6 | Demonstration and Training | | | |
| 7 | Subsidy for small and marginal farmers on IRDP pattern | 50 % (to be adjusted against loan) | 110.39 | 2.8 |
| 8 | Construction of field channel | i. 50 % of the cost from outlet to 5-8 ha block<br>ii.25 % of the cost within 5-8 ha block | 1,315.49 | 33.7 |
| 9 | Construction of field drain | 25 % | 21.83 | 0.6 |
| 10 | Management subsidy for farmers association | 50 % Rs.100/ha for first 2 years and Rs.75/ha for the 3rd year (to be included as part of CAD Estt.) | 85.82 | 2.2 |
| 11 | Orientation training for senior level of officers | 100 % | 4.12 | 0.1 |
| 12 | Evaluation study | 50 % | 4.26 | 0.1 |
| | | | 107.04 | 2.7 |
| | | total | 3,157.15 | 80.8 |
| B. LOANS | | | | |
| 1 | Construction of field channel | 25 % of the cost within 5-8 ha block | 632.83 | 16.2 |
| 2 | Construction of field drain | 25 % | 6.78 | 0.2 |
| 3 | Equipment and machinery | 50 % | 8.45 | 0.2 |
| 4 | Equity support to Land Development Corporations and Farmers Service Societies etc. | 50 % | 22.29 | 0.6 |
| 5 | Special Loan Account for financing (ii) eligible farmers for executing of OFD works | 50 % | 80.00 | 2.0 |
| | | | (0.46) | 0.0 |
| | | total | 749.89 | 19.2 |
| | Total | | 3,907.04 | 100.0 |

Table H.3 Accumulated Physical Achievement of CAD Works for 1974 to 1989

| No. | State/Union Territory | No.of CAD Project | Culturable Command Area(1,000ha) | Field Channel (1,000ha) | Osrabandi (1,000ha) | Land Levelling (1,000ha) |
|---|---|---|---|---|---|---|
| 1 | Andra Pradesh | 7 | 1,340.0 | 646.5 | 292.2 | 322.9 |
| 2 | Assam | 3 | 52.3 | 31.3 | 31.9 | 0.0 |
| 3 | Bihar | 6 | 2,393.6 | 1,211.5 | 75.2 | 1.3 |
| 4 | Goa | 2 | 6.7 | 3.9 | 2.0 | 0.3 |
| 5 | Gujarat | 21 | 953.2 | 746.6 | 534.5 | 176.4 |
| 6 | Haryana | 4 | 443.4 | 84.7 | 160.8 | 27.7 |
| 7 | Himachal Pradesh | 3 | 10.1 | 4.7 | 1.9 | 0.0 |
| 8 | Jammu and Kashmir | 7 | 61.9 | 24.9 | 22.9 | 22.8 |
| 9 | Karnataka | 5 | 1,920.8 | 882.1 | 164.9 | 602.9 |
| 10 | Kerala | 10 | 92.2 | 30.1 | 33.0 | 0.0 |
| 11 | Madhya Pradesh | 22 | 1,500.8 | 747.4 | 382.0 | 44.2 |
| 12 | Maharashtra | 16 | 1,279.3 | 832.1 | 355.4 | 571.2 |
| 13 | Manipur | 2 | 29.0 | 17.2 | 10.3 | 2.2 |
| 14 | Meghalaya | 1 | 0.9 | 0.0 | 0.5 | 0.0 |
| 15 | Orissa | 4 | 601.6 | 234.4 | 127.6 | 12.5 |
| 16 | Rajasthan | 4 | 972.7 | 549.2 | 239.7 | 83.0 |
| 17 | Tamilnadu | 5 | 664.5 | 288.7 | 21.7 | 0.0 |
| 18 | Tripura | 1 | 4.5 | 0.1 | 0.0 | 0.0 |
| 19 | Uttar Pradesh | 3 | 4,308.0 | 4,117.0 | 1,746.3 | 8.5 |
| 20 | West Bengal | 4 | 1,832.4 | 43.2 | 0.0 | 3.0 |
| 21 | Daman & Diu | * | 3.4 | 0.0 | 0.0 | 0.0 |
| 22 | Dadra & Nagar Haveli | 1 | 8.3 | 0.0 | 0.0 | 0.0 |
| | Total | 131 | 18,479.6 | 10,495.6 | 4,202.8 | 1,878.9 |

Source: Report on the Centrally Sponsored Command Area Development Programme, Ministry of Water Resources, 1990

Table H.4 Central Release and Expenditure in State Sector for CAD Project in the Five-Year Plan Period (1985-90)

| No. | State/Union Territory | Cenral release from Government India | | Expenditure in State Sector | |
|---|---|---|---|---|---|
| | | (10x6 Rs) | ( % ) | (10x6 Rs) | ( % ) |
| 1 | Andra Pradesh | 162.7 | 3.3 | 349.9 | 3.6 |
| 2 | Assam | 72.1 | 1.5 | 85.3 | 0.9 |
| 3 | Bihar | 354.4 | 7.1 | 310.1 | 3.2 |
| 4 | Goa | 53.5 | 1.1 | 56.5 | 0.6 |
| 5 | Gujarat | 373.8 | 7.5 | 390.3 | 4.1 |
| 6 | Haryana | 171.3 | 3.4 | 895.2 | 9.3 |
| 7 | Himachal Pradesh | 13.2 | 0.3 | 18.0 | 0.2 |
| 8 | Jammu and Kashmir | 35.5 | 0.7 | 49.8 | 0.5 |
| 9 | Karnataka | 448.0 | 9.0 | 626.7 | 6.5 |
| 10 | Kerala | 160.2 | 3.2 | 183.7 | 1.9 |
| 11 | Madhya Pradesh | 304.6 | 6.1 | 1,110.9 | 11.5 |
| 12 | Maharashtra | 856.4 | 17.2 | 2,707.4 | 28.1 |
| 13 | Manipur | 20.5 | 0.4 | 22.8 | 0.2 |
| 14 | Meghalaya | 2.0 | 0.0 | 4.1 | 0.0 |
| 15 | Orissa | 120.0 | 2.4 | 129.2 | 1.3 |
| 16 | Punjab | 0.0 | 0.0 | 330.0 | 3.4 |
| 17 | Rajasthan | 695.1 | 14.0 | 951.6 | 9.9 |
| 18 | Tamilnadu | 188.6 | 3.8 | 388.8 | 4.0 |
| 19 | Tripura | 0.5 | 0.0 | 1.8 | 0.0 |
| 20 | Uttar Pradesh | 884.5 | 17.8 | 947.0 | 9.8 |
| 21 | West Bengal | 48.2 | 1.0 | 47.3 | 0.5 |
| 22 | Daman & Diu | 0.0 | 0.0 | 0.0 | 0.0 |
| 23 | Dadra & Nagar Haveli | 0.0 | 0.0 | 12.6 | 0.1 |
| 24 | Grant and studies | 3.7 | 0.1 | 0.0 | 0.0 |
| | Total | 4,968.8 | 100.0 | 9,619.0 | 100.0 |

Source: Status Report on the Centrally Sponsored Command Area Development Programme, Ministry of Water Resources, 1990

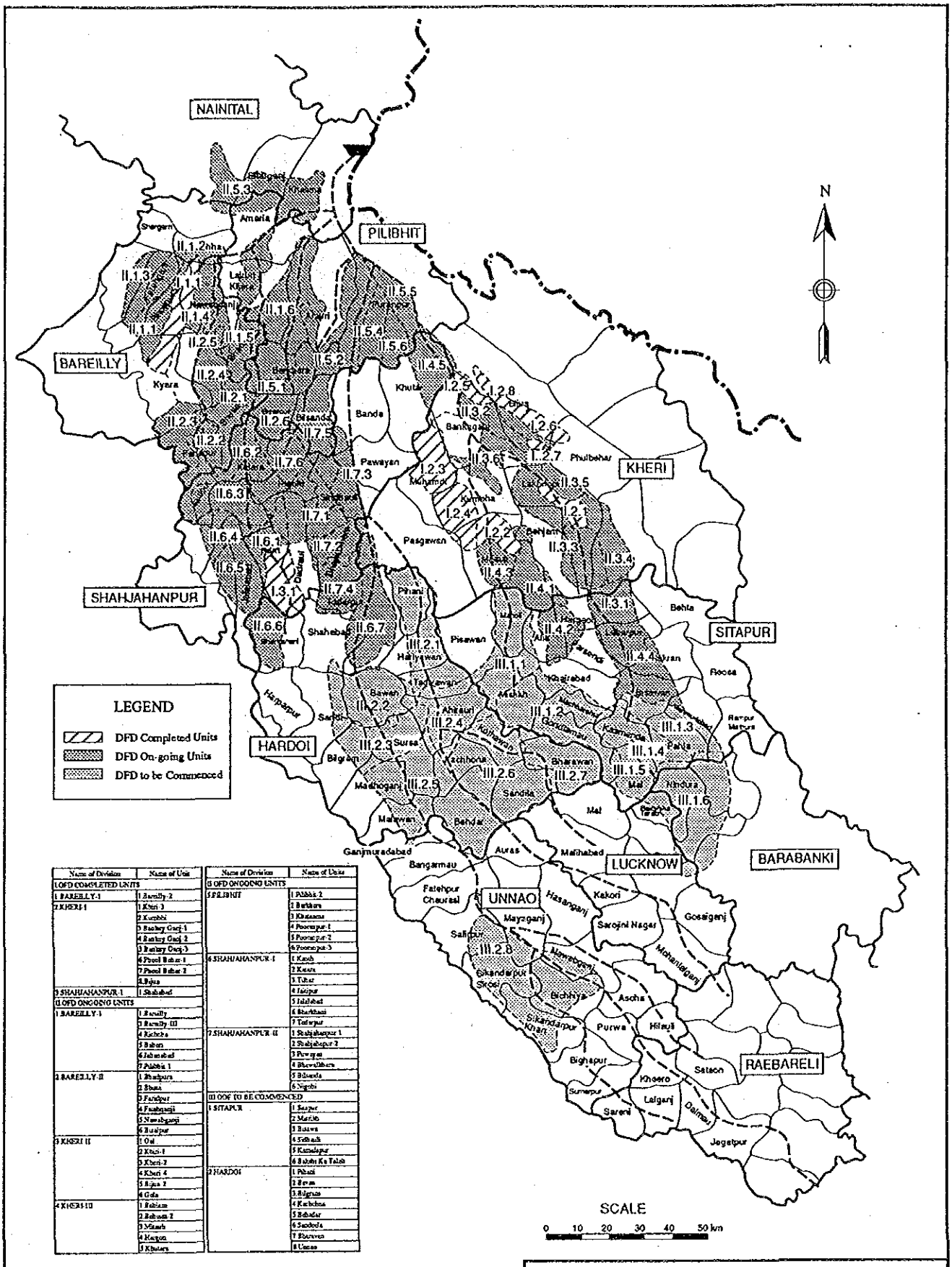
# Table H.5 Progress of Area Development Works of Sharda System by Work Area Unit(1/2)

| Name of Division | Name of Unit | Total | | Workable Area | | Surveyed/89-90 | | Planned/89-90 | | Area Executed as at 31/3/90 | | | | | | Year 90-91 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Kulaba Nos. | C.C.A. (ha) | Kulaba Nos. | C.C.A. (ha) | Kulaba Nos. | C.C.A. (ha) | Kulaba Nos. | Area (ha) | Kulaba Nos. | Area (ha) | Earth C. (km) | Lined C. (km) | Field D. (km) | Structure Nos. | Area Surveyed Kulaba | Area Surveyed C.C.A. (ha) | Area Planned Kulaba | Area Planned Area (ha) |
| I. OFD COMPLETED UNITS | | | | | | | | | | | | | | | | | | | |
| 1 BAREILLY-I | 1. Bareilly-2 | 1,328 | 59,583 | 822 | 33,239 | 0 | 0 | 0 | 0 | | 1,982 | 113.49 | 1.00 | 1.05 | 5 | | 0 | | 0 |
| 2 KHERI-I | 2. Khiri-3 | 59 | 2,622 | 50 | 2,003 | 0 | 0 | 0 | 0 | | 2,066 | 144.90 | 0.16 | 16.50 | 77 | | 0 | | 0 |
| | 3. Kumbhi | 202 | 12,251 | 188 | 10,713 | 0 | 0 | 0 | 0 | | 1,034 | 81.62 | - | 1.70 | - | | 0 | | 0 |
| | 4. Bankey Ganj-1 | 140 | 9,036 | 136 | 8,613 | 0 | 0 | 0 | 0 | | 2,660 | 202.78 | - | 9.00 | - | | 0 | | 0 |
| | 5. Bankey Ganj-2 | 96 | 5,064 | 65 | 1,940 | | | | | | 1,940 | 130.01 | - | 15.35 | - | | | | |
| | 6. Bankey Ganj-3 | 79 | 3,379 | 68 | 2,736 | | 0 | 0 | 0 | | 2,108 | 138.02 | - | 3.07 | - | | 0 | | 0 |
| | 7. Phool Behar-1 | 97 | 8,283 | 63 | 6,813 | 0 | 0 | 0 | 0 | | 1,429 | 80.08 | - | 1.30 | - | | 0 | | 0 |
| | 8. Phool Behar-2 | 56 | 2,789 | 49 | 2,402 | 0 | 0 | 0 | 0 | | 1,214 | 82.94 | - | 1.52 | - | | 0 | | 0 |
| | 9. Bijua | 51 | 2,341 | 51 | 1,927 | 0 | 0 | 0 | 0 | | 1,474 | 102.71 | - | 7.20 | - | | 0 | | 0 |
| 3 SHAHJAHANPUR-I | 10. Shahabad | 386 | 19,899 | 104 | 5,454 | 0 | 0 | 0 | 0 | | 1,699 | 88.18 | 0.10 | 0.56 | - | 0 | 0 | 0 | 0 |
| TOTAL (I) | | 2,494 | 125,247 | 1,596 | 75,840 | 0 | 0 | 0 | 0 | 0 | 17,606 | 1,165 | 1 | 57 | 82 | 0 | 0 | 0 | 0 |
| II. OFD ONGOING UNITS | | | | | | | | | | | | | | | | | | | |
| 1 BAREILLY-I | 1. Bareilly | 293 | 14,887 | 241 | 10,655 | 130 | 3,802 | 130 | 3,802 | 89 | 2,482 | 152.66 | 0.40 | 7.26 | 4 | | 3,558 | | 2,171 |
| | 3. Bareilly-III | 203 | 7,476 | 149 | 5,431 | 60 | 1,741 | 60 | 1,741 | 58 | 1,659 | 91.98 | 0.33 | - | 6 | | 2,055 | | 1,640 |
| | 4. Richcha | 308 | 11,560 | 262 | 10,577 | 109 | 2,930 | 109 | 2,930 | 109 | 1,997 | 133.86 | 1.13 | 5.24 | 28 | | 2,038 | | 2,038 |
| | 5. Baheri | 277 | 12,126 | 227 | 8,865 | 71 | 3,347 | 71 | 3,347 | 61 | 1,837 | 97.52 | 1.85 | 4.10 | 22 | | 2,500 | | 2,041 |
| | 6. Jahanabad | 324 | 13,441 | 324 | 12,586 | 119 | 3,063 | 119 | 3,063 | 66 | 2,700 | 170.02 | - | 24.48 | - | | 4,093 | | 4,092 |
| | 7. Pilibhit-1 | 465 | 20,032 | 452 | 16,028 | 91 | 2,413 | 91 | 2,413 | 81 | 2,029 | 126.87 | - | 4.19 | - | | 4,093 | | 3,520 |
| | Total | 1,870 | 79,522 | 1,655 | 64,142 | 580 | 17,296 | 580 | 17,296 | 464 | 12,704 | 772.90 | 3.71 | 45.27 | 60 | 0 | 18,337 | 0 | 15,503 |
| 2 BAREILLY-II | 1. Bhadpura | 391 | 20,292 | 259 | 12,152 | 62 | 4,058 | 62 | 2,448 | 62 | 2,448 | 133.52 | 0.33 | 8.80 | 5 | | 4,026 | | 3,509 |
| | 2. Bhuta | 339 | 16,331 | 217 | 12,182 | 81 | 3,830 | 81 | 2,272 | 81 | 2,272 | 141.40 | 1.40 | 9.06 | 20 | | 4,624 | | 3,542 |
| | 3. Faridpur | 461 | 18,636 | 281 | 10,224 | 88 | 3,438 | 88 | 3,054 | 72 | 1,800 | 120.00 | 2.00 | 7.50 | 45 | | 5,244 | | 3,172 |
| | 4. Fatehganji | 313 | 17,596 | 209 | 11,667 | 89 | 4,649 | 89 | 2,933 | 64 | 1,802 | 121.00 | 0.25 | 10.27 | 5 | | 4,525 | | 3,355 |
| | 5. Nawabganji | 366 | 17,452 | 312 | 13,847 | 117 | 4,314 | 117 | 2,865 | 88 | 1,825 | 103.10 | 1.07 | 8.46 | 14 | | 4,200 | | 3,474 |
| | 6. Bisalpur | 352 | 15,311 | 267 | 11,524 | 68 | 3,235 | 68 | 3,235 | 68 | 2,484 | 176.17 | - | 7.89 | - | | 3,785 | | 2,491 |
| | Total | 2,222 | 105,618 | 1,545 | 71,595 | 505 | 23,525 | 505 | 16,806 | 435 | 12,630 | 795.18 | 5.05 | 51.98 | 89 | 0 | 26,404 | 0 | 19,542 |
| 3 KHERI-II | 1. Oel | 376 | 15,910 | 219 | 8,598 | 86 | 2,615 | 86 | 2,615 | 86 | 2,500 | 184.50 | - | 11.84 | - | | 4,503 | | 4,003 |
| | 2. Khiri-1 | 92 | 4,908 | 85 | 4,232 | 37 | 1,986 | 37 | 1,986 | 37 | 1,947 | 117.67 | - | 8.49 | 10 | | 3,876 | | 2,831 |
| | 3. Kheri-2 | 141 | 6,390 | 138 | 6,250 | 41 | 1,869 | 41 | 1,869 | 41 | 1,869 | 142.26 | 0.75 | 11.14 | 32 | | 4,381 | | 4,125 |
| | 4. Kheri-4 | 198 | 9,728 | 172 | 5,217 | 86 | 2,392 | 86 | 2,392 | 86 | 2,187 | 145.54 | 0.60 | 4.91 | 41 | | 1,200 | | 1,200 |
| | 5. Bijua-2 | 116 | 10,862 | 110 | 4,265 | 37 | 2,116 | 37 | 1,506 | 37 | 1,021 | 56.62 | - | 2.98 | - | | 585 | | 2,378 |
| | 6. Gola | 114 | 5,167 | 114 | 4,303 | 105 | 3,170 | 105 | 3,170 | 77 | 1,970 | 135.66 | 0.33 | 4.08 | 6 | | 2,378 | | 585 |
| | Total | 1,037 | 52,964 | 838 | 32,865 | 392 | 14,147 | 392 | 13,537 | 364 | 11,494 | 782.25 | 1.68 | 43.44 | 89 | 0 | 16,923 | 0 | 15,121 |
| 4 KHERI-III | 1. Behjam | 145 | 6,751 | 137 | 6,184 | 56 | 2,529 | 56 | 2,529 | 56 | 2,140 | 150.00 | 0.08 | 21.27 | 6 | | 3,341 | | 2,299 |
| | 2. Behjam-2 | 190 | 8,178 | 134 | 5,508 | 81 | 3,161 | 76 | 2,651 | 76 | 2,651 | 175.00 | - | 11.50 | - | | 2,943 | | 1,745 |
| | 3. Mitauli | 147 | 6,656 | 147 | 5,931 | 67 | 2,542 | 67 | 2,542 | 67 | 2,542 | 185.18 | - | 27.37 | 2 | | 3,269 | | 3,125 |
| | 4. Hargon | 545 | 21,119 | 113 | 4,492 | - | | | | | | | | | | | 4,492 | | 2,401 |
| | 5. Khutare | 76 | 5,873 | 50 | 1,808 | 50 | 1,808 | 50 | 1,808 | 48 | 1,400 | 102.14 | - | 2.05 | - | | 5,944 | | 3,544 |
| | Total | 1,103 | 48,576 | 581 | 23,922 | 254 | 10,039 | 249 | 9,529 | 247 | 8,732 | 612.32 | 0.08 | 62.20 | 8 | 0 | 19,989 | 0 | 13,113 |

# Table H.5 Progress of Area Development Works of Sharda System by Work Area Unit(2/2)

| Name of Division | Name of Unit | Total | | Workable Area | | Surveyed/89-90 | | Planned/89-90 | | Area Executed as at 31/3/90 | | | | | | Year 90-91 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Kulaba Nos. | C.C.A. (ha) | Kulaba Nos. | C.C.A. (ha) | Kulaba Nos. | C.C.A. (ha) | Kulaba Nos. | Area (ha) | Kulaba Nos. | Area (ha) | Earth C. (km) | Lined C. (km) | Field D. (km) | Structure Nos. | Area Surveyed Kulaba | Area Surveyed C.C.A. (ha) | Area Planned Kulaba | Area Planned Area (ha) |
| 5 PILIBHIT | 1. Pilibhit-2 | 330 | 15,408 | 305 | 12,676 | 105 | 2,308 | 45 | 2,195 | 45 | 2,195 | 142.50 | - | 10.00 | - | 80 | 4,114 | 80 | 3,059 |
| | 2. Barkhera | 335 | 16,019 | 328 | 13,060 | 77 | 3,587 | 59 | 3,178 | 59 | 3,178 | 218.04 | - | 15.12 | - | 69 | 4,073 | 69 | 3,102 |
| | 3. Khateema | 538 | 17,203 | 518 | 15,945 | 155 | 3,063 | 120 | 2,871 | 120 | 2,871 | 255.19 | - | 19.20 | - | 110 | 4,573 | 110 | 3,760 |
| | 4. Pooranpur-1 | 196 | 13,508 | 137 | 6,858 | 66 | 4,253 | 66 | 4,253 | 50 | 1,833 | 93.32 | - | 5.79 | - | 71 | 2,605 | 71 | 2,605 |
| | 5. Pooranpur-2 | 214 | 15,425 | 139 | 6,841 | 76 | 3,936 | 76 | 3,936 | 53 | 2,060 | 93.90 | - | 9.39 | - | 63 | 2,905 | 63 | 2,905 |
| | 6. Pooranpur-3 | 294 | 14,988 | 159 | 6,311 | 61 | 2,722 | 61 | 2,722 | 42 | 1,583 | 85.17 | - | 4.35 | - | 98 | 3,590 | 98 | 3,345 |
| | Total | 1,907 | 92,550 | 1,586 | 61,691 | 540 | 19,868 | 427 | 19,154 | 369 | 13,719 | 888.12 | 0.00 | 63.85 | 0 | 491 | 21,861 | 491 | 18,777 |
| 6 SHAHJAHANPUR-I | 1. Kanth | 350 | 20,813 | 152 | 8,548 | 65 | 3,950 | 65 | 2,668 | 64 | 2,230 | 153.69 | - | 2.61 | - | 92 | 4,719 | 92 | 3,310 |
| | 2. Katara | 347 | 18,146 | 257 | 14,029 | 88 | 4,214 | 88 | 2,929 | 88 | 2,683 | 191.66 | - | 4.25 | - | 106 | 4,460 | 106 | 3,881 |
| | 3. Tilhar | 259 | 10,351 | 237 | 8,764 | 116 | 3,849 | 116 | 2,853 | 110 | 2,230 | 160.56 | 0.02 | 2.63 | 11 | 108 | 4,069 | 108 | 3,174 |
| | 4. Jaitipur | 419 | 17,541 | 227 | 8,639 | 102 | 3,906 | 95 | 2,655 | 95 | 1,800 | 125.00 | - | 2.50 | - | 132 | 4,073 | 132 | 3,548 |
| | 5. Jalalabad | 358 | 18,170 | 224 | 10,925 | 69 | 3,861 | 69 | 2,935 | 66 | 2,010 | 135.25 | - | 0.39 | - | 120 | 5,008 | 120 | 3,996 |
| | 6. Bharkhani | 455 | 24,339 | 249 | 15,153 | 50 | 3,500 | 50 | 1,502 | 50 | 1,502 | 90.74 | - | 4.79 | - | 52 | 3,284 | 52 | 2,999 |
| | 7. Todarpur | 400 | 26,170 | 116 | 9,432 | 59 | 4,517 | 59 | 4,294 | 58 | 3,074 | 245.01 | - | 45.17 | - | 57 | 4,915 | 57 | 4,700 |
| | Total | 2,588 | 135,530 | 1,462 | 75,489 | 549 | 27,796 | 542 | 19,836 | 531 | 15,529 | 1,101.91 | 0.02 | 62.33 | 11 | 667 | 30,528 | 667 | 25,608 |
| 7 SHAHJAHANPUR-II | 1. Shahjahanpur-1 | 338 | 14,988 | 136 | 6,287 | 93 | 4,261 | 93 | 4,261 | 65 | 1,790 | 133.11 | - | 6.68 | - | - | 6,193 | - | 2,695 |
| | 2. Shahjahanpur-2 | 264 | 16,923 | 254 | 16,232 | 58 | 3,936 | 58 | 2,822 | 26 | 1,603 | 135.50 | - | 2.25 | - | - | 6,103 | - | 1,917 |
| | 3. Puwayan | 182 | 13,791 | 179 | 12,023 | 59 | 4,642 | 59 | 3,052 | 49 | 2,540 | 121.71 | - | 9.38 | - | - | 3,106 | - | 2,810 |
| | 4. Bhawalkhera | 639 | 36,382 | 258 | 14,550 | 121 | 6,288 | 121 | 4,130 | 121 | 2,286 | 154.40 | - | 6.00 | - | - | 5,120 | - | 3,470 |
| | 5. Bilsanda | 512 | 26,998 | 501 | 26,121 | 83 | 4,886 | 83 | 4,886 | 65 | 2,116 | 135.44 | - | 8.93 | - | - | 5,035 | - | 3,240 |
| | 6. Nigohi | 403 | 18,611 | | | 56 | 1,824 | 0 | 0 | 0 | 0 | - | - | - | - | - | 5,398 | - | 3,563 |
| | Total | 2,338 | 127,692 | 1,328 | 75,213 | 470 | 25,836 | 414 | 19,151 | 326 | 10,335 | 660.16 | 0.00 | 33.23 | 0 | 0 | 30,955 | 0 | 17,695 |
| TOTAL (II) | | 13,065 | 642,453 | 8,995 | 404,918 | 3,290 | 138,507 | 3,109 | 115,310 | 2,736 | 85,144 | 5,613 | 11 | 362 | 257 | 1,158 | 164,997 | 1,158 | 125,360 |
| III. OFD TO BE COMMENCED | | | | | | | | | | | | | | | | | | | |
| 1 SITAPUR | 1. Sitapur | 742 | 41,587 | - | - | - | - | - | - | - | - | - | - | - | - | | 2,789 | | 2,536 |
| | 2. Misrikh | 600 | 25,775 | - | - | - | - | - | - | - | - | - | - | - | - | | 4,000 | | 3,535 |
| | 3. Bisawa | 547 | 25,417 | - | - | - | - | - | - | - | - | - | - | - | - | | 4,560 | | 4,560 |
| | 4. Sidhauli | 366 | 24,136 | - | - | - | - | - | - | - | - | - | - | - | - | | 3,538 | | 3,138 |
| | 5. Kamalapur | 433 | 22,056 | - | - | - | - | - | - | - | - | - | - | - | - | | 3,043 | | 2,837 |
| | 6. Bakshi Ka Talab | 215 | 34,637 | - | - | - | - | - | - | - | - | - | - | - | - | | 4,119 | | 2,808 |
| | Total | 2,903 | 173,608 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0 | 0 | 22,047 | 0 | 19,413 |
| 2 HARDOI | 1. Pihani | 559 | 34,862 | - | - | - | - | - | - | - | - | - | - | - | - | | 4,925 | | 3,081 |
| | 2. Bavan | 336 | 25,350 | - | - | - | - | - | - | - | - | - | - | - | - | | 2,997 | | 2,251 |
| | 3. Bilgram | 507 | 33,954 | - | - | - | - | - | - | - | - | - | - | - | - | | 3,349 | | 3,155 |
| | 4. Kachchna | 484 | 32,758 | - | - | - | - | - | - | - | - | - | - | - | - | | 2,464 | | 2,002 |
| | 5. Behadar | 600 | 37,623 | - | - | - | - | - | - | - | - | - | - | - | - | | 3,660 | | 2,338 |
| | 6. Sandeela | 535 | 23,323 | - | - | - | - | - | - | - | - | - | - | - | - | | 1,973 | | 1,493 |
| | 7. Bharavan | 516 | 30,460 | - | - | - | - | - | - | - | - | - | - | - | - | | 2,465 | | 1,815 |
| | 8. Unnao | 608 | 34,424 | - | - | - | - | - | - | - | - | - | - | - | - | | 1,180 | | 993 |
| | Total | 4,145 | 250,754 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0 | 0 | 23,012 | 0 | 17,128 |
| TOTAL (III) | | 7,048 | 424,362 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45,060 | 0 | 36,541 |
| GRAND TOTAL(I+II+III) | | 22,607 | 1,192,063 | 10,591 | 480,758 | 3,290 | 138,507 | 3,109 | 115,310 | 2,736 | 102,750 | 6,778 | 12 | 420 | 339 | 1,158 | 210,057 | 1,158 | 161,901 |

# *FIGURES*




| Name of Division | Name of Unit |
|---|---|
| I.OFD COMPLETED UNITS | |
| 1 BAREILLY-I | 1 Bareilly-2 |
| 2 KHERI-I | 1 Kheri-3 |
| | 2 Kumbhi |
| | 3 Bachhraon Gaon-1 |
| | 4 Bachhraon Gaon-2 |
| | 5 Bachhraon Gaon-3 |
| | 6 Phool Babar-1 |
| | 7 Phool Babar-2 |
| | 8 Pajna |
| 3 SHAHJAHANPUR-I | 1 Shahabad |
| II.OFD ONGOING UNITS | |
| 1 BAREILLY-I | 1 Bareilly |
| | 3 Bareilly III |
| | 4 Richhola |
| | 5 Baheri |
| | 6 Jahanabad |
| | 7 Pilibhit-1 |
| 2 BAREILLY-II | 1 Bhadpura |
| | 2 Bhuta |
| | 3 Faridpur |
| | 4 Fatehganj |
| | 5 Nawabganj |
| | 6 Rudrapur |
| 3 KHERI-II | 1 Oel |
| | 2 Kheri-1 |
| | 3 Kheri-2 |
| | 4 Kheri-4 |
| | 5 Pajna-2 |
| | 6 Gola |
| 4 KHERI-III | 1 Behjam |
| | 2 Behjam-2 |
| | 3 Mitauli |
| | 4 Nighasan |
| | 5 Khairigarh |

| Name of Division | Name of Units |
|---|---|
| II OFD ONGOING UNITS | |
| 5 PILIBHIT | 1 Pilibhit-2 |
| | 2 Barkhera |
| | 3 Khatauna |
| | 4 Puranpur-1 |
| | 5 Puranpur-2 |
| | 6 Puranpur-3 |
| 6 SHAHJAHANPUR-I | 1 Katra |
| | 2 Kanya |
| | 3 Tilhar |
| | 4 Jasipur |
| | 5 Jalalabad |
| | 6 Barkhaul |
| | 7 Tehrpur |
| 7 SHAHJAHANPUR-II | 1 Shahjahanpur-1 |
| | 2 Shahjahanpur-2 |
| | 3 Powayan |
| | 4 Bhawalkhera |
| | 5 Biloanda |
| | 6 Nigohi |
| III OOF TO BE COMMENCED | |
| 1 SITAPUR | 1 Sarpur |
| | 2 Machhi |
| | 3 Biswan |
| | 4 Sidhauli |
| | 5 Kamalapur |
| | 6 Jahan Ka Talab |
| 2 HARDOI | 1 Pihani |
| | 2 Sawan |
| | 3 Bilgram |
| | 4 Kachchona |
| | 5 Bahadur |
| | 6 Sandeela |
| | 7 Bhawan |
| | 8 Umrao |

Fig. H.1 Progress of Sharda Canal CAD Project

| INDIA |
|---|
| FEASIBILITY STUDY ON<br>IRRIGATION AND DRAINAGE DEVELOPMENT OF<br>SHARDA CANAL CAD PROJECT |
| JAPAN INTERNATIONAL COOPERATION AGENCY |

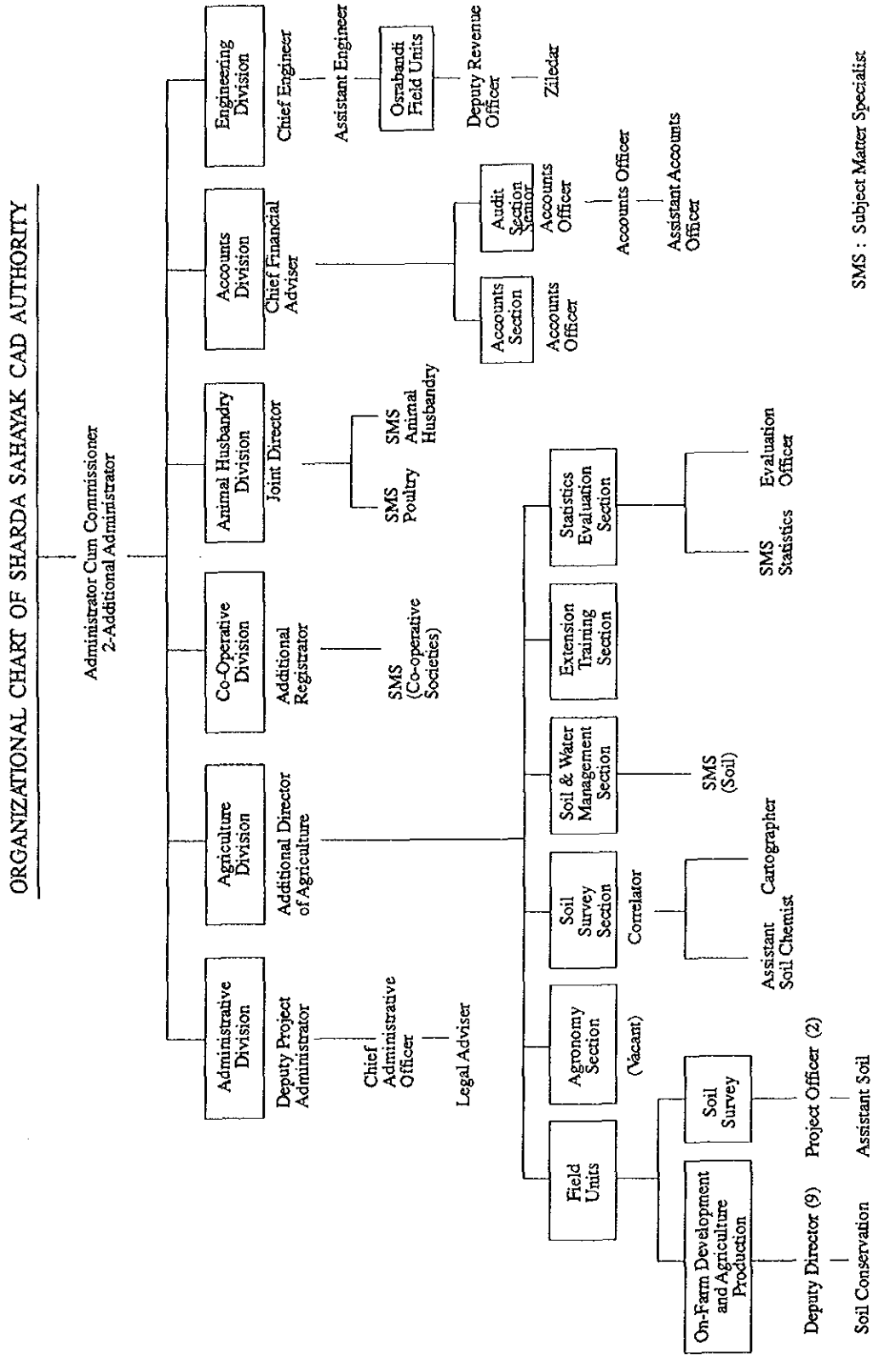



Fig. H.2 Organization Chart of Sharda Sahayak CAD Authority

INDIA

FEASIBILITY STUDY ON
IRRIGATION AND DRAINAGE DEVELOPMENT OF
SHARDA CANAL CAD PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

# *ANNEX-I*

# *SELECTION OF REPRESENTATIVE AREA*

FEASIBILITY STUDY ON
IRRIGATION AND DRAINAGE DEVELOPMENT OF
SHARDA CANAL CAD PROJECT

ANNEX -I
SELECTION OF REPRESENTATIVE AREAS

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES

# ANNEX-I SELECTION OF REPRESENTATIVE AREAS

## 1. Categorization of the Study Area

The Study area is categorized from the natural and socio-economic conditions. The work flow chart is as shown in Fig. I.1.

### 1.1 Categorization from Natural Conditions

The following parameters are used in categorization of the Study area from the view point of natural conditions:

(i) Irrigation Condition
(ii) Poor Drainage Condition
(iii) Salt Affected Condition

(1) Irrigation condition

(a) Irrigation rate

To grasp the irrigation dependability of the Sharda canal system, irrigation ratios of annual irrigation area to the proposed one are worked out for every block. The irrigation ratios fluctuate widely, depending on the location and canal systems. The command areas at the tail ends of Unnao branch, Purwa branch and Hardoi branch are restricted in irrigation water supply, while the areas around the bifurcation sites of Hardoi and Lucknow branches receive much irrigation water. Even water distribution is not practiced along the Hardoi branch.

(b) Canal Conditions

Irrigation water is supplied to the fields through farm outlets (kulaba) provided on branches, distributaries and minors. Some of the canals have reduced capability due to inefficient operation and maintenance of facilities. A modern water management system including O&M facilities is considered necessary to improve the irrigation efficiency.

(c) Irrigation Rate by Government Canals

Irrigation in the Study area is effected by both government owned canal systems such as the Sharda canal and farmers owned facilities. Irrigation areas served by government owned facilities are very different from those served by farmers owned facilities, and vary from 5% to 85% of the total irrigation area. In making the irrigation plan, the areas which are less served by the government system will be given the higher priority.

(d) Dependency of Ground Water in Irrigation

Ground water is an important source of irrigation water in the Study area. There are about 40 thousand tubewells for irrigation purposes, of which 97% are privately owned small size tubewells. The density of tubewells differs widely according to location depending on the availability of canal water. It is considered that areas with a high density of tubewells definitely require irrigation water .

The result of categorization of the irrigation condition is as shown in Table I.1.

(2) Poor drainage conditions

Categorization of the Study area with respect to poor drainage conditions was carried out on the basis of the following parameters:

(a) Drainability

The Sharda canal command extends over a vast alluvial plain lying between the Ganga and Sharda rivers. The major Sharda canals run almost from northwest to southeast parallel with those rivers.

Natural drains follow these topographic features. The area located inland (mid land) is inherently less capable of draining itself by reason of being remote from the main drainage streams and being surrounded by high land, etc. To evaluate the drainability of the area, the ratio of mid land to the geographical area is employed.

(b) Poor Drainage Area Ratio

A large amount of water logging and marshy land is located in the mid land. The high rate of water logging and marshy land to the mid land means that drainage improvement will be urgently required.

(c) Drainage Canal Density

Where drainage is strongly required, drainage canals have been provided in the Study area. Such drainage canals have reduced functions, resulting in poor drainage conditions. It is considered that poor drainage conditions in the areas with a high density of drainage canals will be improved by means of establishing of efficient drainage networks.

The result of categorization of poor drainage conditions is as shown in Table I.2.

(3) Salinity/Alkalinity Affected Condition

The Study area was categorized in terms of salinity/alkalinity affected conditions by the following parameters:

(a) Alkalinity

Degradation of the land due to alkalinity/salinity gets larger with irrigation practice. Alkalinity and salinity affected soils in UP State are estimated to be 85% and 15%, respectively. A major part of the soils in the Study area, however, belongs to alkalinity affected soils. According to the criteria of the Government of India for classification of alkaline soils, those with pH 8.5 to 9.0 are grouped as "alkaline", and those with more than 9.0 are classified as "strongly alkaline". Alkalinity/salinity affected conditions of the areas was evaluated by use of the ratios of alkalinity and strong alkalinity areas to the geographical area.

(b) Soil texture

Soil texture is an important factor in evaluating soil productivity in terms of the physical characteristics of soils. In general, coarse textured soils are highly