



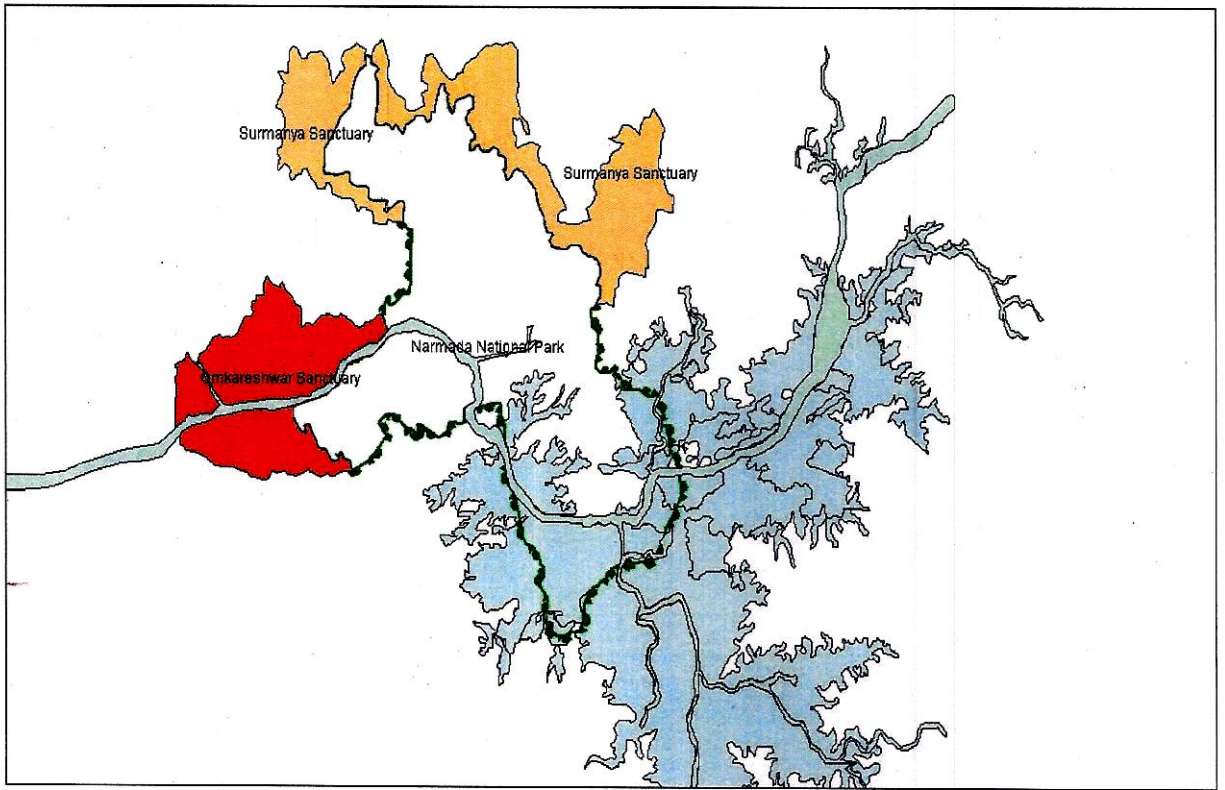
स्थिति विवरण  
Status Report

पर्यावरण प्रबन्धन

**Environment Management**

इंदिरा सागर परियोजना

Indira Sagar Project



दिसम्बर, 2004

December, 2004

**नर्मदा नियंत्रण प्राधिकरण**

**NARMADA CONTROL AUTHORITY**

इन्दौर

Indore

फरवरी, 2005

February, 2005

**Environment Management:  
Indira Sagar Project  
December, 2004**

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# Chapter - 1

## ENVIRONMENT MANAGEMENT

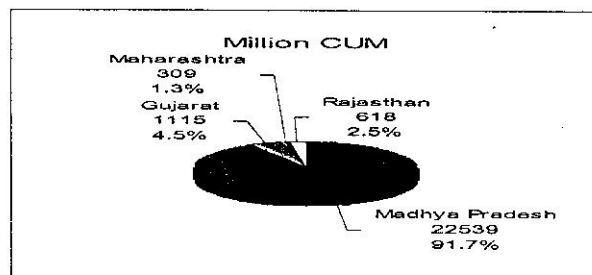
Narmada is the fifth largest river of India. It originates from Amarkantak in district Shahdol of Madhya Pradesh at an altitude of 1065 meters and runs through a deep valley between Vindhya and Satpuda ranges for a distance of 1312 Km and joins the Arabian Sea. It runs about 1,100 km in the State of Madhya Pradesh through the districts of Shahdol, Mandla, Jabalpur, Khandwa, Khargone, Dhar and Jhabua and about 170 Km through the State of Maharashtra and 82 Km in the State of Gujarat.

Investigations into harnessing the waters of the Narmada Valley commenced around the time of Independence. There were differences amongst riparian States with regard to sharing of Narmada Water. Therefore, on the application of Government of Gujarat, in order to settle the dispute relating to sharing of Narmada water among the concerned States of Gujarat, Madhya Pradesh and Maharashtra, the Govt. of India constituted the Narmada Water Dispute Tribunal in October 1969 under Section-4 of the Inter State Water Disputes Act, 1956. The Tribunal investigated the matters referred to it and forwarded to the Central Government a report in August 1978. Award of the Tribunal was gazetted by the Central Govt. on 12<sup>th</sup> December 1979.

### NARMADA WATER DISPUTES TRIBUNAL AWARD

The total water availability of the river at 75% dependability was estimated by the Tribunal as 34580 mm<sup>3</sup> (28 MAF) and the Tribunal awarded the share of Narmada waters to the different States as follows:

Madhya Pradesh	18.25 MAF (22539 mm <sup>3</sup> )
Gujarat	9.00 MAF (11115 mm <sup>3</sup> )
Maharashtra	0.25 MAF (309 mm <sup>3</sup> )
Rajasthan	0.50 MAF (618 mm <sup>3</sup> )

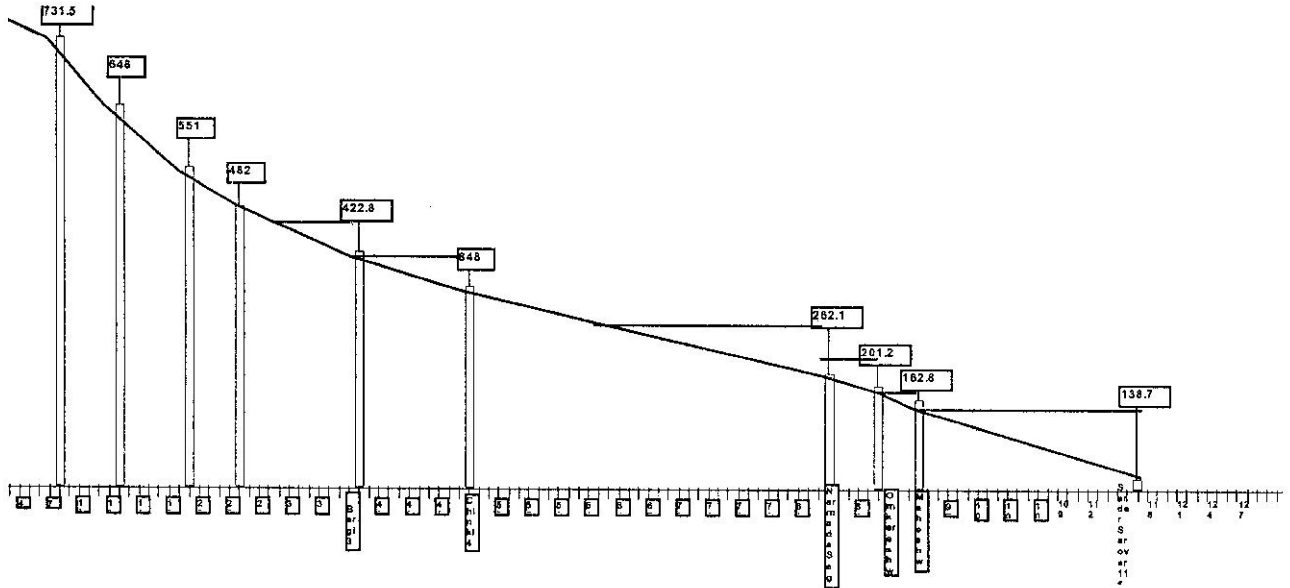


The Award inter-alia stipulated the FRL of the Sardar Sarovar Project in Gujarat and Indira Sagar Project in M.P. The regulated releases to be made by Narmada Sagar for utilisation at Sardar Sarovar, sharing of cost by Sardar Sarovar in Narmada Sagar and has also stipulated that the construction of Narmada Sagar be taken up by M.P. concurrently with or earlier than the construction of Sardar Sarovar dam.

### NARMADA BASIN PLAN

After the Tribunal fixed the share of Narmada Water the Master Plan of Narmada Water was prepared for the development of irrigation, industries land domestics requirements. It has been proposed to construct 30 major projects of which 11 would be on

the main river and 19 on the tributaries, 135 medium and 3,000 minor projects. All these proposed schemes are in Madhya Pradesh except the Sardar Sarovar Project (SSP). SSP a terminal project on the main stem of the river, is under construction in the State of Gujarat.



## PROPOSED DEVELOPMENT IN MADHYA PRADESH

Out of the major projects in Madhya Pradesh, Tawa, Barna and Sukta projects have been completed: and Mateyari, Bargi and Kolar projects are nearing completion. The balance projects, which are in the initial phase of construction, are proposed to be completed in two phases. In the first phase, Indira Sagar, Omkareshwar, Maheshwar, Bargi Diversion, Man and Jobat Projects are proposed to be completed. The rest of the 17 major projects are proposed to be constructed in the second phase.

## NARMADA CONTROL AUTHORITY

The Award also stipulated the setting up of an inter-state administrative authority called Narmada Control Authority (NCA) for the purpose of securing compliance with the implementation of the decision and directions of the Tribunal. The Award envisaged a coordination and direction role for the Authority. Narmada Control Authority was charged with the power and under key duty to do, any or all, things necessary, sufficient and expedient for the implementation of the Award. The Narmada Water scheme was notified by the Central Govt. in September 1980 setting up the NCA with the duties and functions envisaged by the NWDTA.

Ministry of Water Resources the then Ministry of Irrigation & Power had developed detailed guidelines framed during October, 1980 for project formulations which included a detailed check-list by the Ministry of Environment & Forests, the then department of Environment of the department of Science & Technology of the Govt. of India, for assessment of environmental impact of the projects and planning for Environmental Safeguard Measures. In accordance with the requirement of the Department of

Environment, project authorities submitted the detailed project report (DPR) along with the needed information on environmental issues during February to October 1980. Environmental Appraisal Committee of the Ministry of Environment & Forests approved the project in principle during its 12<sup>th</sup> meeting held in 1983 and sought more information & data on certain parameters of Environmental impact & management . After a checkered history due to absence a comprehensive EIA report and consequently absence of the needed detailed action plans for implementation of Environmental Safeguard Measures, the project was referred to the Hon'ble Prime Minister of India by the Ministry of Environment & Forests during 1986. After due consideration and upon agreement by the party states for empowering the Narmada Control Authority for monitoring of the Survey / studies and implementation of the Environment Safeguard Measures, the project was approved by the Prime Minister of India during April 1987,with riders

In pursuance the Central Govt. on 4<sup>th</sup> June 1987 modified through statutory instrument, the powers, functions and duties of the Narmada Control Authority. Accordingly amongst others Union Secretaries of Ministry of Environment & Forests, Social Justice & Empowerment were included as key members. Besides the role of the Authority was modified to include overall coordination and direction of the implementation of all the projects, including the engineering works, the environmental protection measures and the rehabilitation programme besides ensuring the faithful compliance of the terms and conditions stipulated by the Central Government at the time of clearance of the aforesaid projects. The Authority was given the mandate to constitute one or more sub-Committees and to assign them such of its function and delegate such of its powers as deemed fit.

Ministry of Environment & Forests issued order of clearance; thereafter on 24<sup>th</sup> June 1987 for both the projects viz. Sardar Sarovar & Indira Sagar Project.

To ensure proper planning and implementation of the plan with regard to Environmental safeguards the Authority under clause 9(2) of the Scheme notified under Inter State water Dispute act of 1956, constituted among others a sub-groups on Environment , under the Chairmanship of Secretary, Govt. of India, Ministry of Environment & Forests (MOE&F).

### **ENVIRONMENT SUB-GROUP**

Environment Sub-Group, a body constituted under provisio to Statute, is headed by Secretary MOEF and has as members one representative each from the four participating States. Representative of ICAR, MOWR, technical experts in the field of forestry, wild life , hydrology, flora, health, archaeology, anthropology, agriculture, and environment. The terms of reference to the sub-group are as follows:

- To work out the environmental safeguard measures to be planned and implemented for the **entire Narmada Basin** so that the environmental safeguard measures are executed and remain fully in consonance with the clearance accorded to the **Narmada Sagar and Sardar Sarovar Projects**
- To determine the terms of reference of required surveys necessary for the implementation of environmental safeguard measures inclusive of data-base required, the method by which the data base is to be prepared and also to identify the institutions/individuals to undertake the preparation of such documents.

- To get prepared for clearance by Ministries and NCA the action plans with regard to all environmental safeguard measures and the assessment criteria thereof.
- **To devise a suitable monitoring and evaluation mechanism** so that the action plans are effectively implemented in consonance with stipulations at the time of clearance of the projects.

The Secretary, Ministry of Environment & Forests has expressed the opinion that R&R aspects of Indira Sagar Project should be monitored by the R&R sub-group of NCA.

## NCA REVIEW COMMITTEE

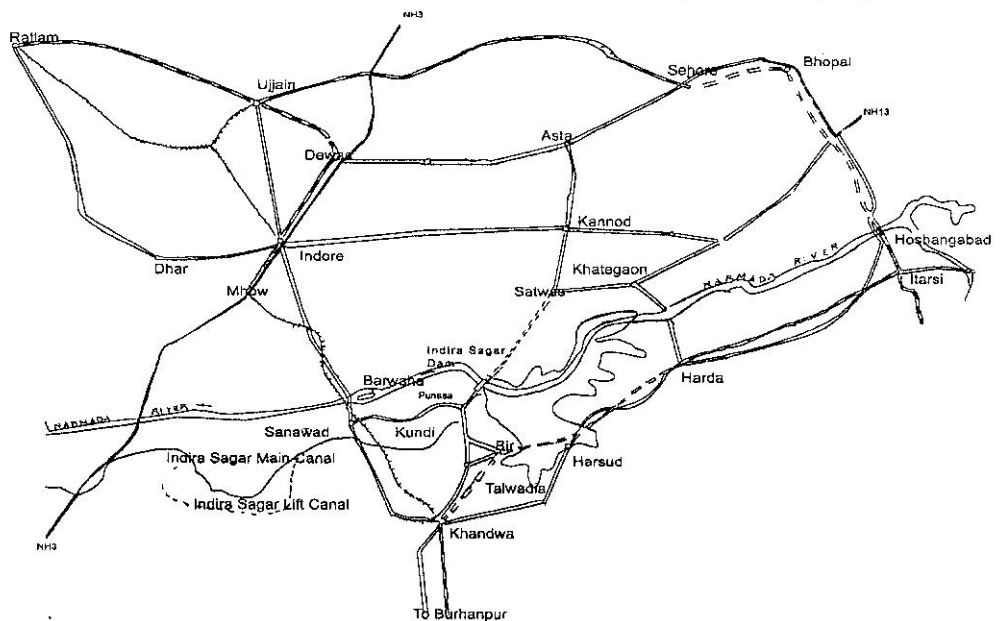
The Government vide notification No. S.O. 856 (E) dated 22.11.82 has constituted Review Committee of Narmada Control Authority (RCNCA) chaired by Union Minister, Water Resources and the Chief Ministers of four States as Members. The Secretary to the Govt. of India, Ministry of Water Resources has been the convener of the Review Committee. Later, Union Minister of Environment & Forests was included as Member of the Review Committee vide notification No. 554(E) dated 3.6.87 giving him an opportunity to take up the issues related in Environmental Safeguard.

Review Committee Suo moto or on the application of any party State or Secretary to the Government of India, Ministry of Environment and Forests/ review any decision of the authority. In urgent cases the Chairman of the Review Committee may on the application of the Government of any part State,/ or Secretary to the Government of India, Ministry of Environment and Forests **grant stay of any order of the Authority** pending final decision on review.

## NARMADA SAGAR COMPLEX & INDIRA SAGAR PROJECT

Indira Sagar Project is the key project on Narmada River providing excellent storage site. The dam is proposed on the main river near village Punasa in Khandwa district of Madhya Pradesh. Omkareshwar, Maheshwar and Sardar Sarovar projects are proposed in the downstream to utilise the regulated releases of Indira Sagar Project for irrigation and power generation. The cascade of Indira Sagar, Omkareshwar and Maheshwar projects together, are known as "Narmada Sagar Complex".

Indira Sagar is a multipurpose project with the largest storage capacity in the country. It has an



LOCATION MAP OF INDIRA SAGAR PROJECT

installed capacity of 1000 Mega Watt and an annual irrigation of 1.69 lakh ha. The project provides regulated releases of 8.12 Million Acre Feet to Sardar Sarovar Project (SSP), a terminal project on mainstream of the river in the State of Gujarat. The water on its way to the SSP would generate power at two intermediate projects in Madhya Pradesh.

Mrs. Indira Gandhi, the then Prime Minister of India laid the foundation stone of Indira Sagar Project located about 467 Km from the sea, roughly 320-Km upstream from the Sardar Sarovar dam site, on 24<sup>th</sup> October 1984. Later, the Project was renamed as Indira Sagar Project (ISP). The ISP Dam on completion would create a lake that will inundate about 91,300 ha of valley lands. The area to be inundated constitute lands from five tehsils of three districts in Madhya Pradesh namely Khandwa and Harsud in Khandwa District, Kannod and Khategaon in Dewas Dist. and Harda in Hoshangabad District. Of the total area of 91,300 ha to be submerged about 67,000 ha. is in Harsud Tehsil, 11,500 ha is in Khandwa Tehsil and 12,800 ha area is divided among the other three tehsils.

Indira Sagar Project is a key project providing water storage which enables the downstream projects in the cascade, i.e., Omkareshwar, Maheshwar and Sardar Sarovar to cater the needs of irrigation and power generation as given in the following table:

Sl.No.	Name of Project	Gross Submergence (Lakh Ha.)	Proposed annual irrigation (Lakh Ha.)	Power Generation (MW)
1.	Indira Sagar	0.91348	1.69	1,000
2.	Omkareshwar	0.09393	2.83	520
3.	Maheshwar	0.04866	-	320
4.	Sardar Sarovar	0.34867	17.92	1,450
<b>Total</b>		<b>1.40474</b>	<b>22.44</b>	<b>3,290</b>

## THE SOURCE OF IMPACT

- i) Construction of a concrete gravity dam, 653 m long with a slightly curved alignment and 92 m high above the deepest foundation level.
- ii) The gross storage capacity of the reservoir is 12.22 Bm<sup>3</sup> (9.9 Maf) and live storage of 9.75 Bm<sup>3</sup> (7.9Maf).
- iii) There shall also be a saddle dam on the right flank of the dam, which will form a portion of the road between Narmada Nagar and Bhopal.
- ii) Construction of a subsurface powerhouse on the right flank of dam with eight Francis turbine units of 125 MW each.
- iii) Construction of 400 KV switchyard on right bank of river Narmada.
- iv) River diversion arrangement comprising of upstream and downstream coffer dam and 390 m long diversion tunnel on the left bank.
- v) Construction of a tunnel 3.677 km long popularly known as "Punasa facilities" with appurtenant structures taking off from the reservoir, designed to carry a



discharge of 185 cumec inclusive of 25 cumec for Punasa lift irrigation scheme. This is followed by a 248.65 km long gravity flow left bank canal with a head discharge of 160 cumec to irrigate 1.23 lacks ha of CCA ,comprising 19000 ha in Khandwa District, 68000 ha in Khargone District and 36000 ha. in Barwani District, with an irrigation intensity of 138%.

- vi) The Punasa lift irrigation scheme is planned to irrigate additional 25600 ha. of CCA in high reaches of Khandwa District. A canal head powerhouse with three units of 4 MW each has also been planned.

## **INDIRA SAGAR DAM**

The dam is proposed to be 92 m (302 Ft.) high and 653 m (2142 Ft.) in length with a slightly curved alignment of 880 m radius across river Narmada near village Punasa, about 845 km from the origin in District Khandwa with a gross storage of 12,220 Mm<sup>3</sup> (9.9 MAF) and a live storage of 9,750 Mm<sup>3</sup> (7.9 MAF) corresponding to FRL of 262.13 m (860 Ft.). It comprises of 27 blocks, of which 4 to 16 form the main spillway and 17 to 24, the auxiliary spillway. Blocks 1 to 3 and 25 to 27 form the non-overflow section of the dam. The hillock on the right of the dam is also proposed to be raised to the TBL of 267.00 m. For this, Block No.28 to 35 are proposed. There will also be a small saddle dam on the right side of the reservoir.

### **Plan of Implementation**

The Project was proposed to be completed in different stages as follows :

#### **i.) Dam and Power House**

##### **Stage-I**

- Completion of concrete dam and saddle dam upto an elevation of 213 m (700 Ft.).
- Diversion of Railway track between Talvadia and Khirkiya railway stations.
- Rehabilitation of oustees in Harsud town.

##### **Stage-II**

- Completion of concrete dam upto crest level without radial gates, power house and installation of one unit of 125 MW and commissioning of 1st unit by September, 1997.

##### **Stage-III**

- Installation of radial gates and appurtenant works including remaining 7 units of 125 MW each.

## **REGULATED RELEASE TO SSP**

In accordance with Clause-IX of Narmada Water Dispute Tribunal (NWDT) "Final Orders and Decisions", regulated flows corresponding to 10.01 B Cum (8.12 MAF) shall be released from Indira Sagar Project to Sardar Sarovar Project (SSP, ex-Maheshwar).

ii.) **Canals**

The canal system was proposed for completion in three phases as below :

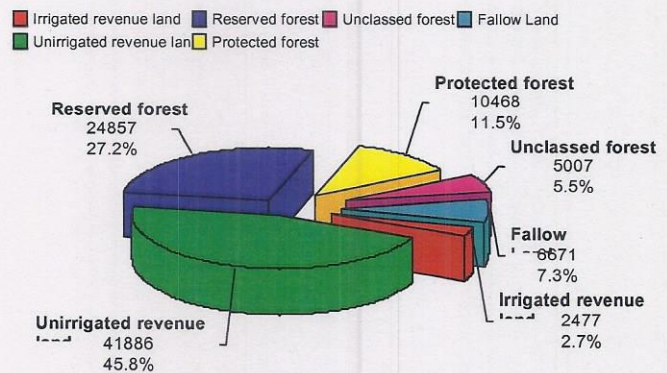
Sl.No.	Phase	Description of canal reach	Proposed Irrigation (ha) (CCA)
1.	I	Main canal from Km 0 to Km 81.59	36,100
2.	II	Main canal to Km 206.28	82,900
3.	III	Main Canal to km 248.65, including canal from Khargone Lift Scheme	1,23,000

Note:-\* As per Revised Implementation Schedule of the Project-1992.

SUBMERGENCE OF LAND

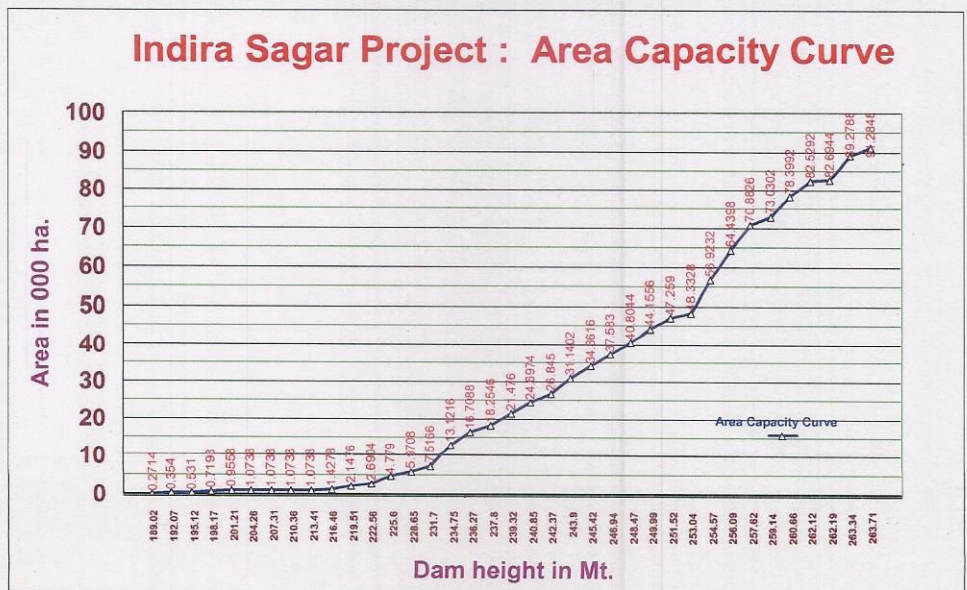
The break-up of 91000 ha areas proposed to be submerged by the ISP is as under

- Irrigated revenue land : 2477ha.
- Unirrigated revenue land : 41866ha.
- Reserved forest : 24857ha.
- Protected forest : 10468ha.
- Unclassed forest : 5007ha.
- Fallow land : 6671ha.



**Progress on Construction Works :**

After getting necessary clearances the construction works were started in May, 1992 and the dam was targeted to be completed by June, 2000. However, due to various reasons the progress lagged behind. Subsequently, the work was handed over to Narmada Hydroelectric Development Corp. (NHDC), a Joint Venture of Govt., of Madhya Pradesh and National Hydroelectric Power Corporation. The targeted date of completion has been



revised to May 2005. As per the available information 99.86% of the estimated concreting was completed bringing the reservoir nearly to full level by the end of Dec. 2004. Accordingly the ISP would submerge an area of 91,000 ha. by the next monsoon and consequently would impact the land, Flora and fauna etc in full. The water was filled upto a level 243.18m as on 30<sup>th</sup> Nov. 2004.

## **KEY ENVIRONMENTAL CONCERN IN INDIRA SAGAR PROJECT**

Ecological transformations following impoundment result in succession of fluvial biocoenoses by lentic environment, the hydrography undergoes a shift by way of, fluctuations in water level, changes in physico-chemical regime and inundation, impacting areas upstream, downstream and in the irrigated command. Inundation results in involuntary resettlement of the people living in the submergence area, submergence of agricultural, forests and other resources like minerals, spawning grounds of fishes, resting/nesting places, buildings, roads etc. Fluctuation in water level brings in the issues of diseases, sedimentation, aesthetics of the area etc. Physico-chemical changes relates to quality of water, formation of hydro-sulphuric sludge, morphology of the river/estuary, salinity ingress etc. The key issues being monitored included the following:

- ◆ Losses of natural forests & Afforestation programme.
- ◆ Loss of wildlife : Flora Fauna & Carrying capacity.
- ◆ Erosion and sedimentation : Catchment Area Treatment
- ◆ Public Health issues, especially the water-borne diseases
- ◆ Seismicity and reservoir-induced seismicity.
- ◆ Cultural resources/Heritage : Loss of religious and historic sites.
- ◆ Command Area and Waterlogging .

## **LOSS OF FOREST & WILDLIFE RESOURCES/EROSION AND SEDIMENTATION**

The loss of forest and wildlife resources and the question of erosion and sedimentation are linked to a greater extent as both of these have synergistic impact and are fuelled by a common causative factor, excessive pressures from human and bovine.

The total forest area getting submerged by the impoundment of Indira Sagar dam has been estimated is 41,589ha. Out of this 72% are reserved forests and the rest is protected forests. The total forest in Khandwa division constitutes about 28% of its geographical area. After losses to submergence, the forest area will be reduced to 26%. In Dewas and Hoshangabad divisions, forest areas of 35.7% and 34.1% will be reduced by 0.6 and 0.01% respectively in terms of geographical areas. The project impact area for purposes of environmental considerations must include not only the area of actual submergence but also the surrounding lands that will be looked upon to absorb displaced people, livestock, and wildlife. Plans for afforestation and treatment/rehabilitation of large areas in the catchment are under implementation.

The process of soil erosion and sedimentation of the Narmada River could shorten the useful life of the project reservoirs as they gets filled with sediments. However the process of erosion and sedimentation of the Narmada River and it's tributaries has been going on for a long time. The rate of erosion stand increased each time the land was disturbed/overexploited. In order to achieve an expected project life of at least 100 years for

the Indira Sagar Project, notwithstanding that planners have incorporated into project designs sufficient provisions for the same, plans for afforestation and treatment/rehabilitation of large areas within the Narmada catchment are under implementation

## **PUBLIC HEALTH**

Large water-development projects have often been accompanied by increases in water-related diseases. The Narmada projects involve large reservoirs and canal distribution systems. Their potential to create public health hazards has been recognised and provisions have been included in project planning to budget funds to provide adequate medical facilities, staffing and services. Studies have shown that the project areas are now free of Schistosomiasis. Plans are set to monitor on a continuing basis and to take whatever actions are necessary to keep the project areas free from the schistosomiasis and other diseases.

## **SEISMICITY & RESERVOIR INDUCED SEISMICITY**

Seismicity and the potential for reservoir induced seismicity (RIS) have been studied by the Geological Survey of India, Central Water and Power Research Station of Pune, University of Roorkee, State Govt. of M.P. and several consultants. Investigations have considered the Narmada Sagar Complex the dam sites at Indira Sagar, Omkareshwar and Maheshwar. The conclusions of the studies were that reservoirs might cause earthquakes to occur sooner but that the magnitude or intensity of ground motion associated with the earthquakes would not be affected. This implies that the dam design should be determined by the estimated possible severity of an earthquake that could occur. In case of the Indira Sagar dam, upon the recommendation of the experts, a conservative seismic design that provides an extra measure of safety is already accepted and implemented. A network of seismological stations has been proposed through Indian Meteorological Department covering the area of the projects of Narmada Sagar Complex.

## **CULTURAL RESOURCES/HERITAGE**

The Narmada Projects will have two impacts on cultural resources. The Narmada River is held to be sacred. In keeping with its holy status, the river is the site of a religious pilgrimage known as the Parikarma. Traditionally, the Parikarma is called as the circumambulation of the entire river by foot. There is possibility to discontinue this parikarma as the Parikarma path will be lost because of the change in configuration of the river. From the Sardar Sarovar Dam Site in Gujarat to the eastern extreme of Indira Sagar Reservoir in M.P, the riverine environment of Narmada River will be transformed largely into a lake environment. There are Plans for providing new pilgrimage routes to replace the earlier Parikarma Path so that Parikarma of the Narmada can be continued by traditions.

In addition, a number of religious and historic sites will be inundated by the reservoirs. Central Govt. and State Govt. departments have prepared plans for relocation and protection of the monuments impacted by the submergence. These plans are under implementation by the agencies otherwise responsible for maintaining and safeguarding the archaeological monuments under the provisions of the relevant acts.

## COMMAND AREA & WATERLOGGING

Waterlogging occurs when the groundwater table rises too close to the ground surface and the soils are unable to drain properly. Considering that several projects in India, including the Tawa project, located within the Narmada basin, less than 200 km, east of the Narmada Sagar reservoir site in Hoshangabad District have suffered from such conditions of waterlogging in the past, the issue of waterlogging in the Command Area of Narmada project needs attention.

This concern has been carefully tackled in planning stage to avoid the problems. The conjunctive use of surface and groundwater resources, the provision of drainage systems to prevent the accumulation of excessive water in the soils, water management planning and monitoring to control the proportions of surface water and groundwater used in irrigation and water levels in the groundwater aquifers are some of the measures planned for prevention of any such eventuality.

Permission for diversion of the forestland was also subsequently accorded for the project separately by the MOEF during December 1987. The Investment Clearance for the Indira Sagar Project was received from the Planning Commission during November, 1988 respectively, thus paving the way for implementation of the project.

The clearances issued subsequent to the expansion of the NCA by the Central Government departments, contained certain conditions to be complied with during the course of project implementation

The Narmada Control Authority was given the responsibilities to ensure that the environmental safeguard measures would be planned and implemented in depth and the pace of its implementation would be pari passu with the progress of the work on the Projects namely the Sardar Sarovar and Indira Sagar Projects. The four conditions of the clearance were:

- the Narmada Control Authority would ensure that the environmental safeguard measures are planned and implemented pari passu with the progress of the work on the project;
- the detailed surveys/studies would be done
- catchment area treatment and rehabilitation programs would be completed ahead of reservoir filling.
- The Department of Environment would be kept informed of progress.

The Action Plans and status of studies and implementation of Environmental Safeguard Measures upto quarter ending December, 2004 are summarised in this report. As 'Resettlement and Rehabilitation' is dealt with separately, current status of other suggested parameters is presented

## Chapter - 2

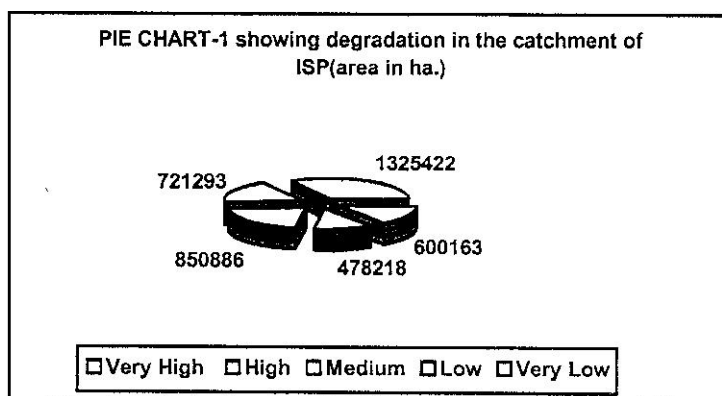
### CATCHMENT AREA TREATMENT

Consequent to the preliminary assessment, based on the reconnaissance report of Inter-Departmental Committee, on Soil Conservation and Afforestation, (the Dewan Committee Report), 1985, the MOEF clearance granted in 1987, contained two conditions pertaining to CAT, as follows:

- ❖ More detailed surveys for prioritisation of the sub-catchments in the ISP area should be undertaken;
- ❖ A phased CAT programme should be prepared and implemented ahead of reservoir filling.

#### Studies : Detailed surveys for prioritisation

The Narmada River drains a total catchment area of 9.879 million ha. upto it's mouth at the Arabian sea. Out of this, about 6.164 million ha forms the catchment area of Indira Sagar Project. The freely draining area of Indira Sagar Project down stream of Bargi Dam is about 3.925 million ha. The prioritisation at watershed level using LANDSAT TM data of 1:2,50,000 scale was completed much before 1986.



The master plan for treatment of the Indira Sagar catchment area was submitted by the state Govt. of M.P. during December 1986 about 7,920 km<sup>2</sup> was classified as critical catchment area to be treated. Establishment of priority in areas to be treated was followed by a detailed soil survey to determine what treatment measures would be most effective. This surveys was carried-out by the All India Soil and Land Use Survey Organisation of the Govt of India during 1989 to 1991.which was subsequently revised and updated during 1993.

Surveys and studies have been undertaken to aid the development of a management plan for CAT in the ISP catchment. They are: -

- Report on Prioritisation of Sub-watersheds in sub-catchments of the Narmada Catchment, 1991 by AIS&LUSO, New Delhi. Revised subsequently in 1994.

According to the above studies the freely draining area of Indira Sagar Project down stream of Bargi Dam is about 39,75,982 ha. Prioritisation survey of the watersheds was entrusted to the All India Soil & Land Use Survey Organisation, New Delhi. The Survey has been completed by AIS&LUSO, New Delhi and the survey reports have been received in the Narmada Valley Development Authority (NVDA) Government of Madhya

Pradesh. Findings of the AIS&LUSO indicated that about 28% of the catchment was yielding SYI of 1200 and above . As such these were considered as critically degraded.

AIS&LUSO in their final report have identified 508 no. of critically degraded sub-watersheds (having Silt Yield Index of 1200 and above). However considering that the area requiring treatment was large, enough to be loaded on to the cost of the project, Ministry of Water Resources referred the issues to the Govt. of India. After consideration it was directed by Govt. of India in its order of 8<sup>th</sup> July 1992 that

- ❖ The project would bear the costs of the treatment of all critically degraded sub-watersheds draining directly [Phase-I] into the reservoir. These watersheds were identified amongst those classified as either very high or high-priority categories by the All India Soil and Land Use Survey Organisation (AISLUSO). The project would also be responsible for the treatment of those areas of the catchment, which are directly damaged by the project activities.
- ❖ In addition, plans are required to be prepared for the treatment of the balance of the critically degraded sub-watersheds but the cost of this will be met from other ongoing schemes and in a timeframe to be determined.

**Phased Programme:**

As per the guidelines of MOWR, directly draining watersheds of very high and high priority categories only, are to be treated *pari-passu* with the construction of the dam and at the project cost. On the basis of their proximity to the reservoir these watersheds have been planned for treatment in two phases namely Phase-I and Phase-II

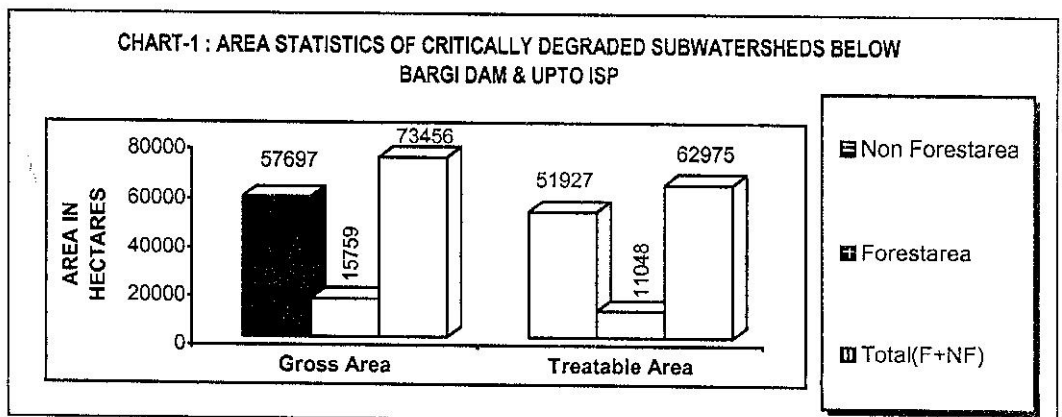
**Action Plan :**

1. Macro-watershed plan for the ISP was submitted during 1993. This plan was subsequently revised and updated. The updated plan of work is under implementation.

According to the plan submitted by the NVDA, 30 sub-watersheds covering an area of 73,456 ha have been identified as directly draining sub-watersheds. Out of the gross area of 73,456 ha, directly draining sub-watersheds, 57,697 ha is non-forest and the remaining 15,769 ha is forestland. The net area available for treatment, however, is 62,975 ha of which 51,927 ha area is non-forest and the balance 11,048 ha is forestland.

**PHASE-I Programme**

On the basis of the reports submitted by the AIS&LUSO, sub-watersheds belonging to the very high and high

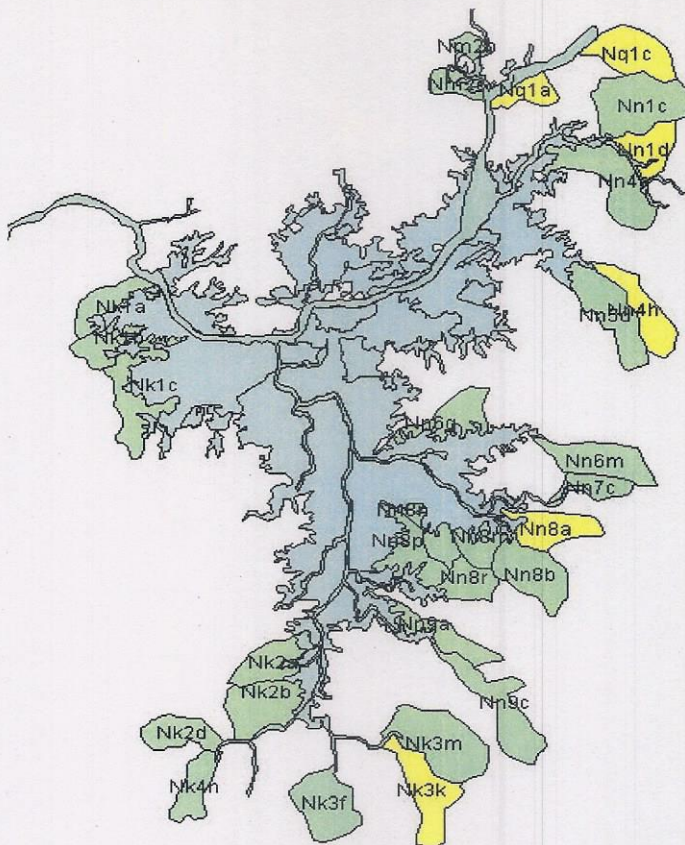


priority categories and directly draining into the reservoir have been identified for treatment. There are 30 such sub-watersheds. They cover an area of about 73,456 ha

**IMPLEMENTATION:**

NVDA have planned to treat the Phase-I area in about 10 years' time commencing 1991, at the cost of the project and pari-passu with the construction work on the project.

By the end of December 2004, the cumulative progress was 58451 ha. It includes 4587 ha progress under forest sector which was covered in Datuni Pilot project. NVDA proposes to treat the balance areas during the next four years.



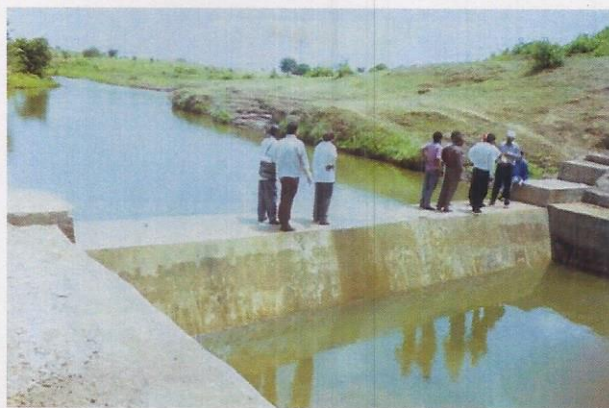
	Area in ha.	Treated by NVDA	Covered under Comp Afforestation	Total area treated up	Balance Area proposed to be treated by State Forest Deptt /NVDA
Non-forest	49837*	49598	00	49598	239
Forestland	11515**	4273	4587	8860	1833
Total	62,975	53871	4587	58458	2072

\* Revised targets as per micro planning( including unworkable area of 2090 ha) Earlier targets were 51,927 ha

\*\* Revised targets as per micro planning (including unworkable area of 822 ha) Earlier targets were 11,048 ha

**II. FREELY DRAINING AREA (Excluding Directly Draining Sub-watersheds)**

According to the plan submitted by the NVDA, 478 sub-watersheds, covering a gross area of 10,12,640 ha have been identified as freely draining (other than directly draining) sub-watersheds. The net area available for treatment, however, is 9,15,150 ha of which 806720 ha area is non-forest and the balance 108430 ha is forestland.





**ACTION PLAN :**

NVDA have submitted macro-watershed plans covering the above area during 1993. NVDA have planned to treat the Phase-II area in about 30 years' time commencing 1994-95, as per the schedule of implementation given in Table-5 below. However, detailed micro-watershed schemes are required to be submitted to the funding agencies like NAEB, RVP etc. in accordance with the guidelines of these schemes. A few schemes have been submitted and got approved while the remaining schemes are under formulation.

**IMPLEMENTATION :**

The Project Authorities have submitted CAT Phase-II plans for NAEB/ Jawahar Rojgar Yojna etc. funding for seeking funds. Fourteen schemes covering the area of 28,949 ha were approved by the Govt. of India. By the end of December 2004 the progress reported was 20734 ha.

The progress achieved is about **2.26%** as depicted below.

	Area in ha.	Treated by NVDA	Already treated under other schemes	Schemes submitted	Balance Area remained to be treated
Non forest	806720	20734	00	Not available	
Forest land	108430				
Total	915150	20734			894416

**REQUIREMENT OF FUNDS :**

It was informed by the NVDA that progress is behind schedule due to non availability of the required funds. The plan drawn up for treatment of Phase-II treatment works places requirement of total funds at Rs. 1038 crores. It is proposed by GOMP to treat the non-forest area at an estimated cost of Rs.602.57 crores and forest area Rs.435.12 crores.

**Works remain to be done.**

- ❖ Treatment of balance area of Phase-I 2079 ha
- ❖ Assessment of the efficacy of the treatment work for both forest & non-forest area.
- ❖ Submission of the scheme for Phase-II works, schedule of treatment with manpower, resources & budget.

**Summary of the Status :**

Sl. No.	Issue	Implementation	Balance works
1.	Treatment of balance area of Phase-I 2079 ha	Schedule for completion by June, 2005.	3.5% remaining. (2079 ha.)
2.	Assessment of the quality of work (forest & non-forest).	Non initiated.	100% remaining.
3.	Submission of the scheme for Phase-II works, schedule of treatment with manpower, resources & budget.	Work very slow due to lack of resources.	97.74% remaining. (8,94,416 ha.)

## Chapter - 3

# COMPENSATORY PLANTATIONS

A total of 40,332 ha forestland would come under submergence and an additional 779.90 ha. of forestland has been diverted for the residential colony, powerhouse complex, main dam, saddle dam and approach roads.

Subsequently, another 308.40 ha. of forestland was permitted to be diverted for powerhouse. Thus a total of 41,420 ha of forestland has been permitted to be utilised for the construction of ISP. Area proposed to be utilised for the ISP covers three districts as shown in Table-1 below.

**TABLE-1 : Showing area taken by the ISP from three districts in M.P.**

District	Area in hectares diverted for ISP
Khandwa	33,383
Dewas	4,528
Hoshangabad	3,678
Total	41,589

MOEF clearance granted in 1987 contained several conditions pertaining to compensatory afforestation. The key conditions among others was that " Since the project involves violation of Forest (Conservation) Act, 1980, compensatory afforestation will be carried out over suitable degraded forest land double the diverted forest area in extent and in addition to the equivalent area in non-forest land. For this purpose, the area offered by the State Govt. vide their letter No.5/III/84-10-3, dated 14.10.1986 will be accepted and compensatory afforestation raised at the cost of the project in this area."

- State Forest Department re-conveyed the forestland for the purpose of ISP vide it's letter dated 28<sup>th</sup> November 1987 clarifying that-

"The plantations over the degraded forest, double in extent to the area which has been worked upon without the permission of the Forest Department, violating Forest Conservation Act thereby, shall be carried out, in addition to the usual plantations over non-forestland equal in extent to the area diverted."

- Ministry of Environment and Forest vide letter No. 8-646-84-FC Dated the 7<sup>th</sup> Oct. 1987 permitted diversion of 41,111.97 hectares of forest land in Khandwa, Dewas and Hoshangabad districts for the Narmada Sagar Multipurpose Project. under Section 2 of the Forest (Conservation), Act, 1980, subject to the following key conditions that
1. Compensatory afforestation will be carried out over suitable degraded forest land double the diverted forest area in extent and in addition to the equivalent area in non-forest land. However subsequently the scheme for compensatory afforestation submitted vide letter Nos. F.D /AAA/ AO/3 dated 13.11.1987, as detailed below was approved by the MOEF . However additional compensatory afforestation over 150 ha. degraded forest was directed.

2. The areas will be surveyed, demarcated and declared protected forests and placed under the control of the Forest Department for compensatory afforestation at the cost of the project. Areas not found suitable will be substituted by suitable area.
3. Forest clearance was to be done only upto 4 M below FRL

#### ACTION PLAN :

To compensate for this loss of forest the M.P. Forest Department had submitted an Action Plan for Compensatory Afforestation for the Indira Sagar Project in December, 1986. Area offered to this plan was accepted. The acceptance was acknowledged through the clearance order.

Accordingly, 10,143 ha of non-forest and 70,802 ha of degraded forestland has been identified for compensatory afforestation, in the districts of Khandwa, Hoshangabad, Dewas, Sehore, Dhar and Khargone as shown in Table below.

Showing the district wise areas identified for compensatory plantation

District	Degraded Forest (In ha)	Area other than forest (In ha)
Khandwa	30,572	2,314
Hoshangabad	22,739	2,842
Dewas	17,491	802
Sehore	-	1,247
Dhar	-	1,001
Khargone	-	1,937
Total	70,802	10,143

The M.P. Forest Department has added additional areas to the prescribed afforestation hectare as a contingency to account for unforeseen circumstances. In selecting forestlands for the plantations, local requirements for grazing, firewood, and other nistar needs were kept in view. However, considering that with the dedication of vast areas to the proposed National Parks, some future adverse impacts on the local population's nistar needs may develop and that the wood from the submergence zone was expected to meet local fuel needs only for about 8 to 10 years, more emphasis was placed on fodder production in plantation areas in Khandwa and Dewas divisions. The plantations were to provide shelter and habitat to wildlife also.

#### IMPLEMENTATION :

NVDA started the plantation works in the degraded forests within the Narmada catchment on the areas identified in the plan. By the end of December 2004 the progress reported was 83372 ha.

District	Area in hectares diverted for ISP	CA target in Degraded Forest	CA target in non forest area	Total target in ha.
Khandwa	33,383	30,572	2,314	32886
Dewas	4,528	17,491	802	18293
Hoshangabad	3,678	22,739	2,842	25581
Sehore		-	1,247	1,247

Dhar		-	1,001	1,001
Khargone		-	1,937	1,937
Total	<b>41,589</b>	70,802	10,143	80,945
Revised Targets		70,952*	10,452**	

\* Targets revised due to additional works over 150 ha area as penalty.

\*\* Targets revised due to release of additional 308.47 ha of land.

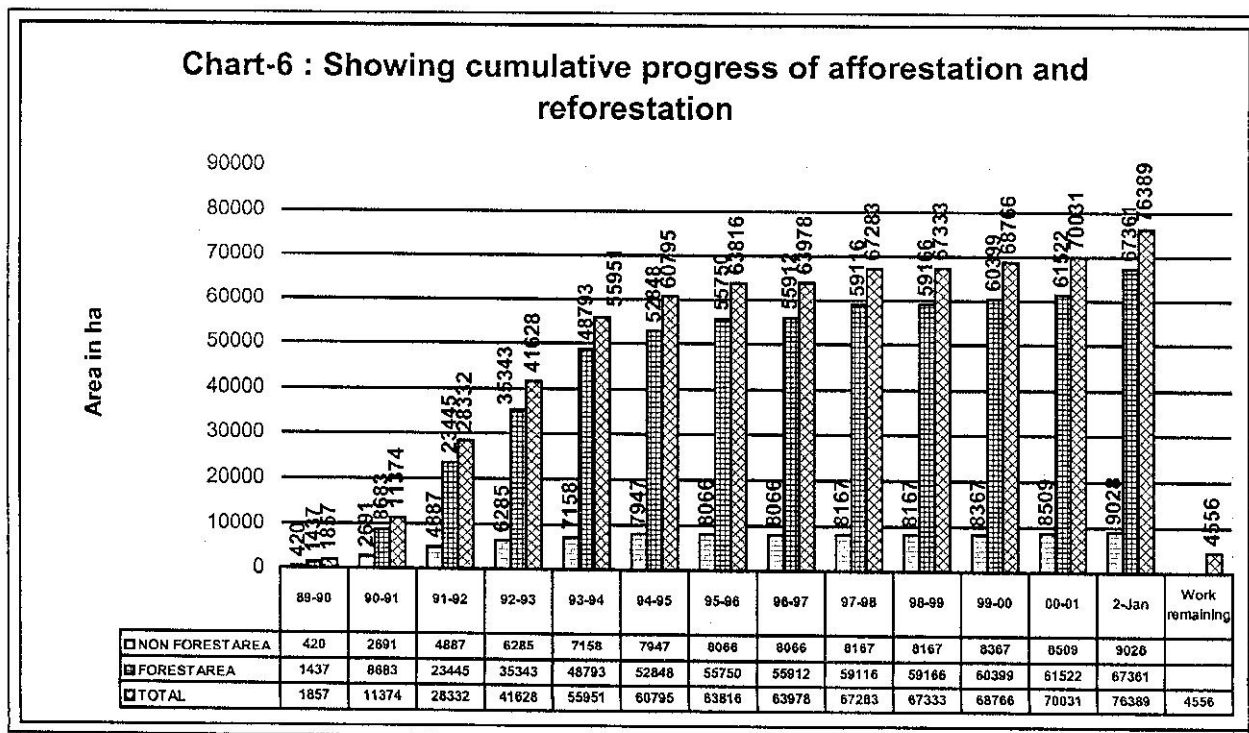
### Progress of implementation

It was directed by the Environment Sub-Group that plantations raised as vegetative measures under CAT should not be doubly counted. Accordingly GoMP was requested to exclude the plantation areas covered under the CAT from the achievement of compensatory afforestation.

The progress reported by GoMP by the end of Monsoon 2004, after deleting the targets covered under CAT programmes, was 81,308 ha (forest area = 70,952 & Non forest area = 10,356 ha). The balance target of 136 ha is proposed for plantation by monsoon of 2005.

### Works remain to be done:

- ❖ The balance target of 136 ha is by monsoon of 2005.
- ❖ Regular upkeep & maintenance of the plantations until established & transferred.



- ❖ Assessment of survival percentage, crop composition, replacement of casualties
- ❖ Transfer of forest area planted up to territorial forest division for regular upkeep & maintenance.

Summary of the Status :

Sl. No.	Issue	Implementation	Balance works
1.	Treatment of balance area of 136 ha	Schedule for completion by June, 2005.	0.2% remaining. (136 ha.)
2.	Assessment of the survival percentage & crop composition	Awaited.	Not available.
3.	Transfer of forest area planted up to territorial forest division for regular upkeep & maintenance.	Work progressing.	Details awaited.

**Chapter - 4****COMMAND AREA DEVELOPMENT**

The Command area proposed to be irrigated by the NSP spreads on the left bank of the Narmada River. It comprises territory falling in the Khandwa tehsil of Khandwa District and six tehsils of Khargone District. The Satpura Ranges flank the command on the south. The northern boundary is formed by the Narmada River itself. The land of the command comprises Forest:10,055ha; Grasses and pastures:10,498ha; Cultivated land: 142,406ha; Culturable fallow : 8,116 ha; Barren:18,385 ha. The project on completion will provide annual irrigation to 1.69 lakh ha. The command area has immense potential for development. The objectives of the command area development are :

- Optimum utilisation of created potential of irrigation.
- Introduction of multiple cropping patterns and increasing the levels of productivity and strengthening of agriculture research activities.
- Creation of adequate communication and storage facilities.
- Conservation management of integrated fisheries development.
- Intensification of dairy development.

The main components of the command area development program are

- On Farm Development,
- Conjunctive Use,
- Agro-Industries
- Regulated Market,
- Warehousing Facilities,
- Roads etc.

As per the direction of the Planning Commission, project proposals are required to include the command area development plan also. MoEF clearance of 1987 also required it. The forest clearance stipulated that tree planting should also be done on either side of canal road and foreshore of the reservoir and in the wasteland / vacant lands under the control of the Irrigation Department in the command area.

**The key conditions attached with the investment clearance were as follows.**

- The State shall comply with the conditions as laid down in the O.M.No.3-87/80-IA dated 24.6.1987 and letter No.8/646/84-FC dated 7.10.1987 both issued by the Ministry of Environment and Forest while according the environmental clearance and the approval for diversion of forest lands for this project respectively for this project and ensure
- Completion of Rehabilitation and Resettlement Plan in scheduled time with close monitoring as per requirements of Department of Environment and Forest.
- State will establish adequate network for ground water monitoring in the command within 2 years and the State should submit to Planning Commission the time frame for establishing such network with mile-stone achievements, duly vetted through Central Water Commission, for monitoring the same by Planning Commission
- State should draw up a detailed time schedule for completion within 5 years the Investigation, detailed survey, planning and working out the detailed cost estimates for micro level network system for the balance area ( Not already submitted) of the total command of this project.

- The State should draw up an implementation schedule segment-wise for completion of canal network, in such a manner that a segment of the canal network, taken up from head reaches, is completed in all respect so as to make the irrigation water available, for the design potential of that segment upto the outlet in that particular segment;

## STUDIES AND FINDINGS

In 1975, at the request of the Narmada Water Dispute Tribunal (NWDT), the Gwalior Campus of J.N.K.V.V. University undertook a reconnaissance survey of the Narmada Sagar Command, using a 2-mile grid. Nearly 265 soil profiles were examined.

Reports on the quality of groundwater in the Indira Sagar Project area are limited, but the general assumption is that the quality is suitable for use in irrigation. Limited water quality testing was done in several blocks in the Indira Sagar Project area. These tests were apparently conducted in 1966 and 1967. In Barwaha block, five samples out of seven tested were of excellent quality.

During 1982-83, to appraise land irrigability, an area of about 2,80,000 ha falling within parts of Khandwa and Khargone districts was surveyed by the Department of Agriculture, M.P. Surveys were carried out on 1:50,000 – scale topo-sheets. Aerial photo-interpretation was carried out wherever possible. About 366 profiles and about 2787 auger bores were examined. The rate of profile examination was about 1 per 1000 ha. A total of 30 soil series were mapped. Areas falling under different classes of depth, erosion, slope, texture, and land irrigability subclasses were identified. This report indicated that typical vertisols are not extensive in the surveyed area .

A detailed reconnaissance soil survey of the Narmada Sagar Command Area was also carried out in January 1984 by the Directorate of Agriculture in co-ordination with the Govt. of India, National Bureau of Soil Survey and Land Use Planning Wing and the Agricultural University, Jabalpur in the command area of 2.10 lakh ha. The soils of the areas have been classified into 26 soil series taking into account the morphological features, topography, and physical and chemical characteristics. As per soil taxonomy (1970), altogether three orders, three suborders, three great groups, eight subgroups and ten families have been identified. Soils have been classified into various recognised classes in terms of their suitability for irrigation.

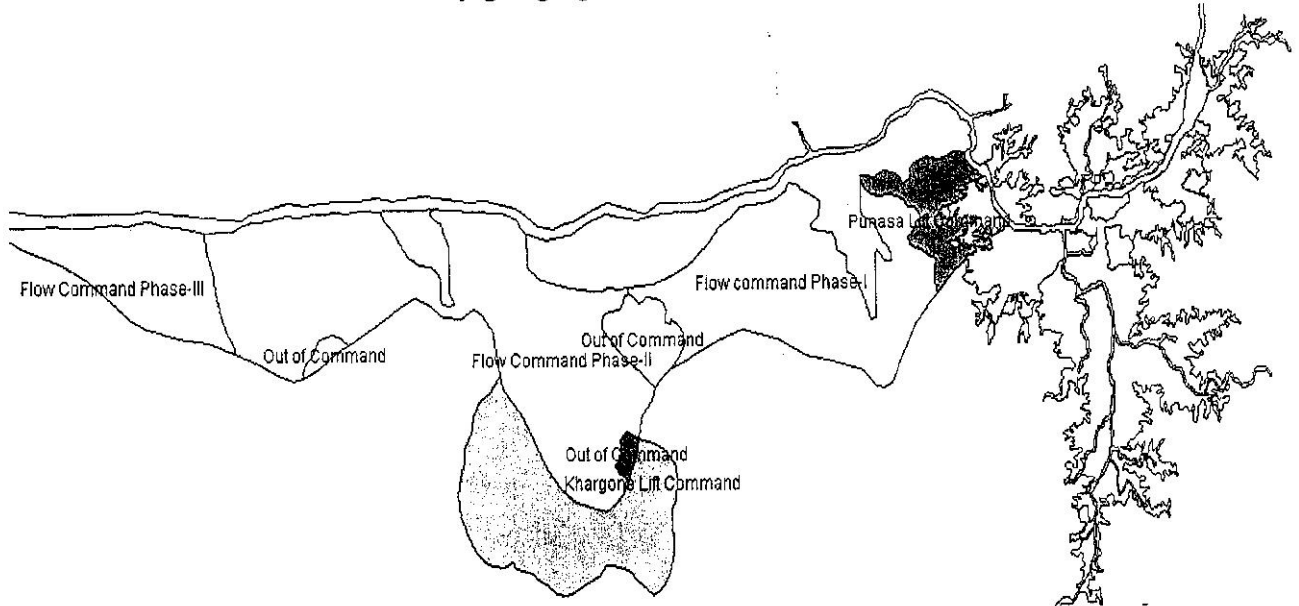
### Showing land irrigability classification

Sl. No.	Land Irrigability Class	Slope Percent	Depth of Soil (in cms.)	Percentage of gross command area
1.	2	0-3%	More than 90	29.5
2.	3	1-5%	22.5 to 90	21.5
3.	4	3-10%	7.5 to 45	25.7
4.	6	5-15%	0 to 22.5%	23.3

In order to study whether full irrigation would lead to water logging and salinity problems, state govt. of Madhya Pradesh commissioned special studies on subsurface drainage and groundwater behavior to the Indian Institute of Science at Bangalore. For

study purposes, the entire Narmada Sagar complex Area was divided into 34 hydro-geological zones. The studies considered the following :

- Rainfall data from stations around the composite command.
- Runoff as measured in nearby gauging stations.



- Evaporation rate data.
- Climatological data.
- Groundwater-level data from all types of wells.
- Pump test data.
- Hydro-geological information on wells and aquifers.
- Soil and soil moisture data.
- Agricultural land use data, including information on crops and the seasonal nature and extent of surface water and groundwater irrigation.
- Proposed crop-water requirements.

Jawaharlal Nehru Krishi Vishwavidhyalaya, Jabalpur through their research centre are carrying out studies on impact of agro-chemicals run-off from fields on underground and surface water in command area with an objective of assessing the residues of toxic agricultural chemicals from fields in the ground water and surface water of command areas and ecological effects of the residues in irrigation water and their physiological effects on aquatic and terrestrial vegetation, crops, animal life and agro-ecosystem as a whole for devising measures to mitigate the same under the fallow and cropped yield conditions. Studies are commenced and are making progress.

## SUGGESTED STRATEGIES

The Bangalore institute's study concluded that conjunctive use of surface water and groundwater on a significant scale would be required to avoid water logging and salinity problems in the Composite Command Area. Study data indicated that a water balance of 70% surface water and 30% groundwater would be suitable in most project areas to avoid waterlogged conditions.



Natural drainage conditions in the Narmada Sagar Complex Command Areas are quite favourable as Narmada Sagar area has a well-developed natural drainage system. The command complex lies on both flanks of the Narmada River, with a number of tributaries draining the area towards the Narmada River. The slope of the cultivable land generally ranges from 1 to 3% and it has good natural drainage. The groundwater aquifers are deeply incised, and major problems of surface drainage do not appear to exist. Surface drainage will, however, be required after irrigation is implemented through the provision of a proper network of field drains so that excess water will be removed from the cultivated fields.

Irrigation water from the Narmada River will be of good quality, and normal irrigation applications are considered sufficient to leach out the salts from saline/sodic soils. No additional leaching requirements will generally be necessary. Project planners do not expect any salinity problems if proper surface and subsurface drainage systems are installed.

## **ACTION PLAN :**

### **Macro-Plan**

The Government of Madhya Pradesh has earlier submitted command area development plan, delineating the soil classifications and land irrigability in the Narmada Sagar Command Area showing the first three phases of irrigation development by area, the land irrigability map of the Narmada Sagar Command Area during 1986.

Accordingly, the implementation of the plan was to be taken up in three phases for completion by December-2007.

The Government of Madhya Pradesh have submitted command area development plan, delineating the soil classifications and land irrigability in the Narmada Sagar Command Area showing the first three phases of irrigation development by area, the land irrigability map of the Narmada Sagar Command Area showing lands of classes 2 through 6 by location in the first three phases of irrigation development during 1986.

The project on completion will provide annual irrigation to 1.69 lakh ha. Waterlogging occurs when the groundwater table rises too close to the ground surface and the soils are unable to drain properly. This concern has been carefully planned to avoid the problems. The conjunctive use of surface and groundwater resources to the extent of 30% is proposed.

The provision of drainage systems to prevent the accumulation of excessive water in the soils, and water management planning and monitoring to control the proportions of surface water and groundwater used in irrigation and the water levels in the groundwater aquifers are some of the measures being planned for prevention of any such eventuality.

In keeping with the study conclusions, planning for the Indira Sagar Project includes maintaining a water balance of 70% surface water and 30% groundwater use, lining of the canal distribution system from the Main Canal upto the eight ha. service area, and installing and maintaining surface and field drainage systems. Because of the deeply

incised aquifers, plans for surface and field drains, and plans for conjunctive use of surface water and groundwater, the planned groundwater monitoring program would be sufficient to indicate the needed remedial measures. Essentially all of the groundwater development will be undertaken by the farmers, however the State Govt. plan to take appropriate action to encourage planned groundwater development on schedule and to ensure that the required 30% of the total irrigation demand was met from the groundwater. If groundwater development does not occur on schedule because of the lack of farmer initiative or because of problems with water quality or adverse aquifer conditions, State Govt. plan to step in and install appropriate drainage systems whenever wherever needed

### Action Plan : Micro-Plan

The subgroup directed updating of this plan in line with the plans being developed for the SSP in Gujarat and Rajasthan.

As informed during the 40<sup>th</sup> meeting, a GIS based CAD plan is under preparation with the help of NIC, MAPCOST and Survey of India and experts from NCA. Preparation of a comprehensive command area development plan has been entrusted to MITCON, Pune at the estimated cost of about Rs.40.00 lacs. A Multi-disciplinary Expert Group has been constituted by the GoMP to supervise and monitor the preparation of this plan. The MITCON, Pune has already started the work. The work is likely to be completed by June 2005.

### Canal Net work

As for the progress on the canal system, earth work has been completed in the first 28 kms of the main canal and almost completed in another 13.25 km length. Work for most of the distributaries will follow.

### IMPLEMENTATION: Environment Safe guard measures

Implementation shall be taken up after formulation of the micro-plan.

### Summary of the Status :

Sl. No.	Issue	Implementation	Balance works
1.	Completion of ongoing studies.	Progressing	NIL
2.	Canal Network	28 km. completed & progressing in balance	
3.	Preparation of CAD plan.	Progressing	100% remaining.

## Chapter - 5

### FLORA, FAUNA & CARRYING CAPACITY

The guidelines of the MOEF require that while seeking environmental clearance for the hydropower projects, surveys should be conducted so that the status of the flora and fauna present can be assessed, listed (rare and endangered) species can be detected, if present, and appropriate conservation measures devised. Important survey work undertaken for the purpose had included the following

- Preliminary Report on First Botanical Exploration and Plant Collection from Narmada Valley by the Botanical Survey of India in 1986.
- Report on the Survey of the Narmada Sagar Area by Zoological Survey of India, 1988.
- Narmada Basin Water Development Plan: Development of Fisheries, 1987, was prepared by the Narmada Planning Agency, GOMP.
- Rapid Reconnaissance Survey of Limnological Aspects Part I, II and III, 1987, were undertaken by the Bhopal, Vikram and Rani Durgavati, Universities for GOMP.
- Water quality data has been collected by the Central Pollution Control Board, Central Water Commission, the State Pollution Control Boards and the National Institute of Oceanography

On the basis of relevant details supplied by the various states, MOEF issued clearance in 1987. A condition of this clearance, as far as it related specifically to the Flora & Fauna, was that the Narmada Control Authority would ensure in-depth studies on flora and fauna needed for implementation of environmental safeguard measures.

Further in-depth studies with focus on the following prime concerns were taken up.

- Relocating and protecting wildlife through setting up and maintenance of the permanent protection areas.
- Detailed surveys of both flora and fauna to determine the number of individuals of the various species, their habitat types and other needs, their status in terms of being endangered, threatened or protected under Indian Legislation, and recommendations for minimising project impacts and maximising opportunities for protecting and enhancing plant and animal life.
- Studies to ascertain the capacity of the surrounding areas to accommodate additional wildlife

The objective of the suggested studies was to assess the environmental impacts as a result of the Narmada Sagar Complex, consisting of the three dams: the Narmada Sagar, Maheshwar and Omkareshwar, to ensure minimal adverse effects on wildlife as a result of the project development works. Studies were entrusted to Wildlife Institute of India and Friends of Nature Society. Institutes carried out exhaustive studies with a view to address the above concerns. Studies focused on the following

The reports submitted by the identified premier organisation during the period 1986 and 1997 included the following

- Sociological Survey of the Fishing Families of the Narmada River by CICFRI, 1991.

- Aquatic Fauna (Fish) Studies in Indira Sagar Submergence Area, prepared by the Friends of Nature Society in 1991 on behalf on the NVDA reported on the fish fauna of the Narmada.
- Pre-and Post-Impoundment Limnological Studies of Narmada Basin, by three universities coordinated by Barkatullah University for the NVDA. (1989-92) Study report was available in 1994.
- Studies on Fish Conservation in Narmada Sagar, Sardar Sarovar and its Downstream, is a desk review sponsored by the NCA and undertaken by CICFRI, 1993.
- Wetland and aquatic flora of Narmada Valley in Madhya Pradesh was also published in 1991 in Vol. 15 No.3 in J.Econ. Toxicology Bot.
- Studies on EIA of Flora & Fauna of NSP were entrusted to the Wildlife Institute of India, Dehradun in December, 1989 and were completed by March 1994.

#### Ongoing study

- ❖ By IIFM study entitled "Ecosystem resoration and development of Analogue forest near NVDA project area"

**Key concerns** addressed on the terrestrial ecosystem were as follows:

- A wildlife inventory giving reliable estimates of the numbers of various species of wildlife in the project impact area.
- A catalogue of habitat types found in the project area.
- A status report on individual species indicating ones that are endangered, threatened, or protected under prevailing Indian wildlife Laws. The report on these special status species was also included the recommendations for actions to be taken to safeguard threatened species
- Recommendations for the creation of new protected areas for wildlife in the areas neighboring the submergence area.
- An assessment of the impact of the project gene pool reserves of wildlife in the project area.

The objective of the suggested studies was to assess the environmental impacts as a result of the Narmada Sagar Complex, consisting of the three dams: the Narmada Sagar, Maheshwar and Omkareshwar, to ensure minimal adverse effects on wildlife as a result of the project development works. Studies were entrusted to Wildlife Institute of India, Deheradun, Friends of Nature Society, Bhopal, Limnological studies to the Universities ( Jabalpur, Ujjain & Bhopal). These institutes carried out studies with a view to address the above concerns and recommended certain mitigation measures ,which included the following.

#### Suggested strategies & Action Plan :

Establishments of protected areas in many parts of the country in the last three decades has largely been and outcome of the Govt. concern for mitigation of the environmental degradation specially for preservation of species diversity and the genetic variation within them. Besides, maintaining productive capacities of Eco-system and safeguarding habitat critically for the local range of species. Three new protected areas were proposed to mitigate the losses. This includes Narmada National Park, Suryamanya Sanctuary and Omkareshwar Sanctuary.

It is suggested that the severity of the impact resulting from direct and indirect losses could be minimised through restoration of some of the aquatic vertebrates and delineation of a substantial area of the contiguity forest which has similar conservation values that are being lost in submergence and to elevate its status to a protected area – a combination of a national park and sanctuary.

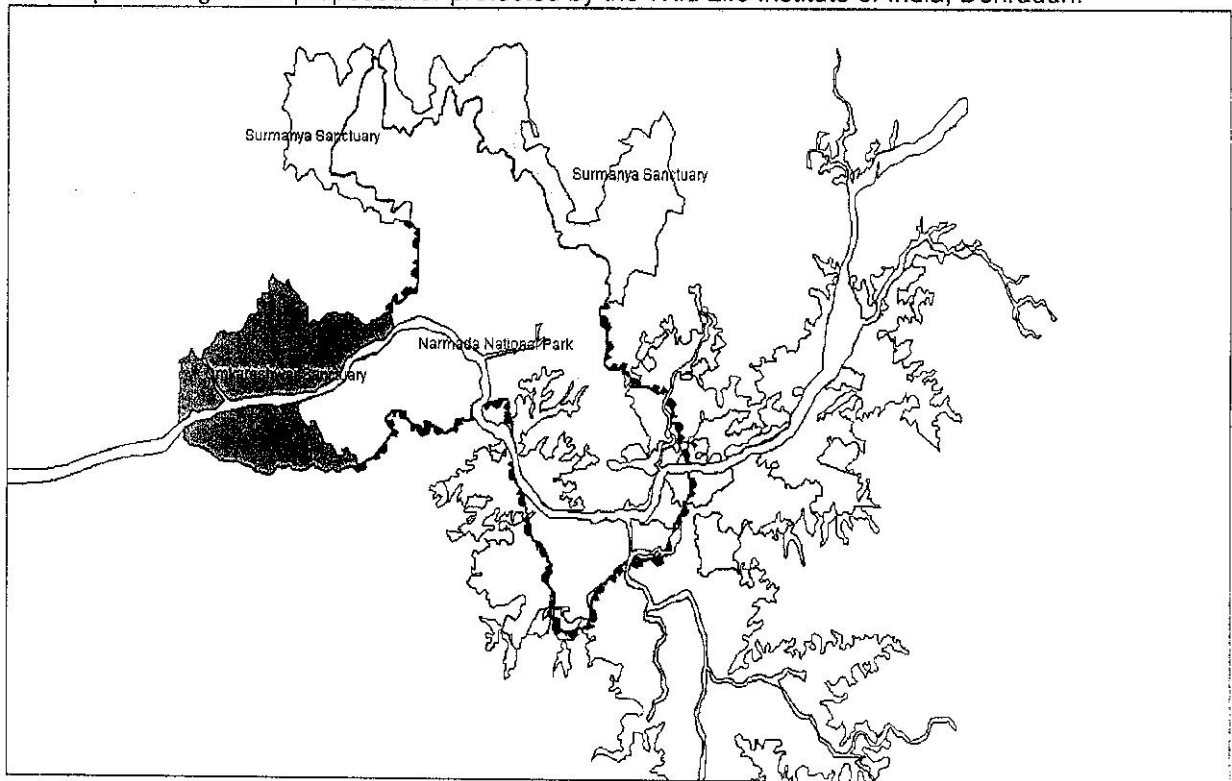
1. Key aquatic vertebrates species like **otter** was proposed to be restored and translocated. It was suggested to explore the possibility of capturing and translocation of impacted otters of Narmada Sagar into identified localities of the vacant niches in central Indian rivers.
2. Besides, a species restoration plan for **aquatic reptile (turtle)** was also suggested within the submergence zone and also in other stretches of the river with rocky structure and sandy banks.
3. The restoration program for **muggar crocodile** as being practised in other districts of M.P. was also suggested.
4. The studies of certain aspects of fisheries and reservoir sciences have been included in the Limnological studies being conducted by the three Universities of the State. Studies in the Upper Narmada, (Bargi Reservoir) by Rani Durgawati University, Jabalpur, studies in the Middle Narmada (Tawa, Barna and Kolar Reservoirs) by Barkatullah University, Bhopal, studies in the Lower Narmada by Vikram University, Ujjain. All the three Universities have completed the studies in their respective areas as per MOU and final report is available
5. Since the topography in the reservoir area consists of rolling hills, the higher peaks to remain above the water surface level and constitute islands in the reservoir. In addition to these small islands, two large islands will be formed to the north and south of the Narmada River just upstream of the Indira Sagar Dam. These islands were required to be protected. As per suggestions of the Sub-group NVDA had presented a plan for protection which was required to be implemented.
6. **National Park / Sanctuaries for ISP areas :**

It was suggested that the severity of the impact resulting from direct and indirect losses could be minimised through restoration of some of the aquatic vertebrates and delineation of a substantial area of the contiguity forest which has similar conservation values that are being lost in submergence and to elevate its status to a protected area – a combination of a national park and sanctuary. Three new protected areas were proposed to mitigate the losses. This included Narmada National Park, Suryanmaya Sanctuary and Omkareshwar Sanctuary, as per details given below.

*Govt. of M.P. vide their letter No. F5/58/83/10/3 dated 29.05.1990, formed a committee for suggesting the steps and drawing up of the plan for conservation & management of wildlife for SSP & ISP both. It was reported by the NVDA that, to ensure that no villages are included inside the proposed area of National Park and Wildlife Sanctuaries, the areas recommended by the EIA report was reduced by about 35.23%. i.e. instead of covering an area of 75888 ha recommended by the EIA studies GoMP is to constitute protected area only for 49155 ha. as follows*

Name of the Park/ Sanctuaries/Conservation Reserves	Area in sq. km.
Omkareshwar National Park	293.56
Singhaji Wildlife Sanctuary	178.21
Mandhata Wildlife Sanctuary	69.24
Narmada Conservation Reserve-I	135.03
Narmada Conservation Reserve-II	20.87
<b>Total Area :-</b>	<b>696.91</b>

Map showing areas proposed for protected by the Wild Life Institute of India, Dehradun.



## B) Aquatic Ecosystem

The studies of certain aspects of fisheries and reservoir sciences were included in Limnological studies conducted by the three Universities of the State. Studies in the Upper Narmada, (Bargi Reservoir) by Rani Durgawati University, Jabalpur, studies in the Middle Narmada (Tawa, Barna and Kolar Reservoirs) by Barkatullah University, Bhopal, studies in the Lower Narmada by Vikram University, Ujjain. All the three Universities have completed the studies in their respective areas as per MOU and final report is available

### IMPLEMENTATION:

- ❖ Administrative offices of Project Director(s) have been established but notifications regarding declaration of Sanctuaries areas are awaited.

- ❖ GoMP reported that felling was under progress in 300 compartments of forest areas, 407 Khasra from 24 villages besides private areas of 125 villages. It was further reported that by the end of December, 2004 all trees in the private areas were felled where out of 25,872 trees from revenue areas 21,249 trees were already removed. However in the forest areas out of 49,27,457 about 641702 nos. of trees were yet to felled.

Area	Area Covered	Total Trees	Felled Trees	Balance Trees
Forest Area	29,134.172 Ha.	93,66,608	93,42,865	23,743
Revenue Forest	N.A.	48,879	48,879	Nil

- ❖ In addition to these small islands, two large islands will be formed to the north and south of the Narmada River just upstream of the Indira Sagar Dam. Present plans are to reserve the northern island of 17 km<sup>2</sup>, for people and to link it to the mainland and the highways leading to Indore and Bhopal. The southern island of about 23 km<sup>2</sup>, however, is earmarked for conversion into a wildlife sanctuary. This prospective island would be considered large enough to preserve existing flora and fauna.

**Summary of the Status of preparation & implementation of action plans.**

Sl. No.	Issue	Action Plan	Implementation of Environment Safeguard Measures
<b>A) Terrestrial Ecosystem</b>			
	<b>Declaring the Island as sanctuaries / protected areas.</b> topography in the reservoir area consists of rolling hills therefore the higher peaks to remain above the water surface level and constitute islands in the reservoir. These islands would contain remnant flora and fauna that would remain isolated and would be subjected to changes in microclimate by virtue of being surrounded by a large body of water	No formal action plan yet.  Statement to declare only one island as sanctuary.	Nil
	Key aquatic vertebrates species like <b>otter</b> was proposed to be restored and translocated. It was suggested to explore the possibility of capturing and translocation of impacted otters of Narmada Sagar into identified localities of the vacant niches in central Indian rivers.  Besides, a species restoration plan for <b>aquatic reptile (turtle)</b> was also suggested within the submergence zone and also in other stretches of the river with	Action plan included in the EIA report itself.	Nil

	rocky structure and sandy banks. The restoration program for <b>muggar crocodile</b> as being practised in other districts of M.P. was also suggested.		
	<b>Protection for the wildlife moving out from the submergence area</b> A plan for felling was also required, to ensure protection to wildlife (providing of migratory corridor). Environmental consequences of this large scale felling were documented to by the wildlife Institute of India in the EIA studies which called for implementation of mitigation measures, commensurate with progressive filling of the reservoir.	Felling is nearly completed. Submergence is already effected. No formal action plan	NIL
	Name of the Sanctuary/Park/Area in ha.	<b>As per State committee</b>	
	Omkareshwar National Park	<b>47522</b>	<b>25082</b>
	Suryamanya Sanctuary	<b>16370</b>	<b>17400</b>
	Narmada(Mandhata) Sanctuary	<b>11996</b>	<b>6672</b>
	<b>Total Area</b>	<b>75888</b>	<b>49154</b>
	By IIFM study entitled "Ecosystem restoration and development of Analogue forest near NVDA project area"	Ongoing study	
<b>B) Aquatic Ecosystem :</b>			
	Fisheries conservation & Development		Nil
	Water Quality; Hydro biological Monitoring		
	Prevention of Eutrophication (felling of trees)	<b>No formal plan</b>	<b>Forest areas :</b> Out of 49,27,457 trees  6,41,702 removed



## Chapter - 6

# SEISMICITY & RIM STABILITY

The Narmada Sagar reservoir has a gross capacity of 12,200 million cubic meters, or about 9.9 million acre-feet, by far the largest-capacity reservoir planned in the Narmada River basin. Therefore the issues of seismicity, the potential for reservoir-induced seismicity (RIS) and the rim stability have been carefully studied and addressed.

Some of the staff of NVDA was trained by IMD for initial analysis of observed data and determining the magnitude of earthquake.

### STUDIES

Investigations have considered the Narmada Sagar complex dam sites at Indira Sagar, Omkareshwar and Maheshwar together for the studies. Geological Survey of India, the Central Water and Power Research Station of Pune, the University of Roorkee, GOG, GOMP and World Bank Consultants Pinkerton, Markwell and others have been closely associated with the studies and the mitigation planning. Several reports on seismological factors affecting design of the dam, including the following are available

- Technical Memorandum 3.09, Evaluation of the Earthquake Parameters of the Indira Sagar Dam, by the Department of Earthquake Engineering, Roorkee University. Technical Memorandum 4.12,
- Seismological Considerations for Indira Sagar Dam. Part-1: Evaluation of Earthquake Parameters for Design of Dam. Part-2: Assessment of Potential for Reservoir-Induced Seismicity in Narmada Basin.
- Induced Seismicity and Other Geodynamic Processes Associated with Man-made lakes, Guha, S.K., Visiting Seismology Consultant, North Eastern Council, Shillong, India,
- Sessional Report presented at IVth International Congress, International Association of Engineering Geology, New Delhi, India, 10-15 December 1982.

### SUGGESTED STRATEGIES

Major conclusions related to the effects of RIS considerations on seismic design requirements and the needed plans for seismic monitoring. As for design, it was suggested that reservoir impoundment's by general agreement can trigger significant earthquakes only where tectonic deformations already exist in the geological structures. Thus it was concluded that filling the Narmada Sagar reservoir might cause an earthquake to occur sooner, but it would not affect the magnitude or intensity of ground motion associated with the earthquake. Consequently, RIS was assumed to have no influence on seismic design requirements for structures near to the reservoir.

Detailed studies got done from the University of Roorkee, by consultancy with Dr. Guha and expert opinion obtained from Dr. Ray W.Clough, were placed before the Dam Review Panel. The Indira Sagar Dam Review Panel considered all available reports and data and recommended that

- To monitor seismicity during the pre and post-impoundment phases. Network of about five stations each be developed in the Narmada Sagar, Omkareshwar, and Maheshwar areas .
- To record the ground motion intensity and response of the dams for any significant earthquake in the vicinity, installation of three strong motion seismographs at each dam site.
- To record any significant ground motion that occurs during construction, one strong motion instrument near each dam site.

Based on the recommendations of the Dam Review Panel, detailed designs for the dam have been prepared by the Central Water Commission.

Accordingly, a network of 10 seismological observatories with sophisticated instruments has been established. It has been proposed to monitor pre and post impoundment seismicity also at these seismic stations to help in assessing the adequacy of seismic parameters adopted for designs. The location of these seismic observatories is as under:

- |                  |                        |
|------------------|------------------------|
| 1. Narmada Nagar | 2. Omkareshwar (Kothi) |
| 3. Maheshwar     | 4. Khandwa             |
| 5. Indore        | 6. Barwani             |
| 7. Bagli         | 8. Kannod              |
| 9. Hirapur       | 10. Chhanera           |

On the request of District Administration, one micro earthquake recording system has also been installed to record regional earthquake originating in and around Pandhana region of Distt. Khandwa, MP by NHDC.

At present, seismic data is being recorded at 10 observations except at Kannod observatory. The pre and post impoundment data are collected and are analytically analyzed. At present, it is also ensured that seismic data from the MEQ recorders shall be collected without interruption as the Indira Sagar reservoir is partially impounded up to existing level 237.80 m. The reservoir shall be filled up during this monsoon up to EL (+/-) 245.13 m.

The complete package of seismic digital and analog recorders and sensors had been procured from M/S. Sprengnether Inst. Inc. USA and installed.

IMD had recommended installing Wood Anderson Seismographs at 6 locations. Eminent seismologist, who visited ISP, suggested that seismic data collected by digital seismographic are more reliable. The existing digital recorders having 2 MB data recording capacity and manual time synchronization are on the process of upgradation to digital recorders of 10 GB (8 & 4 channel) capacity with GPS facility for automatic time synchronization as per recommendations of Experts. The latest versions of Digital Recorders are proposed to be procured and action has been already taken up and the same is being processed.

The AC power supply of each station is affected by power cuts, hence to ensure reliable power supply, Solar Photovoltaic System for each station is proposed to be procured. The case for procurement of SPV system is being finalized.

The visual recorders VR-60 operate on AC power mains and require costly heat sensitive papers. Ink pen assembly which operates on 12V DC power is proposed to be installed in place of the AC power operated system. The case for supply and installation of VR-60 ink pen recorder is finalized. This will ensure continuous operation of VR-60 recorder by Solar Power.

Manpower has been deployed for day-to-day operation, maintenance and watch and ward of seismic observatories of ISP on contract basis at a cost of Rs. 9.3 lacs per annum. The laboratory attendant so deployed operates seismic instruments for data collection. However, the data of MEQ collected needs to be analyzed regularly. Trained manpower is proposed to be deployed at the observatories and for which action has been initiated by the project authorities. Project authorities are also considering entrusting entire seismicity studies to private agency that are well equipped and having expertise in this field.

Accordingly a high level committee was constituted for consideration for engaging private agency for day-to-day running maintenance, data acquisition and analysis for an initial period of three years. M/s. Anatech Instruments, Mumbai, the Indian agent of M/s. Sprengnether Instruments Inc., USA who supplied, installed and maintained the entire seismic instruments during warranty period have been approached and proposal invited. On finalization of their offer the seismicity studies shall be done in systematic manner and project personals shall be attached with them to get on job training for operating such systems. However, as an alternative M/s. Central Water & Power Research Institute, Pune has also been approached for getting the job of inferring long term trends by analyzing data acquired so far from 1995 to 2003 and 2003 onwards and also to provide training to project officers so that in future the work can be expedited. The work has been awarded on 23.09.2004 CWPRS, Pune for a sum of Rs. 13,13,700. Accordingly CWPRS officials shall be providing training to NHDC officials on handling data and its compilation. Report on seismic activities based on the data collected at various observatories during 1995 to 2003 is awaited

## **RESERVOIR RIM STABILITY**

The reservoir competency survey has been done by GSI and report is submitted. In the report, GSI suggested further studies for some patches of narrow water divide. However environment sub-group decided not to have further studies as experts were of the opinion that there was no water loss between Mandla & Rajghat.

**MEQ recorders** All the 11 MEQ recorders have been installed. MEQ recorders are now in working condition at 7 stations. Action is also taken by Project Authority to make functional the remaining MEQ recorders.

**Anderson Seismometers** Out of 6 nos. of Wood Anderson Seismometers supply for 4 was received and 2 sets have been installed already at Narmada Nagar, Khandwa during 1999. These however required recalibration by the IMD.

**Seismic Instrument** Complete instruments including digital data acquisition and analysis system was installed at 10 locations during 1998-99 which includes short term seismometer, long period seismometer, Strong Motion Accelerograph.

Presently only Narmada Nagar and Khandwa observatory station are fully functional.

**Summary of the Status :**

Sl. No.	Issue	Implementation	Balance works
1.	Instrumentation of observatories	10 completed	Nil
2.	Functioning of observatories	2 functional	80% remaining.
3.	Running maintenance & data acquisition.	Contract is being awarded- yet to start	
4.	Training for analysis of the data	CWPRS to conduct training - yet to start	

## Chapter - 7

# HEALTH ASPECTS

The Indira Sagar Project would create a 913 km<sup>2</sup> reservoir, a main canal of 332 km. and 1,820 km of distributaries. Surveys have been conducted in the Indira Sagar impact areas to investigate existing levels of health and to gather information on specific diseases.

### STUDIES :

- ❖ Three specific diseases namely Malaria, Schistosomiasis, and Filaria were studied. Other diseases investigated were leishmaniasis and scabies and other water-washed diseases. The geographical reconnaissance study, to identify the potential breeding sites of malaria vector, is being explored.
- ❖ Pre-impoundment and post-impoundment Limnological studies carried out by three Universities take care of water quality aspect. These studies have been completed and the final report is submitted.
- ❖ Further regarding preventive aspects, Department of Preventive and Social Medicine, Gandhi Medical College, Bhopal carried out epidemiological studies.
- ❖ Jawahar Lal Nehru University which carried out initial studies for the planning commission on the aspects related with the use of insecticides and pesticides in the command through their research station at Khandwa have been entrusted with studies on impacts of application of insecticides etc.

### Findings & Suggested Strategies :

According to the above studies, key findings included the following :

- Malaria is increasing in Khandwa and Khargone Districts surrounding the Indira Sagar Dam site.
- Cholera and gastroenteritis are endemic in Indore, Dhar and Jhabua Districts for more than seven months each year.
- Other common diseases are typhoid and dengue fever, although they are not often found in the project area.
- Filariasis is endemic to at least eight districts of MP, including Chindwara, adjacent to the Narmada Sagar Site. The vector mosquito (mainly *Culex fatignas* responsible for this parasitic diseases proliferates in dirty water in ponded areas and artificial containers and also to a lesser extent in stagnant irrigation tributaries and lakes.
- Little or no autochthonous leishmaniasis exists at present in MP. This disease is not water related since it is spread by sand flies that do not need water to breed. However, according to NICD, Delhi, leishmaniasis flared up following the construction of the Rajasthan canal.
- Guinea worm disease (dracontiasis) affects 3,000 villages in MP. This disease is caused by a nematode worm and the vector for its transmission is Cyclops, the fresh water fleas.

Health problems related to these causes are expected to improve when the projects are implemented. The incidence of water-washed diseases should be reduced by the increased availability of water. The point has also been made that large water supply and irrigation projects often cause problems related to the expanded water environment. Plans have been prepared in both project areas to increase public health-related facilities, staffing, and services during project implementation. The incidence of water borne diseases in the Narmada Valley, as elsewhere in MP, is constantly being monitored by GOMP's Directorate of Health Services (DHS).

Means to control schistosomiasis include physical, chemical, and biological mitigation measures. Physical mitigation measures include draining area with standing water, clearing vegetation from water channels and banks, utilising flushing flows, and manipulating water levels. The primary chemical mitigation measure is the use of molluscicides. Biological mitigation measures would include the use of predator species that would eat the secondary host snails. Schistosomiasis is to be kept out of the project area through vigilant monitoring and the prompt use of eradication measures when needed

Malaria is another disease that requires monitoring and control actions in the project areas. It was found that most of the existing diseases in the project area were related to prevailing socio-economic levels, mainly hygiene. Since the Anopheline mosquito vector has the potential to proliferate in the reservoir, the large draw down strip, and the canals and drains, preventive measures are to be in place to keep the mosquitoes in check. Some experimental resistance of adult mosquitoes to commonly used biocides has been noted under laboratory conditions. Thus research to maintain effective biocides will have to be continued on long term basis. Land levelling and land filling operations as well as appropriate vegetation clearing are being integrated. Control measures will include larvae-eating fish in water bodies, mosquito-inhibiting plants, and clearing of vegetation and other actions to destroy breeding sites.

The geographical reconnaissance study, to identify the potential breeding sites of malaria vector, was suggested and is an ongoing studies with the help of ICMR.

## **ACTION PLAN :**

### **A. Action Plan on Public health**

The NVDA has prepared a plan on health aspect for ISP. The plan covered the up-stream, dam site, command area and the rehabilitation sites of the Indira Sagar and Omkareshwar projects. The plan is estimated to cost Rs.6.49 crores including incremental provisions towards ISP for 30 bedded hospital at Punasa and other facilities as follows:

- ❖ 1 mobile unit,
- ❖ 29 Sub-Health Centers,
- ❖ 2 Public Health Centers besides
- ❖ strengthening of 6 existing health sub-centers.
- ❖ Provisions for IEC, control of Arthropods,
- ❖ provision of insecticides and surveillance were also incorporated.

## B. Action Plan on limnology & Water Quality

Action Plan includes continued investigations of the Central and Western Zone of Narmada at selected sites for the identified parameters. In addition, plan proposes biological characteristic study, microphytes, phytoplankton, zooplanktons, micro invertebrates, biomass etc. The proposal includes among others continued limnological studies, ecological studies.

### IMPLEMENTATION :

#### A. Health Plan

The above Action Plan is under implementation as brought out below.

##### Project site.

- ❖ Presently one 20 bedded hospital is functioning at ISP site with Chief Medical Officer posted with adequate staff and a pathological laboratory. In addition to this, the contractor M/s. Jai Prakash Associates has one hospital with two Medical Officers and a pathological laboratory available at project site.
- ❖ For the control of vector borne diseases the project authorities have engaged M/s. Bayer Company for spraying of insecticides in the project area.

##### Progress on work on Health services being created in ISP Rehabilitation sites.

Sl. No.	Rehabilitation sites	Provision	Status
1.	Bedhani	Ayurvedic Hospital	Work in progress
2.	Anjania Khurd	Ayurvedic Hospital	Work in progress
3.	Chainpur	Ayurvedic Hospital	Work in progress
4.	Saralya	Sub-Health Centre	Work completed

##### Peripheral population

##### Surveillance studies

- ❖ Monthly Statement showing Institutional Cases and Deaths due to Communicable Diseases are being compiled on monthly basis and are available in NVDA.

##### Incremental facilities:

Progress awaited on the following

- ❖ Mobile unit
- ❖ PHC 3 nos., equipped with 5 beds each, equipments, vehicles, staff etc.
- ❖ 2 civil dispensaries with labs
- ❖ 24 sub-health centres with equipments etc

#### B. Limnological aspects and Water quality

Included in fisheries plan

**Summary of the Status of Planning & Implementation :**

Sl. No.	Issue	Implementation		Balance works
		Phy	Fin.	
1.	Incremental Health Infrastructure ❖ Dam site	2 Hospital & Spray of pesticides		In position
	❖ Peripheral villages	Not available		
	❖ Rehabilitation sites	3- Ayurvedic and 1 SHC		Major works remain
2.	Appointment of Doctors / Nurses.	Not Available		
3.	The private practitioners should be imparted training on drug policies for malaria and filariasis etc.			
4.	Supplies of medicines and pesticides etc.			
5.	Supplies of instruments (X-ray, Microscope, Testing kit etc.			
6.	All proposals should indicate management of collection of seepage water from dams in the Engineering Action plan to avoid breeding of mosquitoes.	Details awaited		Progress awaited
7.	All proposals should incorporate introduction of larvi-vorous fishes for mosquito control besides insecticide spray.			
8.	<b>Entomological Reconnaissance studies.</b> The research activities plant with Malaria Research Center			
9.	Water quality monitoring on identified parameters			
10	<b>Epidemiological surveillance</b> The surveillance activity for prevention and control of malaria & other vector borne diseases.			
11	The Action Plan for IEC activities at village level requires detail method of communication activities viz. group meetings, slogans on walls, video films, newspapers, pamphlets etc.	Progressing		Report progress
12	There should be a centralized data management preferably on weekly basis. The details should be indicated in the Action plan.	Monitoring cell in position		Report progress after analysis



## Chapter - 8

# ARCHAEOLOGICAL & ANTHROPOLOGICAL ASPECTS

### Archaeological Aspects

Investigations of the basin revealed that valley was rich in archaeological belongings:

- ◆ Paleolithic sites are to be found in Nemavar, Kannod, Punjapura, Chirapahad, Sitabau, Dhardi, Moretakka, Maheshwar, Kasrawad, Sahastradhara, Khalghat, Dharampuri, Kalibaodi, Manawar, Budada, Barwani, and Kukshi.
- ◆ Mesolithic sites are to be found all over the valley.
- ◆ Cholelithic sites are to be found in Chikalda, Khedi, Badada, Mohipura, Hathnawar, Piplada, Khalghat, Maheshwar, Nawada, Todi, Kapila Sangam, Veda Sangam and Mardana.
- ◆ Rock-cut caves and sculptures are to be found at Piploda, Dharampuri, Bijagadha, Bagha and Mandogharh.

None of the archaeological sites mentioned above, that have special significance, would fall within the area of submergence of the projects.

### SURVEYS :

A survey of the 254 villages for identification of the archaeological monuments falling within the submergence area was carried out by the State Department of Archaeology and Museum, Bhopal.

Archaeological Survey of India has also completed the survey for 167 villages for centrally protected monuments for identification of the monuments of significance. Implementation of the Action Plan is already initiated.

### ACTION PLAN : State Protected Monuments :

The State Department has submitted an Action Plan for relocation of monuments of archaeological significance earlier in 1993. According to this, the archaeological mound at village Khedinema is excavated.

Later on GOMP has revised its plan as Action Plan 1997. The plan was again revised in 2002 and in the revised action plan of 2002, Shiv Mandir, Khudiyamal previously proposed for relocation has not been included for relocation due to its deterioration. Similarly as decided by the Govt., maintenance of Singaji Samadhi has been handed over to NHDC. Whereas, Tomb of Abdul Hasan, Handia Distt. Harda being a new work, not included in the relocation plan. To delete above monuments from the list of relocation, Shiv Mandir, Sarswati Kund, Harsud has been included in the list. Therefore, in revised action plan 2002, 8 monuments have been selected for relocation of which Shiv Mandir, Dharikotla and Chatri Ghisor have already been relocated. The current status of monuments is as below.

- 254 villages surveyed for identification of Archaeological monuments coming under submergence.
- 153 statues have already been collected and preserved at Museum at Dewas, Hoshangabad and Khandwa.

- **Relocation / Protection** 8 Nos. of monuments have been identified which require relocation/ protection. the remaining two viz Shiv Mandir Durga Mandir, Chandel was resurveyed. It was found that the relocation of this monument is not necessary because it is situated outside the submergence

Sl. No	Particulars				Status
	Name of mounment	Village / Tehsil	Distt.	RL in m	
1.	Shiv Mandir, Dharikotla	Harsud	Khandwa	229.500	completed
2.	Shiv Mandir, Punghat	Harsud	Khandwa	240.315	completed
3.	Shiv Mandir, Badkeshwar	Harsud	Khandwa	263.805	completed
4.	Shiv Mandir (Durga Mandir), Chandel	Khandwa	Khandwa	254.917	completed
5.	Chhatri Ghisor	Harsud	Khandwa	239.300	completed
6.	Shiv Mandir, Saraswati Kund,	Harsud	Khandwa	--	completed
7.	Ridheshwar Mandir, Handia	Harda	Hoshangabad	273.380	completed
8.	Rock-cut statues	Deyat	Dewas	267.830	completed

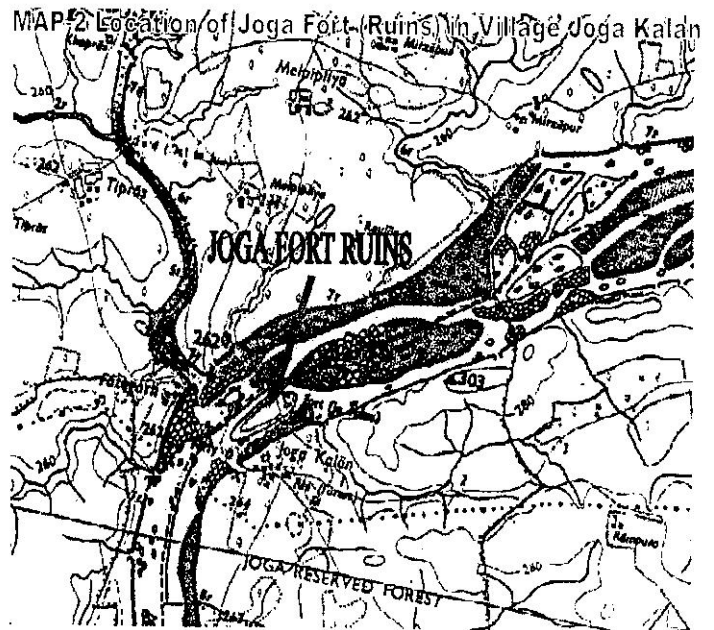
### Centrally Protected Monuments :

Archaeological Survey of India have prepared a plan for protection of monuments coming under the submergence of Narmada Sagar Complex area. According to this plan, in the area of submergence of Indira Sagar Project, only north bastion of the Joga Fort is likely to be affected by scour action of water.

### • Plan of Archaeological Survey of India

Environment Sub-group constituted a committee to look into the plans to protect the Joga Fort. The committee met twice and undertook field visits and observed as follows :

R.L.of plinth of Joga Fort	+274.80 M
R.L. of Top of Joga Fort	+ 284.75 M
R.L. of Main Gate of Joga Fort	+271.035 M
R.L. of Top of well	+ 261.39 M
F.R.L. of ISP	+ 262.10 M
Observed Highest Flood Level (54,000 cumecs)	+ 264.27 M
HFL corresponding to 1 in 100 year Flood (62,500 cumecs)	+ 265.52 M
HFL corresponding to 1 in 100 year Flood (83,366 cumecs)	+ 266.029M
BWL corresponding to 1 in 100 year Flood	+265.00 M
BWL corresponding to 1 in 100 year Flood	+ 266.637M
Water Level (20.7.98)	+ 252.00 M
River Bank	+ 259.14 M
River Bed	+ 248.00 M



From the above data, it was inferred that the, well situated in the midst of north bastion will be fully submerged at FRL + 262.10 M. However, this will remain submerged for 2-3 months during monsoon when reservoir might be at FRL.

As far as backwater effect is concerned, the temporary rise due to backwater will be about 0.60 M near well, above HFL. Archaeological Survey of India has prepared an estimate of Rs.1.50 crores for construction of a wall to protect the in-take well. It was decided that NVDA will carryout the work through NHDC under supervision/ Guidance of ASI.

NHDC has prepared an estimate of Rs.25.00 lacs for construction of protection wall, which has been approved by the Archaeological Survey of India and that NHDC was directed to carry out the work latest by Sept. 2004. The work is expected to be completed by Dec., 2004 before the full reservoir level is attained. The geological aspect of the island on which the Joga Fort is situated was examined by the Chief (Geology), NHDC and his team from 16.10.2004 to 18.10.2004 and the report is awaited.

### **Anthropological aspects:**

The Narmada Valley can be divided into three physiographic units (1) Western Vindhya (2) Narmada through West and South and (3) Western Satpuras. Some Indologists place the Narmada-Chambal civilisation of Malwa as a contemporary of Indus civilisation. Navada Toli is a site contemporary to Harappa where evidence of early farming villages were discovered. Findings of a hominoid skull from Hathnora indicated the possibilities of the existence of human bio-cultural remains within the basin.

### **SURVEYS/STUDIES :**

A series of studies have been conducted for salvaging the Narmada Basin from anthropological point of view which includes Paleo-Anthropological, human ecological, ethnography and pre-historic aspects. Besides studies on contemporary culture and collection of ethnographic specimens were collected and leading anthropologists were associated.

- Rashtriya Manav Sanghralaya has constituted a working group for the retrieval of bio-cultural material in Narmada Basin this includes studies on taphonomy and paleo ecology, excavation of upper paleo lithic sites, collection and documentation of material culture objects from tribal, artisan and folk culture.
- Survey of tribal art and handicraft entrusted to *M.P. Adivasi Kala Parishad* is completed and report is available. The report gathered details from the 24 submergence villages and identified 75 sculptors and eight groups of exhibitionists besides documentation of identified important sculptures. Cultural aspects of the tribes including marriages and their lifestyle were collected.
- The Bhil Track, a study of displaced tribal, sponsored by NVDA, of the 17 submergence villages of SSP compiled the information on their status, layout of their resettlements, construction of houses, social structure, division into clans, economic structure, in-depth, dependence on forests for living, inter-community relationship, leadership pattern, women's role, religion, superstitions and festivals.
- Besides Anthropological Survey of India has covered these studies under its own project called "People of India". The report is in 61 volumes out of which 7 volumes are under final editing.

- A Narmada salvage plan is also launched by Anthropological Survey of India.

#### **ACTION PLAN :**

- Archaeological Survey of India is carrying out excavation at selected sites.
- State Department has reviewed the Action Plan and has proposed 5 excavation sites , in addition to the earlier proposal of collection of sculptures and excavation at Khedinama.
- NVDA has also planned to establish a Centre on Religious and Cultural heritage of the Narmada Basin. Initial discussions were held with the experts by the NVDA during the meeting convened for the purpose on 11<sup>th</sup> July 2003. Decision has been taken to start this Centre in New Narmada Bhawan, located at Arera Hills, Bhopal. Commissioner, Archaeology and Museum, and other experts have been requested to give necessary documents, books, literatures and excavation materials for establishment of this Centre.

#### **IMPLIMENTATION**

- ❖ Ancient tools and artifacts were found and report is available in NCA. The entire area was scanned by the Anthropological Survey of India under Narmada Salvage Plan and some ancient tools have been found
- ❖ Excavation of the early historic mound in village Khedinama in Hoshangabad district was completed earlier during 1993-94.
- ❖ Status of works at excavation sites

#### **EXCAVATION SITES**

Bijalpur Khurd, Khandwa  
Chhalpa Kala, Khandwa  
Gajanpur, Dewas  
Nabalpura, Khandwa  
Gannaur, Khandwa

#### **STATUS**

Completed  
Completed  
Completed  
Completed  
Completed

- ❖ NVDA has also planned to establish a Centre on Religious and Cultural heritage of the Narmada Basin. Implementation is awaited.
- ❖ Anthropological survey of India has planned a detailed investigations on Narmada area implementation is awaited.
- ❖ A report on findings of the excavations is awaited from the State Archaeological Department.

#### **Summary of the Status :**

Sl. No.	Issue	Progress	Balance works
1.	Relocation of State protected monuments	Completed	
2.	Excavation of mounds by State agencies	Completed	
3.	Anthropology documented	Completed	
4.	Display at Museum	Progressing	
5.	Collection of sculpture	153 collected	30 remain
6.	Cultural Centre at Narmada Bhawan	Being formulated	Yet to be done.
7.	Centrally protected monuments	Estimates Ready	Yet to be done.
8.	Narmada Salvage Plan by Central agency	Anthropological Survey of India to start the work.	Yet to be done

**CLEARANCES ACCORDED TO ISP**  
**CLEARANCE FROM ENVIRONMENTAL ANGLE TO SSP & ISP BY MOEF**  
**GOVT. OF INDIA, MINISTRY OF ENVIRONMENT & FORESTS.**  
**NEW DELHI**

No. 3-87/80-IA

Dated 24 June, 1987

**OFFICE MEMORANDUM**

**Subject : Approval of Narmada Sagar Project, Madhya Pradesh and Sardar Sarovar Project, Gujarat from environmental angle.**

The Narmada Sagar Project, Madhya Pradesh and Sardar Sarovar Project, Gujarat have been referred to this Department for environmental clearance.

2. On the basis of examination of details of these projects by the Environmental Appraisal Committee for River Valley Projects and discussions with the Central and State authorities the following details were sought from the project authorities:

- (i) Rehabilitation Master Plan.
- (ii) Phased Catchment Area Treatment Scheme.
- (iii) Compensatory Afforestation Plan.
- (iv) Command Area Development.
- (v) Survey of Flora and Fauna.
- (vi) Carrying Capacity of surrounding area.
- (vii) Seismicity; and
- (viii) Health Aspects.

3. Field surveys are yet to be completed. The first set of Information has been made available and complete details have been assured to be furnished by 1989.

4. The NCA has been expanded and Its terms of reference have been amplified to ensure that environmental safeguard measures are planned and implemented In depth and in Its pace of Implementation part passu with the progress of work on the project.

5. After taking into account all relevant facts the Narmada Sagar Project, Madhya Pradesh and the Sardar Sarovar Project, Gujarat are hereby accorded environmental clearance subject to the following conditions :

- i. The Narmada Control Authority (NCA) will ensure that environmental safeguard measures are planned and Implemented pari passu with progress of work on projects.
- ii. The detailed surveys/studies assured will be carried out as per the schedule proposed and details made available to the Department for assessment.
- iii. The Catchment Area Treatment programme and the Rehabilitation plans be so drawn as to be completed ahead of reservoir filling.
- iv. The Department should be kept informed of progress on various works periodically.

6. Approval under Forest (Conservation) Act, 1980 for diversion of forest land will be obtained separately. No work should be Initiated on forest area prior to this approval.

7. Approval from environmental and forestry angles for any other Irrigation, power or development projects In the Narmada Basin should be obtained separately.

Sd/-  
( S. MAUDGAL )  
Director (IA)

The Secretary,  
Ministry of Water Resources,  
New Delhi.

**No. 8-646-84-FC**  
**Government of India**  
**Ministry of Environment and Forest;**  
**(Department of Environment, Forests and Wildlife),**

**Paryavaran Bhawan, CGO Complex,**  
**Lodi Road, New Delhi – 110003.**

Dated the 7<sup>th</sup> Oct. 1987.

To  
The Secretary,  
Forest Department,  
Government of Madhya Pradesh,  
Bhopal.

**Sub: Diversion of 41111.97 hectares of forest land in Khandwa, Dewas and Hoshangabad districts for the Narmada Sagar Multipurpose Project.**

Sir,  
I am directed to refer to your letter No.5/111/84/10/3 dated 15.10.1984 on the above mentioned subject seeking prior approval of Central Government under Section 2 of the Forest (Conservation), Act, 1980.

2. After careful consideration of the proposal, the Central Government hereby conveys its approval to diversion of 41,111.97 hectares of forest land in Khandwa, Dewas and Hoshangabad districts for the Narmada Sagar Multi-purpose Project as under :

Item No.	Purpose	Area (ha)
(1)	Submergence	40,332.00
(2)	Power House	50.00
(3)	Saddle Dam	37.26
(4)	Road	70.73
(5)	Colony, approach, road etc.	621.98 (already utilised before 1980)
	<b>Total</b>	<b>41,111.97</b>

3. The approval is subject to the following conditions :
- The State Government of Madhya Pradesh will intimate by 31<sup>st</sup> December, 1987, the complete details of equivalent non-forest land identified for compensatory plantation, preferably in project impact area.
  - The work of compensatory afforestation will be completed in five years time, depending upon the availability and selection of suitable area in the non forest /forest land, a detailed scheme will be prepared by the State Government showing year wise targets and expenditure, keeping in view the cost escalation on account of inflation. The project will release the amount for these annual plantation programme as per the scheme in the beginning of each financial year in the non voted fund to the Forest Department of the State Government. The State Government would ensure that these amounts would be in addition to the normal forestry budget.
  - Since the Project involves violation of Forest (conservation) Act, 1980, compensatory afforestation will be carried out over suitable degraded forest land double the diverted forest area in extent and in addition to the equivalent area in non-forest land. For this purpose, the area offered by the State Government vide their letter No. 5/III/84-10-3 dated 14.10.1986 will be accepted and compensatory afforestation raised at the cost of the project in this area.
  - The areas will be surveyed, demarcated and declared protected forests and placed under the control of the Forest Department for compensatory afforestation at the cost of the project. Areas not found suitable will be substituted by suitable area.

- v) The State Government will also intimate details of the non-forest land identified for rehabilitation of the oustees and draw up by 15<sup>th</sup> December 1987 a rehabilitation plan to the satisfaction of the Government of India.
- vi) No work on the project in forest area will commence unless conditions (i) & (v) above are fulfilled.
- vii) Under item (2) of paragraph 2 above only 50 hectares should be utilised for construction of the power house only. The proposed colony in the Power House area should be accommodated in the area of 621.98 hectares already utilised under item (5).
- viii) Sand quarry should be located in the submergence area. Therefore, the area of 72.50 hectares for sand quarries and 41.15 hectares for approach road for sand quarries is not being permitted for non-forest use.
- ix) For conservation and management of wildlife, a committee will be constituted by the State Government by 15<sup>th</sup> December, 1987 which will include a representative from the Government of India. The Committee will suggest the necessary steps to be taken and draw up a plan which will be implemented at the cost of the project.
- x) Forest clearance will be done only upto 4 M below FRL.
- xi) A plan for the treatment of the catchment area will be prepared by 15<sup>th</sup> December, 1987 and implemented at the cost of the project.
- xii) Tree planting will also be done on either side of canal road and foreshore of the reservoir and in the wasteland / vacant lands under the control of the Irrigation Department in the command area.
- xiii) Water should be supplied free of cost to the Forest Department for raising nursery and irrigated forest plantations in the command area.
- xiv) In order that the construction labour and staff while working on the project in the forest area may not cause destruction of forests for meeting their fuel wood needs, the Project Authorities will establish fuel wood depots, and will provide the fuel wood free of cost to the labourers.
- xv) Satisfactory fulfillment of the above conditions will be a deciding factor for the future proposals of the State Government for diversion of forest land under Forest (Conservation) Act, 1980

Yours faithfully,

Sd/-

( R.S. Bisht )

Under Secretary to the Government of India.

Copy to :

- 1) Chief Conservator of Forests, Govt. of Madhya Pradesh, Bhopal.
- 2) Sh. K.P. Nagaraju, Conservator of Forests ( Central), Regional Office (Central Zone), Plot No.E-1/187, Arera Colony, Bhopal.
- 3) Guard File.
- 4) Ministry of Water Resources, Shram Shakti Bhawan, New Delhi.

( R.S. Bisht )

Under Secretary to the Govt. of India.

No. 8-646/84-FC(Part) Vol-II

12 October, 1990

To

The Secretary  
Forest Department  
Department of Madhya Pradesh  
BHOPAL

Sub: **Diversion of forest land for Narmada Sagar Multi Purpose Project.**

Sir,

I am directed to refer to your letter No.F-5/111/84/10/3 dated 18.11.1987 on the above subject and to say that compensatory afforestation scheme submitted to this ministry vide your above referred letter is hereby approved.

Further additional compensatory afforestation over 150 ha. degraded forest may be undertaken as a penalty for violation of the forest (Conservation ) Act, 1980.

Yours faithfully,

Sd /-

( S. PATNAIK )

Dy. Inspector General of Forest (FC)

Copy to:

1. Principal Chief Conservator of Forests, Department of Madhya Pradesh, Bhopal.
2. Narmada Valley Development Authority, Narmada Bhawan, Tulsi Nagar, Bhopal - 462010.

Sd /-

(S. PATNAIK)

Dy. Inspector General of Forest (FC)



**GOVERNMENT OF INDIA,  
PLANNING COMMISSION**

**Yojana Bhawan,  
Parliament Street,  
New Delhi  
October 6-9-1989.**

To

The Secretary,  
Planning Department,  
Government of Madhya Pradesh  
Bhopal.

Sub: Indira Sagar Project (Narmada Sagar Project) in Madhya Pradesh – acceptance of.

Sir,

I am directed to convey that the Indira Sagar Project (Narmada Sagar Project), estimated to cost Rs1993.67 Crores (Rupees One thousand Nine Hundred Ninety Three Crores and Sixty Seven Lakhs) as per the salient features vide Annexure-I enclosed herewith, has been considered acceptable for Investment subject to the conditions as laid down below :

- i. The State shall comply with the conditions as laid down in the O.M.No.3-87/80-IA dated 24.6.1987 and letter No.8/646/84-FC dated 7.10.1987 both issued by the Ministry of Environment and Forest while according the environmental clearance and the approval for diversion of forest lands for this project respectively for this project and ensure completion of Rehabilitation and Resettlement Plan in scheduled time with close monitoring as per requirements of Department of Environment and Forest.
- ii. Looking to the size and Importance of this project, the State Government will give sufficient priority to this project in the Eighth Plan and onward by ensuring adequate funding to match with the construction schedule as indicated in the concurrence of State Planning and Finance Department vide Narmada Valley Development Department's letter No. 354/2/23/27/88 dated 22.4.1989 and confirmed subsequently by Additional Chief Secretary, Narmada Valley Development Department, Bhopal vide their Telex dated 1.7.1989.
- iii. State will establish adequate network for ground water monitoring in the command within 2 years and the State should submit to Planning Commission the time frame for establishing such network with mile-stone achievements, duly vetted through Central Water Commission, for monitoring the same by Planning Commission;
- iv. State should draw up a detailed time schedule for completion within 5 years the Investigation, detailed survey, planning and working out the detailed cost estimates for micro level network system for the balance area of the total command of this project.
- v. The state should take suitable advance measures, as may be necessary to ensure that annual revenue to be accrued from this project covers at least annual operational and maintenance charges including depreciation charges by setting the water rates suitably.
- vi. The State should draw up an implementation schedule segment-wise for completion of canal network, in such a manner that a segment of the canal network, taken up from head reaches, is completed in all respect so as to make the irrigation water available, for the design potential of that segment upto the outlet in that particular segment;
- vii. The State would ensure that completion of other ongoing irrigation and Power Projects as per their schedule by funding adequately and by ..... Special higher allocation for Irrigation ..... sector, if necessary.
- viii. Keeping in view the large magnitude of the project and its effect on Sardar Sarovar Project on downstream area; all important subsequent charges in the project planning, estimates of cost etc., will be placed before the Advisory Committee on Irrigation, Flood Control and Multi Purpose Projects every Five years.

Contd....2/

// 2 //

- ix. Planning Commission may be kept apprised of any revision in the construction schedule till completion.
2. The Project may be executed as per the approved outlay from year to year.
3. Hindi version of this letter will follow.

Yours faithfully.  
Sd/  
**( B.N. NAVALAWALA )**  
**Deputy Adviser (I&CAD)**  
for Secretary, Planning Commission

Encl: As above.

**Copy with above annexure to :**

- 1) Secretary to Chief Minister, Government of Madhya Pradesh, Bhopal – 462 001.
- 2) Chairman, Narmada Valley Development Authority, Narmada Bhawan, Tulsi Nagar, Bhopal-3.
- 3) Secretary, Narmada Development Department / Finance Department,  
Government of Madhya Pradesh, Bhopal.
- 4) Chairman, SSNNL, Block No.12, New Sachivalaya Complex, Gandhinagar - 382010
- 5) Secretary, Narmada Development Department, New Sachivalaya Complex, Gandhinagar.
- 4) Secretary, Irrigation Department, Government of Maharashtra / Rajasthan/Gujarat, Bombay-400001/Jaipur-302001/Gandhinagar-382010..
- 5) Ministry of Water Resources, Shram Shakti Bhawan, New Delhi.  
Secretary  
Commissioner (PP)

