# GOVERNMENT OF MADHYA PRADESH
# WATER RESOURCES DEPARTMENT

# BINA COMPLEX IRRIGATION
# &
# MULTIPURPOSE PROJECT

## EXECUTIVE SUMMARY

## 2014

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## 1. General

Bina Complex Irrigation and Multipurpose Project is an ambitious project of Water Resource Department of Government of Madhya Pradesh. It comprises of construction of four dams namely Madia reservoir, Dehra dam, Dhasan dam and Chakarpur dam in Sagar district.

The project having Culturable Command Area (CCA) 84,200 Ha is designed to irrigate 92,620 Ha land annually including 84,200 Ha Rabi and 8420 ha Kharif irrigation.

Project is also devised to generate hydroelectric power by two power plants with installed capacity of 2x11MW and 2x5 MW at Madia and Dehra dams respectively.

The main river borders in the State are the Chambal, Betwa and Ken (tributaries of Yamuna river), Son and Tons (tributaries of Ganga river), Narmada, Tapti, Mahanadi and Godavari.

The proposed complex project will be constructed across rivers Bina and Dhasan, which are tributaries of Betwa River and Dehra Nalla which in turn, is tributary of Bina River.

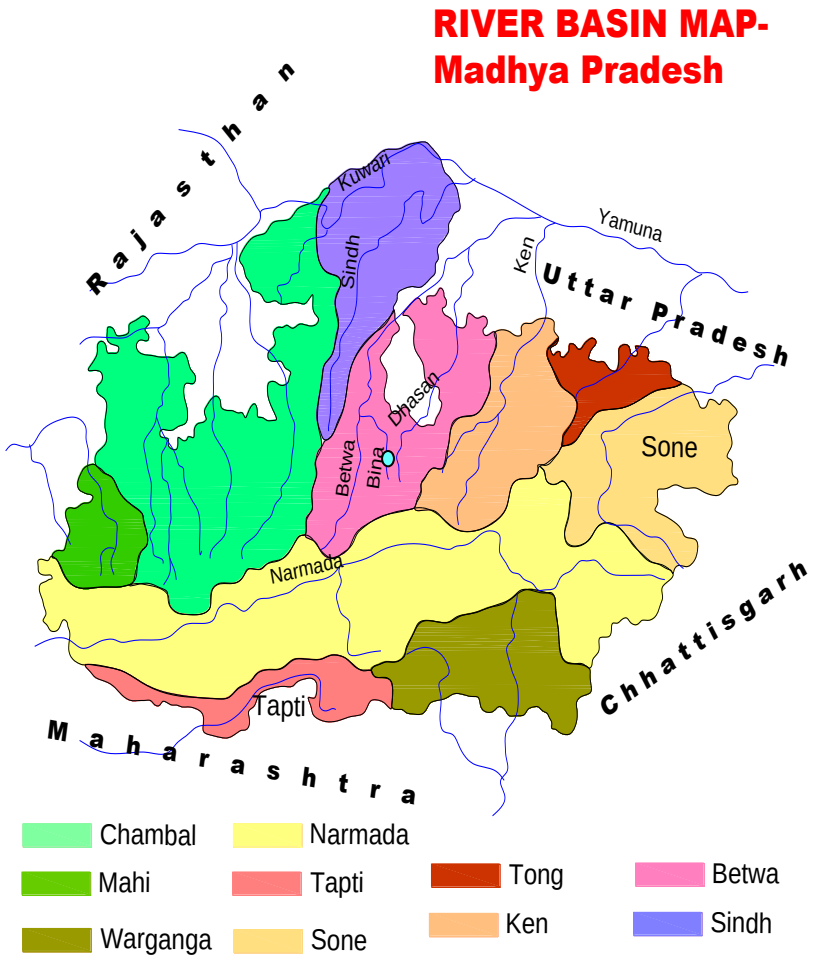



**Figure 1: River Basin Map of Madhya Pradesh**

Bina and Dhasan Rivers are among the tributaries of the Betwa River system which drains part of the M.P. and Uttar Pradesh. As all the four dams and reservoirs, canals lie entirely in M.P. State. Therefore, there are no inter-state issues as regards submergence, land acquisition or R&R.

## 2. Necessity of the Project

At present Sagar is water scarce area. At present irrigation in the project area from all sources is only 23 % of net cropped area. Since the area is dependent on rains only, water scarcity conditions exist all the time and crop yields are low and people in the area are poor. The Project area needs water for domestic and agriculture purposes. Studies carried out earlier show that the some unutilized flows are available and the physiographical conditions are also suitable for harnessing the water resources.

As per share of Madhya Pradesh under Rajghat agreement with Uttar Pradesh, an unutilized flow balance of 483.9 MCM (17.09 TMC) is available for utilization in this project and the same proposed to be utilized in the project area which has not received any water so far. Physiographically, also the project catchment comprises isolated hills and Piedoiment plain with major area forming part of the Sagar plateau. There are a number of rivers and Nallahs Big streams like Dhasan, Dehra, Kurwai apart from Bina river. The average annual rainfall in the project area is around 1200 mm which results in ample flows in these segments. The available water resources will be interlinked for optimum benefits. These resources have not been harnessed, though efforts have been going on since 1980 or even before. Apart from irrigation facilities, certain falls are also available which could be used for generation of hydro power.

With the availability of (i) Un-harnessed water source and (ii) physiographically suitable site the project is aimed to achieve the following objectives.

(i) The project is essentially aimed at raisin agriculture production and form incomes by providing irrigation to new areas. This will increase the general standard of living of the people in the project area.
(ii) Availability of falls will facilitate production of Hydro-Power.
(iii) The reservoirs will provide an excellent opportunity for development of fisheries which would yield additional annual revenues. In addition the sites will provide excellent picnic sport resulting in addition of the economic wealth of the people of the area.
(iv) The project will provide employment to thousands of people and will help in improving the financial condition of the people of this area.
(v) Suitable water allocations have been made for domestic and industrial water supplies to provide healthy living and use in industry.

## 3. Project Layout and Location

The Bina Complex Irrigation and Multipurpose Project is aimed for hydroelectric power generation and irrigation purposes. The project will include following components:

1 Construction of Earthen Dam across Bina River near village Madia, in Rahatgarh Tehsil of Sagar District for irrigation purposes:
2 Construction of Dehra Dam across Dehra Nala
3 Dhasan Diversion Dam at Dhassan River and Feeder Canal to divert its water to Dehra Dam.
4 Chakarpur Dam in 22 km down stream of Bina Dam to arrest tail water from Madia and Dehra Power House for irrigation purpose,
5 Hydropower houses at Madia and Dehra Dams.

As part of the complex project, water flow of Bina River will be arrested and stored in earthen dam near village Madia in Rahatgarh Tehsil of Sagar District in the dam namely, Madia dam. To exploit the hydro-electric power potential of Madia Dam, underground power house with installed capacity of 2x11 Mw is also proposed at this location.

Water flow of Dhasan River will be arrested and stored in a dam namely Dhasan dam which in turn will be diverted to Dehra dam construced across Dehra Nalla through a feeder canal. To exploit the hydro-electric potential of water stored in Dhasan and Dehra dams surface power house is proposed on Dehra dam with installed capacity of 2x5 MW.

Tail water from Madiapower house will flow in Bina river and 22 km down stream of Madia Dam, it will be arrested at another dam namely Chakarpur dam, constructed near Village Bhulna Bhangarh. Tail water from Dehra power house will also ultimately met Bina River and arrested at Chakarpur Dam. Water stored at Chkarpur Dam will be adequate enough for irrigation releases. Therefore, main canal will be constructed for target annual irrigation 92,620 ha in CCA of 84,200 ha in canal command. Schematic layout plan of the complex project is shown in Fig-2.

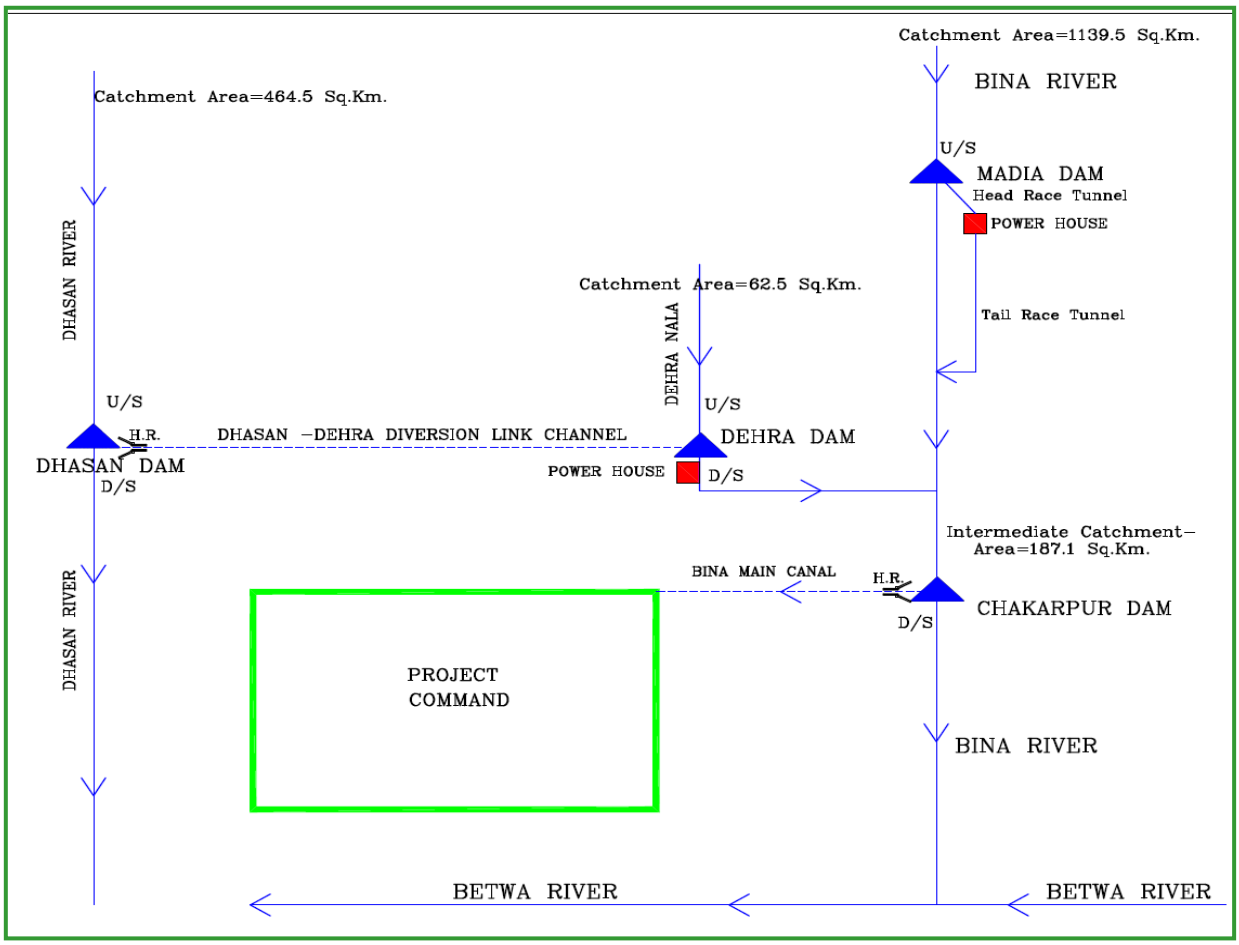



**Figure 2: Schematic Diagram for Bina Irrigation and Multipurpose Project**

The Madia dam site is located at longitude 78˚23’24” and latitude 23˚45’11” in Sagar Tehsil of Sagar District, Sagar Town, the district headquater of Sagar district by an approach road of 1½ km. towards Rahatgarh water fall from the bifurcation at 42 Km on Sagar – Bhopal National Highway.

The Dhasan dam site is located at longitude 78˚33’49” and latitude 23˚49’33” at Dhasan river about 26 Km from Sagar on Sagar-Rahatgarh Road.

The Dehra dam site is located at longitude 78˚26’37” and latitude 23˚48’11” on Dehra Nalla about 36 Km from Sagar on Sagar-Rahatgarh Road.

The Chakarpur dam site is located at longitude 78˚23’16” and latitude 23˚50’27” at Bina river about 50 Km from Sagar on Sagar-Vidisha Road.

Key location map of various components of Bina Complex Irrigation and Multipurpose Project are given in **Figure 3.**

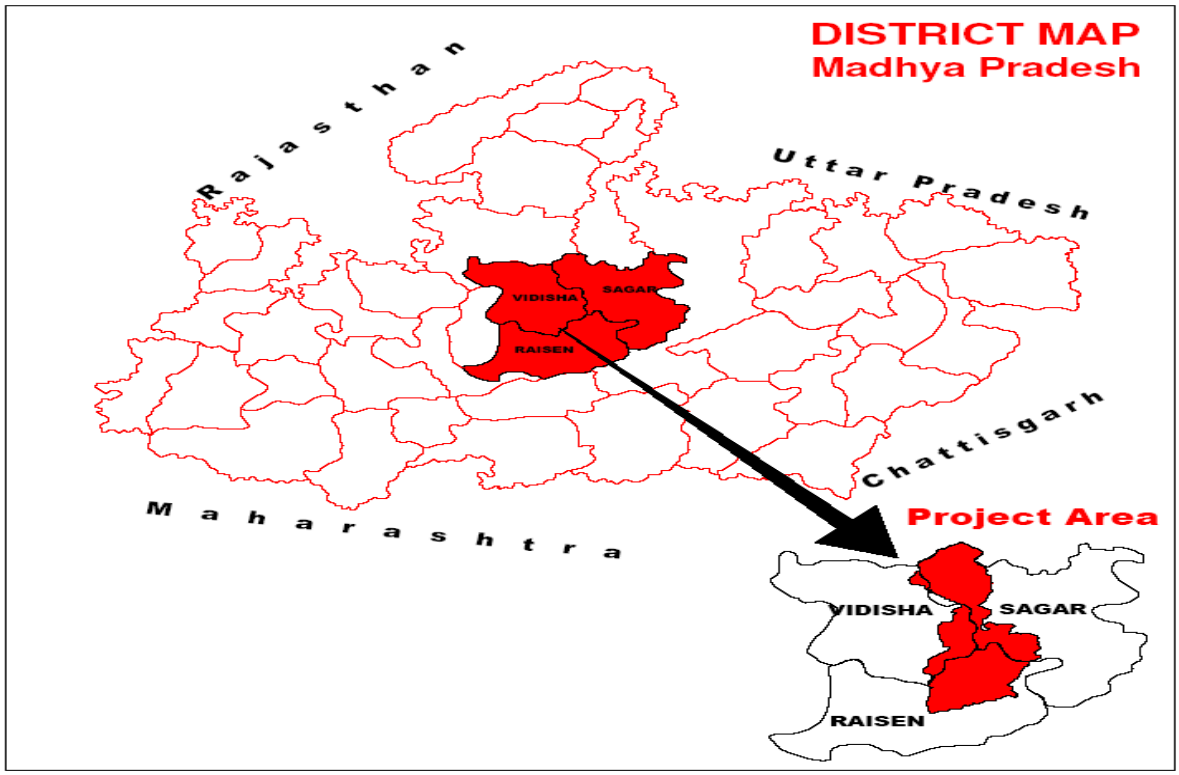



**Figure 3: Location Plan of the Project**

## 4. Betwa River Basin – Bina and Dhasan Rivers

Bina river rises at an elevation of about 596 m near Dahgaon village of Gairatganj Tehsil of Raisen District. It traverses a distance of about 146 km before its confluence with Betwa near village Perotha in Kurwai Tehsil of vidisha district. The main sub-tributaries of Bina are Penti, Bagana and Dhadhar. The site of main dam, Madia is located at longitude $78^0$23'17'' East and latitude $23^0$45'04'' North, some 1.5 km upstream of Rahatgarh Falls near village Madia in Rahatgarh Tehsil of the Sagar district. The site of storage dam and canal headworks is located near village Chakarpur (village Bhulanabhangarh), about 22.95 km downstream of the main dam at Madia. The catchment areas drained by Bina river at the main dam and upto canal headworks near Chakarpur are 1139 sq. km and 1389 sq. km respectively. The Dehra nallah originates at an elevation of about 643 m near Kalipathar reserved forest and after flowing for a length of about 27.4 km meets the Bina river at an elevation of about 440 m. It drains a catchment of about 62.5 sq. km up to the proposed dam site on Dehra nala.

The Dhasan, a major tributary of Betwa, originates at an elevation of 714 m in village Jasarathi of Begumganj tehsil of Raisen district of the State. The proposed site of the dam across Dhasan river is located in the initial reach of the river and upstream of village Bhainsa in Sagar tehsil of Sagar District. The river drains an area of about 464.5 $km^2$ (including 49.5 $km^2$ catchment of Lotna nala) up to the site of the dam.

**Inter-state Aspects**

Bina and Dhasan rivers are among the tributaries of the Betwa river system which drains part of the M.P. and Uttar Pradesh. As all the four dams and reservoirs, canals lie entirely in M.P. State. Therefore, there are no inter-state issues as regards submergence, land acquisition or R&R.

With regard to sharing of Betwa river waters, however, is an interstate agreement which was reached in the year 1972 in between the two states for implementing the Rajghat Dam project on the main Betwa River. This allocated 53 TMC (1500 MCM) for use by M.P upstream of Rajghat. As per the indicative master plan prepared by the M.P State for Betwa, the status of committed water use u/s of Rajghat dam is as under:

| S.No. | Schemes | Utilisation, $Mm^3$ | Utilisation, TMC |
|---|---|---|---|
| 1 | Existing Schemes | 536.45 | 18.94 |
| 2 | Under construction Scheme | 364.76 | 12.88 |
| | **Total** | **901.21** | **31.82** |

Of the total utilization of 684 $Mm^3$ proposed under the Bina project, about 165 $Mm^3$ will be from Dhasan waters and remaining 519 $Mm^3$ from Bina River. Since Dhasan joins the Betwa d/s of Rajghat site, the use of Dhasan waters is excluded while assessing the total water use u/s Rajghat. Adding to the committed water use u/s of 901 $Mm^3$ to that proposed under the future schemes, the total planned use u/s Rajghat works out to 1420 $Mm^3$ or about 50.14 TMC against the present allocation of 53 TMC.

It may be mentioned that proposed water transfer through ken- Betwa Link under the National Perspective Plan would augment water availability to down stream riparian, Uttar Pradesh. M.P. State which is the upper riparian will have the opportunity to seek higher allocation for use of Betwa river system waters by principle of substitution.

## 5. Project Description

Salient Features of the Project and site plan for the various components of the project is shown in **Annexure-I** and **Annexure-II** respectively**.** Various components of Bina Complex Irrigation and Multipurpose project are discussed in detail in following sub sections:

### 5.1 Madia Dam

Dam will be constructed across Bina River near village Madia in Rahatgarh Tehsil of Sagar District. Madia Power House is proposed to be constructed on the downstream side of Madia Dam on Bina River. The Power House will be located on the left bank side downstream of Rahatgarh falls near village Gawri. The water from the Madia dam reservoirs is proposed to be released for irrigation through the Power House. After generation it will be picked up at Chakarpur pick up weir from where irrigation canal takes off. The Madia dam Power House will be a peaking station season from June to October every year. Releases from the reservoirs will be done for Rabi Crop from October to March using full live capacity of the reservoirs. The generation of power can be done throughout the year using canal releases from Madia reservoirs as per release schedule given.

The Madia Power House generates maximum power during the month of February when the discharge through the turbines will be maximum at a value of 72.95 cumecs which is the average canal release during that month. The net operating head is 34.8m. The installed capacity of two turbines installed is 11 MW. The units are proposed to be operated with 10% overloading also.

**Madia Surface Power House**

A surface Power House has been provided for housing two units of 11MW each. It is in a pit. Vertical type Francis Turbines are provided. The overall dimension of the power house unit bays is 38.0 m x 22.0m. A service bay of size 22.0 m x 22.0 m is provided.

The water after generation of power in the power house leaves through the draft tubes and flows through the tail pool. After the tail pool water enters into the Tail Race channel. The length of the Tail race channel is 2220 m. Whole length of the channel is in cutting. Water from the Tail Race channel finally joins the Bina River.

Madia dam will cover 7137.78 ha area under submergence. Break-up of total land to be acquired for submergence for Madia Dam is given in **Table below**:

**Break up of Land to be acquired for Madia Dam**

| **Components** | **Area** |
|---|---|
| Forest Land | 130.98 ha |
| Agricultural Land | 6326.345ha |
| Revenue Land | 680.455 ha |
| Built up land | -- |
| **Total land** | **7137.78 ha** |

Layout plan for Madia Dam is shown in **Figure 5**

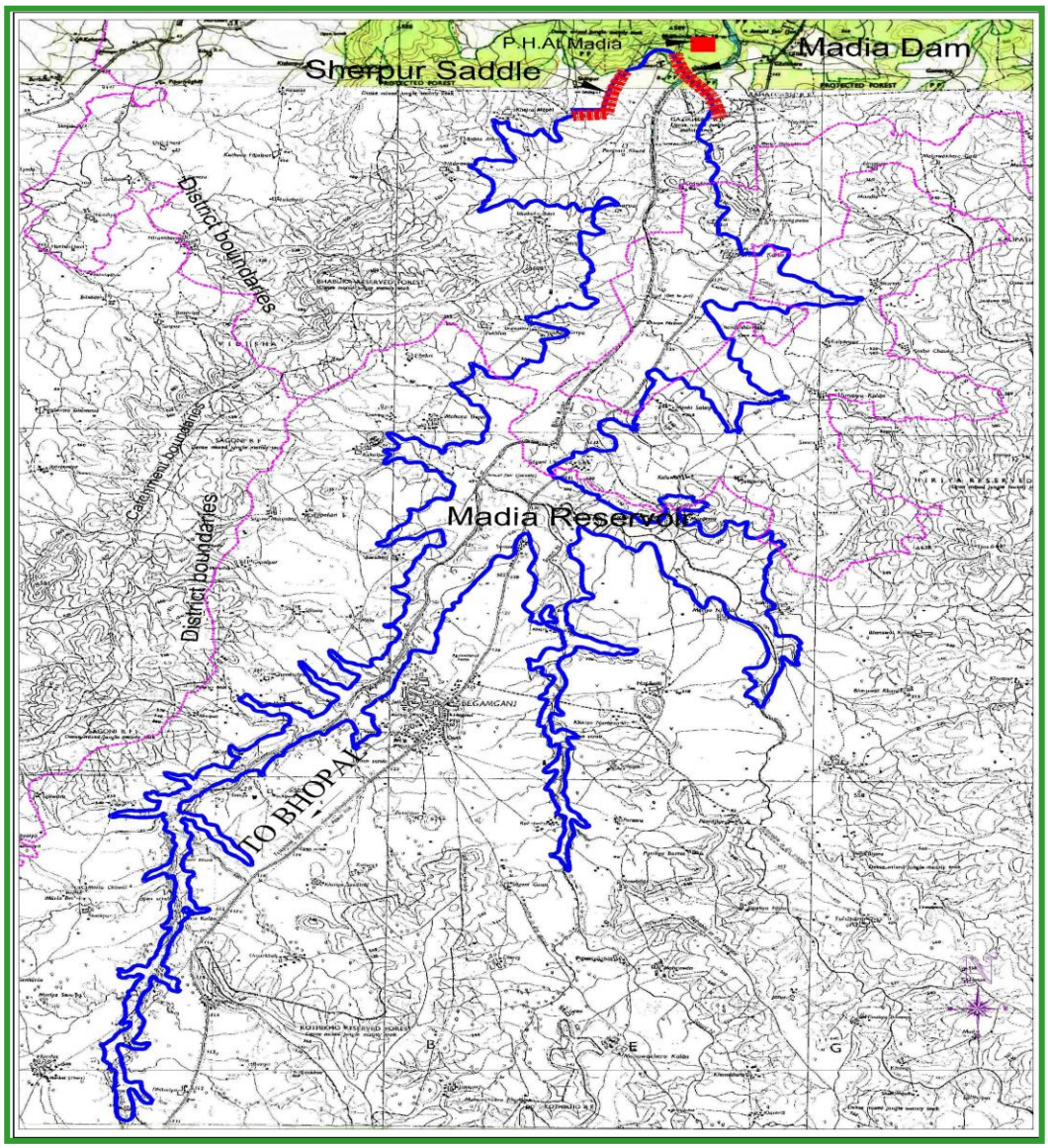



**Figure 5: Layout Plan for Madia Dam**

## 5.2 Dehra Dam

As a part of the project, a concrete dam has been proposed just upstream of Dehra falls (latitude 23˚48'20", longitude 78˚26'20") water stored at Dhasan dam will also be diverted to Dehra Dem by feeder canal. To exploit the hydropower potential, surface power house will be constructed at the Dehra Dam. Live storage capacity of Dehra Dam will be 72.255

MCM at 496 m FRL. To exploit hydro power potential of Dehra Dam, surface hydro power house of 2 x 5 MW (10 MW) capacity will be constructed.

Dehra Dam tail water is also proposed to be utilized for power generation at Dehra Power house during 5 peaking hours daily. The tail water from power house will be taken to the Chakarpur dam through the Dehra Nallah.

The Dehra Power House is proposed as a surface power house of 2 x 5 MW installed capacity. Both are planned as peaking power stations to generate power for 8 hours daily.

The schedule of Canal releases from the Madia and Dehra reservoirs have been worked out proportionate to their live storage during Rabi season and the discharges are used for generation of power. The water from Dhassan reservoir is passed through a link canal to the Dehra reservoir and power is proposed to be generated at Dehra falls. Water from Madia reservoir released for irrigation is proposed to be passed through the Madia Power house for power generation. Water from Madia and Dehra Reservoirs finally gets collected in the Chakarpur reservoir on Bina River from where the irrigation canal takes of.

The schedule of canal releases from Madia Reservoir and Dehra reservoir is worked out based on following assumptions.

- The Power house at Madia and Dehra Dam shall operate for 8 hours during a day as peaking stations for 6 months from October to March using full live capacity of reservoirs.
- Reservoir will be filled up during monsoon season from June to September and power shall be generated by utilizing the spilling water after the reservoir is full which normally occurs during August and September.
- During the 6 months from April to September, power shall be generated by utilsing the releases from the reservoir for irrigation and domestic and industrial water supply also in addition to spilling water. If spill water is available as surplus then the power generation can be extended upto 24 hrs.
- Canal releases from the reservoir will be made as per actual requirement at Chakarpur Dam for releasing in the main canal. The releases from Chakarpur reservoir will be for 24 hours daily whereas the releases through power houses will be made daily for 8 hours only and water will have to be stored in the Chakarpur Dam reservoir temporarily for some hours. Daily variation shall be taken into account for fixing the capacity of the Chakarpur Reservoir

Dehra dam will cover an area of 754.56 ha under submergence. Break-up of total land to be acquired for submergence is given in **Table below:**

**Break up of Land to be acquired for Dehra Dam**

| **Components** | **Area** |
|---|---|
| Forest Land | 378.63ha |
| Private Land | 335.971ha |
| Revenue land | 40.00 |
| Total land | 754.6 ha |

Layout plan for Dehra Dam is shown in **Figure 6.**

## 5.3 Dhasan Diversion Dam– Feeder Scheme

Dhasan is an independent tributary of Betwa River but offers cost effective option for augmenting the Bina river supply for the project. Dhasan dam is storage cum diversion dam in order to provide the requisite total back-up storage in the system. The reservoir levels for Dhasan storage are therefore decided from overall live capacity requirements for the project as a whole besides its own hydrology and site conditions, for storage and river diversion. The recommended dam site is located some 8 km upstream of the earlier site and is upstream of village Bhainsa.

Dhasan dam as feeder scheme will be constructed across Dhasan River. Water from Dhasan dam is proposed to be diverted to Dehra Dam through feeder canal of approximately 6 km in length.

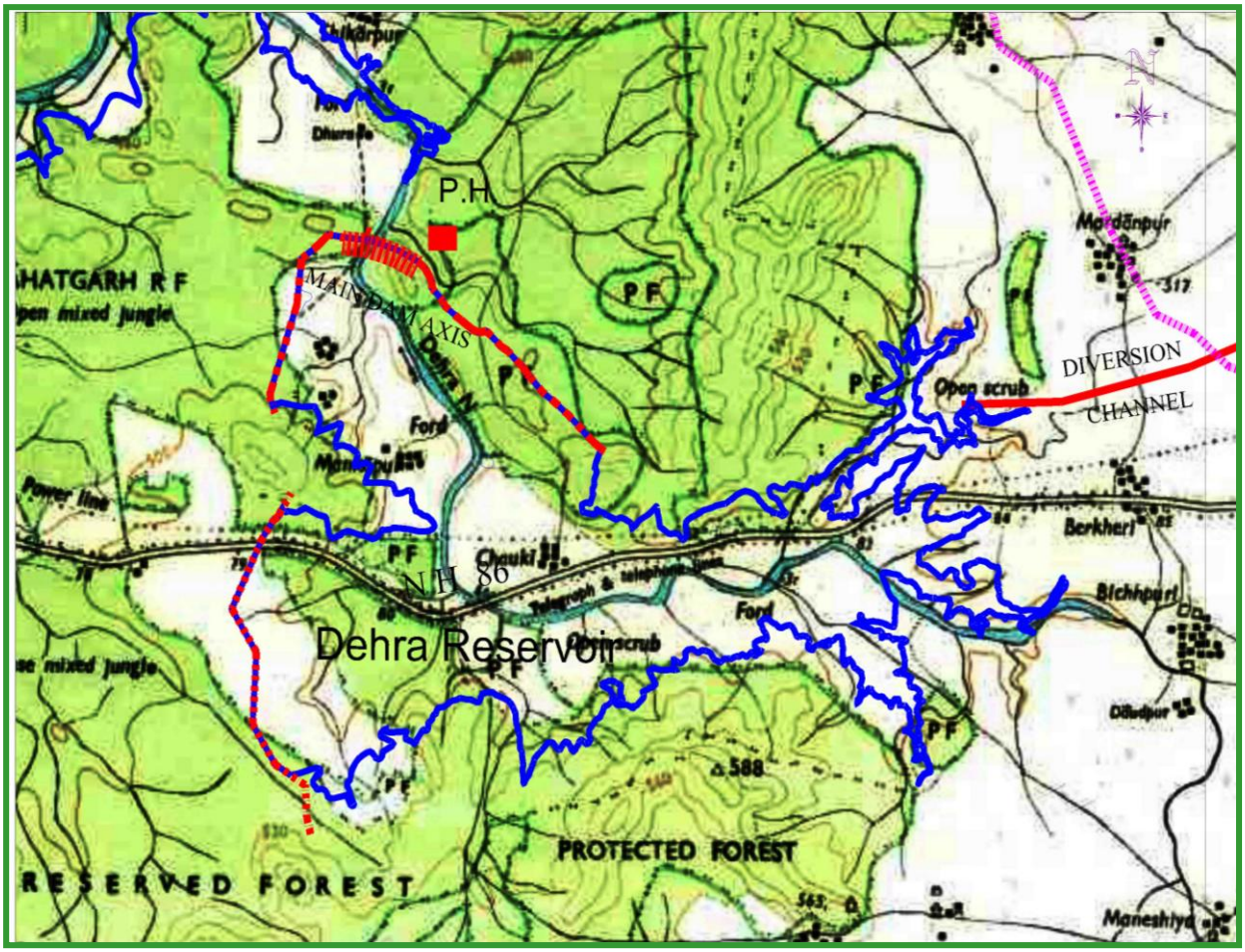



**Figure 6: Layout Plan for Dehra Dam**

## 5.4 Dhasan Dam

Live storage capacity of water in the Dhasan dam will be 80.5 MCM capacity, proposed to be released during October to March as per monthly schedule.

Dhasan dam will cover an area of 2432 ha under submerge. Total land to be acquired for submergence for the dam is 2432 ha agricultural land. No forest land is involved in this dam.

The Dhasan dam is proposed to be filled up during monsoon season from June to September every year. Releases from the Dam will be done for Rabi crops from October to March. Therefore, generation of power at Dehra can be done mainly during October to March. However, power can also be generated during April to September using feeder canal releases during this period.

The total length of the dam is 7402 m (Concrete and Earth and Rock fill Dam)

Layout plan for Dhasan Dam is shown in **Figure 7.**

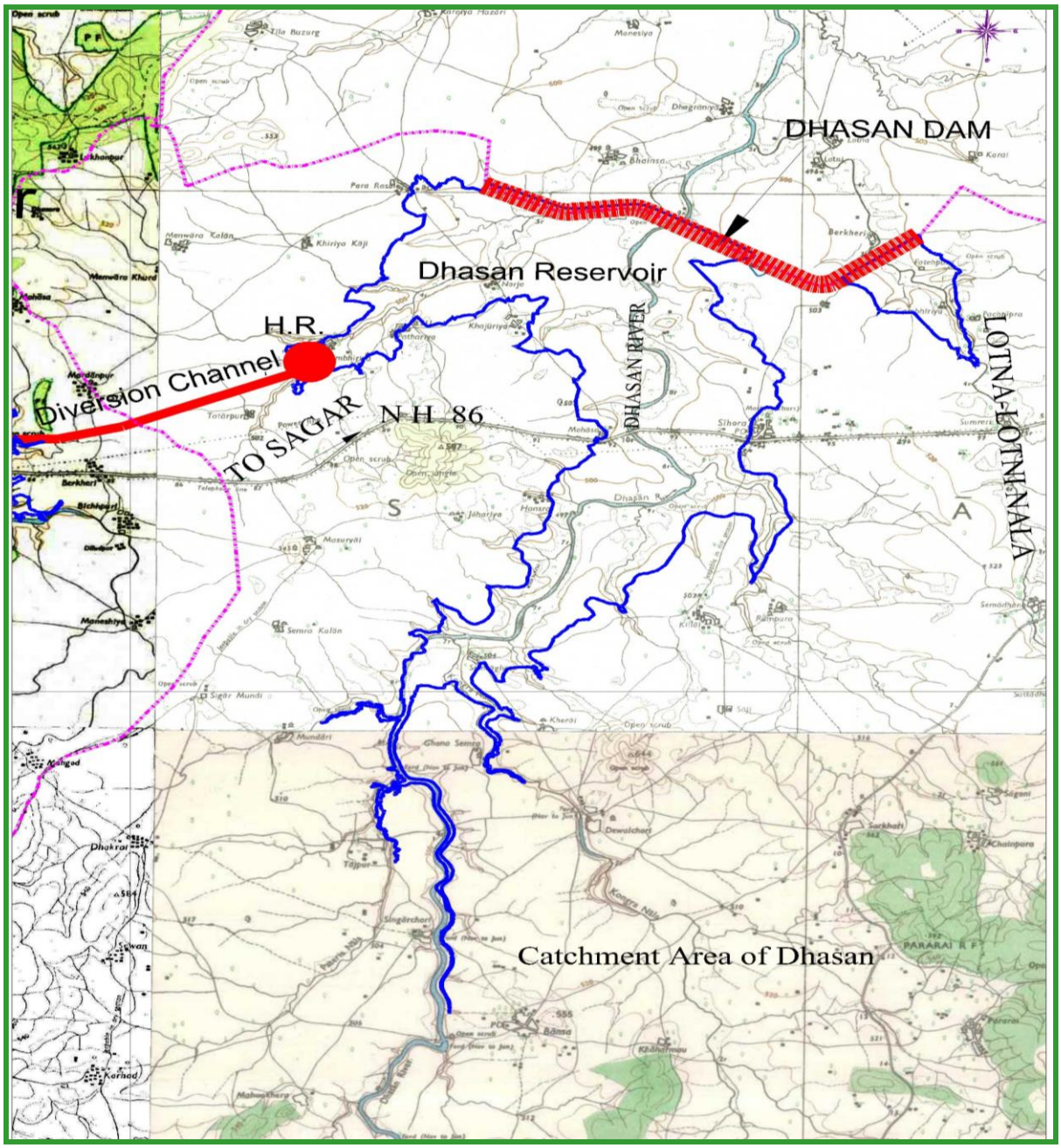



**Figure 7: Layout Plan for Dhasan Dam**

## 5.5 Chakarpur Dam

After Madia Power House, tail water will be stored at Chakarpur dam, which is proposed on Bina River nearly 22 km downstream of the Madia Dam. The tail water from Dehra power house will also be taken to the Chakarpur dam through the Dehra Nallah, which ultimately meet Bina river before Chakarpur dam. Live storage capacity of water in the Chakarpur dam will be 72.89 MCM capacity, which is proposed to be used for irrigation purpose through canal network system for canal command area of about 84,200 ha Bina and Khurai tehsils.

The location of Chakarpur dam site with FRL 451.50 m is recommended for approval by WRD. The location of head regulator (outlet) for Bina Main Canal take off will be on right

side of the reservoir that will be connected by 1060 m long approach channel that will pass through Nallaha in the forest area. The FSL 443.50 M for Bina Main Canal has been considered for canal operation.

Layout plan for Chakarpur dam is shown in **Figure-8**

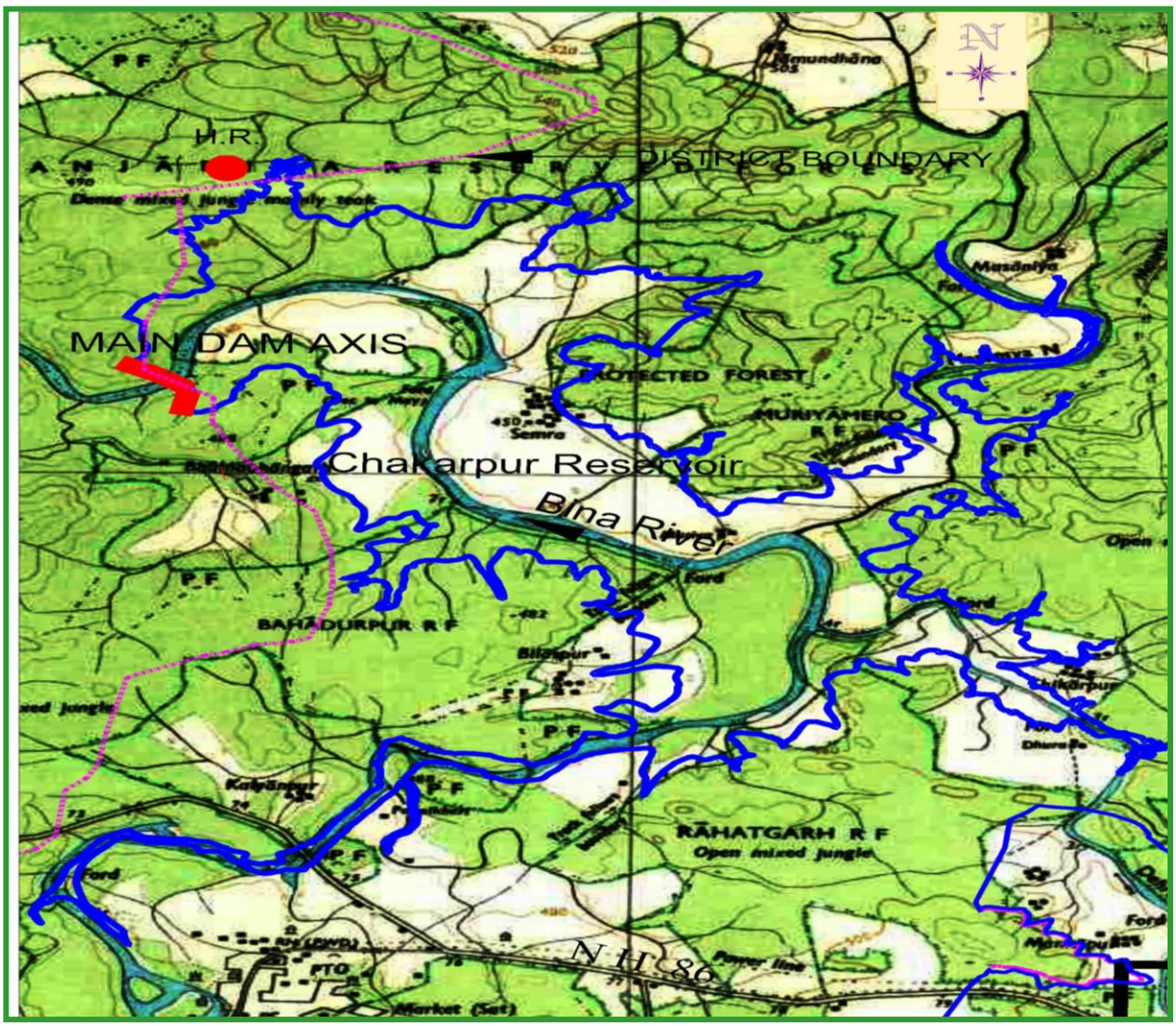



**Figure-8: Layout Plan for Chakarpur Reservoir**

## 5.6 Canal system

The command area lies in Bina, Khurai of Sagar District and Kurwai tehsils of Vidhisha district. The proposed project comprises of 5 primary/main canal system- Bina main canal (Length=6511.00 m), Khurai Branch canal (Length = 38992.25 m), Dhikua-Hardua Sub-branch canal (Length = 16375.35 m), Kanjia Sub-branch canal (Length = 29925.79 m), Khurai Sub-branch canal (Length = 15115.99 m), Malthone Canal (Length= 35000m) and its distributaries and minors offtaking from these main canals. Most of the irrigation is served by Khurai branch canal which offtakes from Bina main canal near Todakachhi Village. The command area is surrounded by Bina River in the east which joins the Betwa River and Narain River in the west.

The CCA covered by these canals along with their capacities at head and length are given in below in table and Canal command area map is shown in **figure-9.**

| S. No | Canal | Off take RD/ Channel | Length | CCA Coverage | Head Discharge |
|---|---|---|---|---|---|
| | | m | m | ha | Cumecs |
| 1. | Bina Main Canal | 0 of Chakarpur dam | 6511 | 3016.34 | 41.673 |
| 2. | Khurai Branch Canal | 6511m of Bina Main canal | 38992.25 | 20943.49 | 39.770 |
| 3. | Dhikua-Hardua Sub-Branch Canal | 26588.972m of Khurai BC | 16375.35 | 16531.37 | 9.59 |
| 4. | Kanjia Sub-Branch Canal | 26588.972m of Khurai BC | 29925.79 | 18584.75 | 10.98 |
| 5. | Khurai Sub-Branch Canal | 26588.972m of Khurai BC | 15115.99 | 11605.16 | 6.794 |
| 6 | Malthone Branch Canal proposed | Bina main canal | 35000.00 | 13519.00 | 13.51 |
| | | **Total** | **141920.38** | **84200.11** | |

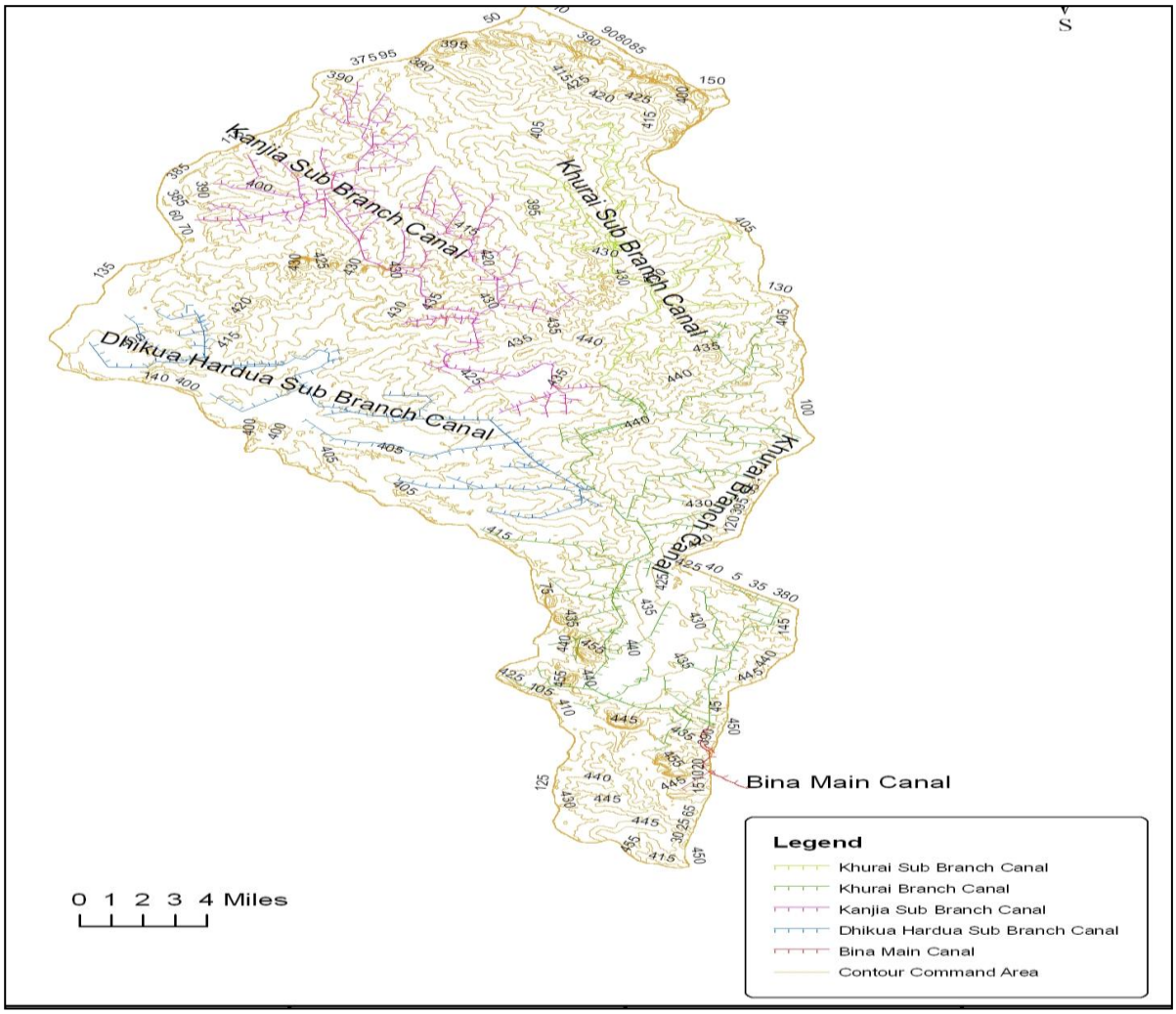



**Figure 9: Canal Command Area**

## 6. Hydrology and Sedimentation Studies (APPROVED BY CWC)

**Design Flood Studies for Reservior**

Estimation of design floods is an essential pre-requisite for rational and safe design ofmajor hydraulic structures. The proposed BINA Complex comprises of four such structures- two dams on river Bina viz. Madia and Chakarpur dam, one on Dhasan and a dam on Dehra nallah, According to IS-11223 (1985) selection of design flood is governed by the gross storage and hydraulic height of dam. Considering the proposed storage and height particulars of these structures, the Probable Maximum Flood (PMF) are selected for design of the spillway and checking safety of dam against overtopping

**Database and Methodology of Design Flood Studies and Results**

Synthetic unit hydrographs are derived making use of the relationships between unit hydrographs parameters and the physical parameters of the catchment as given in CWC Flood Estimation Report for Betwa Sub- zone 1 (C). The estimates of probable maximum and standard project storms were obtained from CWC Dam Safety Assurance and Rehabilitation Project: Generalized Preparation of New PMP Atlas Ganga River BasinVolume I: Main Report (May 2013). Total study is based on the Data obtained from New PMP ATLAS Ganga River Basin Volume I: Main Report (May 2013). The project was designed for design flood at the Four Dam Sites as 6012.2 cumec for Madia, 3011.6 cumec for Dhasan, 932.4 cumec for Dehra and 7587.8 m for Chakarpur reservoir.

**Sedimentation Studies**

No river sediment observations are available at the proposed sites of reservoirs or in their vicinity. Data on silt rates derived from re-surveys of reservoirs intercepting comparable catchment are also not available. However, some results have been reported for major reservoirs in the region, built on very large catchments, viz. Matatila reservoir on Betwa river receiving sediment transported from a catchment of 46,370 sq. km. The average sedimentation index at matatila reservoir based on survey from 1994 is reported to be 4.69 ha-m per 100 sq. km of catchment per year. Considering the large presence of heavy soils, and forested nature of upper watersheds, and in view of the sediment control measures proposed, an average annual sediment inflow rate of 5 ha-m per 100 sq. km. is considered more than adequate and adopted for provision of siltation in storage planning.

## 7. Importance of the Project

The Bina complex irrigation and multipurpose project is proposed to be constructed to obtain the following benefits:

a) **Irrigation Benefits**: From diversion of water to the extent of 610Mm³. Canal Command Area (CCA) that can be covered is 84,200 Ha in Rabi season. Annual irrigated area is 92.620ha approximately. The command area in Bina and Khurai and malthonTehsils is almost flat. Thus, this area may be increased after the survey of command area and finalization of canal network.

**b) Power Benefits:** Two power houses, one underground at Madia Dam with 2x11 MW installed capacity and another on surface at Dehra Dam with 2 x 5MW are proposed to be constructed. The total annual energy generated will be as below

i) Madia Power house – 43.25 Million units

ii) Dehra Power house – 11.94 Million units

Total 55.19 Million units

## 8. Total Estimated Outlay on the Project

Total outlay on establishment charges for unit - I , unit- IIand Unit - III are given below:

| Unit | Estimated Cost (crores) |
|---|---|
| Bina Project | |
| Unit – I Head Work | 970.605 |
| Unit – II Canal | 376.232 |
| Unit – II Hydro. Power | 167.74 |
| **Total :-** | **1514.578 Crores** |

## 9. Land Under Submergnce

Ownership status of land to be acquired for the Bina Irrigation and Multi-purpose project is mentioned in the table below:

District Forest Officer, District Sagar has reported 1024.44ha. land coming under submergence of Bina Complex Project. In this regard, Stage-1 case has been submitted to CCF Sagar.

| ***Components*** | **Forest Land (ha)** | **Private (Agricultural) Land (ha)** | **Revenue Land (ha)** | **Built up land (ha)** | **Total** |
|---|---|---|---|---|---|
| Madia Dam | 130.98 | 6326.345 | 680.455 | 0 | 7137.78 |
| Dhasan Dam | 0 | 2189.00 | 243.00 | 0 | 2432.00 |
| Dehra Dam | 378.63 | 335.971 | 40.00 | 0 | 754.601 |
| Chakarpur Dam | 462.53 | 818.97 | 68.00 | 0 | 1349.50 |
| Diversion Road | 26.30 | 0 | 0 | 0 | 37.00 |
| Main Canal | 10.00 | 0 | 0 | 0 | 10.00 |
| Power House | 16.00 | 0 | 0 | 0 | 16.00 |
| **Total** | **1024.44** | **9670.286** | **1031.455** | **0** | **11736.881** |

## 10. Prediction of Impacts

**The impacts on various aspects of environment are briefly described in the following sections:**

### 10.1 IMPACTS ON LAND ENVIRONMENT

**a) Construction Phase**

The congregation of labour force is likely to create problems of sewage disposal, solid waste management and felling of trees for meeting fuel requirements, etc.

During construction phase, various types of equipment will be brought to the site. These include crushers, batching plant, drillers, earth movers, etc. The siting of these construction equipment would require significant amount of space. In addition, land will be required for storage of various construction material as well. Efforts shall be made that such facilities are located on government or panchayat land only and to the extent possible away from human population, so that hardships caused as a result of land acquisition, though temporarily on this account are minimized to the extent possible.

The runoff from various construction sites, will have a natural tendency to flow towards along with the natural drainage. Thus, the disposal of drainage effluent with such high turbidity levels is bound to affect the water quality, especially in the lean season. The drains/nallahs close to various construction sites along the canal alignment are seasonal in nature. Normally in such rivers biological productivity is not high. Hence, the increase in turbidity levels are not expected to be significant in nature.

b) **Operation Phase**

**Acquisition of land**

**The total land to be acquired for the project is 11763.81 ha.**

As a part of CEIA study, DPR, appropriate compensatory measures as per the ownership of the land to be acquired shall be formulated.

**Change in land use pattern**

The proposed project envisages irrigation over an ICA of 92,620 ha including 8420 ha in Kharif and 84,200 ha in Rabi season. The project CCA of the project is 102,500. The project will lead to increase in cropping as well as irrigation intensity. As a result, barren land will be converted into productive agricultural land, which will be a positive impact.

## 10.2 IMPACTS ON WATER RESOURCES AND QUALITY

### a) Construction Phase

**Impacts due to sewage generation from labour camps**

The total domestic water requirements of the labour population (including families) is expected to be of the order of 0.54 mld @ 135 lpcd. It is assumed that about 80% of the water supplied will be generated as sewage. Thus, the total quantum of sewage generated is expected to be of the order of 0.43 mld. The above pollution loading is likely to be spread over 2 to 3 labour camps. The disposal of sewage without treatment could lead to adverse impacts on land environment or water environment in which the effluent from the labour camps/colonies are disposed. It is recommended that a sewage treatment plant be commissioned at various labour colonies for treatment of sewage prior to disposal.

**Impacts due to runoff from construction sites**

Substantial quantities of water would be used in the construction activities. With regards to water quality, waste water from construction activities would mostly contain suspended impurities. Adequate care should be taken so that excess suspended solids in the wastewater are removed before discharge into water body.

### b) Operation Phase

**Impacts on downstream users**

The water availability in rivers Dhasan, Bina and Dhasan has been studied as a part of the PFR. The annual water availability at various diversion structure sites is as follows:

- Madia Dam : 294.1 MCM
- Dhasan Dam : 116.4 MCM
- Dehra Dam : 17.1 MCM
- Chakarpur Dam : 51.0 MCM

As part of EAI study, impacts on downstream users due to diversion of water for irrigation will be studied and provision of release of minimum flow will be covered as a part of the Environmental Management Plan.

**Impacts on waterlogging and soil salinity**

The increase in water availability can lead to waterlogging in the command area. This aspect will be covered in greater detail as a part of the DPR and CEIA study preparation.

**Changes in water quality due to increased use of fertilizers**

With the introduction of irrigation, use of fertilizers is likely to increase, to maintain the increased levels of production. The drainage system (natural or man-made) is likely to contain much higher level of nutrients. The climatic conditions in the project area too is suitable for the proliferation of eutrophication in the project area. Thus, in the project operation phase, there will be increased probability of eutrophication in the water bodies receiving agricultural runoff. As a part of Environmental Management Plan, appropriate control measures shall be recommended as a part of CEIA study.

## 10.3 IMPACTS ON TERRESTRIAL ECOLOGY

### a) Construction Phase

**Flora**

Workers and other population groups residing in the area may use fuel wood (if no alternate fuel is provided) for whom firewood/coal depot could be provided. In absence of alternative source of fuel, the labour population would resort to cutting of trees and vegetation in areas close to various construction sites. Hence, to minimize such impacts, community kitchens or fuel depot has been recommended.

**Fauna**

During construction phase, a large number of machinery and construction labour will have to be mobilized. This activity may create some disturbance to the wildlife population. The forest area shall not be covered for irrigation. The area which is to be irrigated, and comprises mainly of agriculture land interspersed with settlement. As a result of absence of forest or vegetal cover in the command area and increased level of human interferences in the area, wildlife is generally absent in the area.

**b) Operation Phase**

**Impacts on vegetal cover**

The proposed project envisages acquisition of 11706 ha of land. About 717.849 ha of forest land is to be acquired for the project. The impacts on forests due to the project will be covered as a part of the EIA study report. The density of trees and major tree species are given in Table below**:**

Major tree species and tree density in submergence area

| S.No. | Reservoir | No. of species | Tree density (No/ha) | Major tree species |
|---|---|---|---|---|
| **1** | **Madha Reservoir** | **25** | **128** | ***Butea monosperma, Bombax ceiba*** |
| **2** | **Dehera Reservoir** | **21** | **128** | ***Acacia Arabica, Azadirachta indica*** |
| **3** | **Chakarpur Reservoir** | **24** | **132** | ***Mangifera indica, Acacia arabica*** |
| **4** | **Dhasan Reservoir** | **16** | **84** | ***Butea monosperma,Jatropha curcas*** |

On the other hand, with the increase in irrigation intensity, the vegetal cover is expected to improve significantly. As a part of the project, it is proposed to develop plantation along main canal and distributaries. This is expected to have a positive impact on the ecology of the area.

The introduction of irrigation in the area will increase the agriculture production of the area, leading to the increased availability of fodder as a result of increased agricultural by products and residues. The increased level of fodder availability, would reduce the presence on existing pasture and vegetal cover, which is a significant positive impacts.

**Impacts on wildlife**

About 1024 ha of forest land is to be acquired. The forest area to be acquired has low tree density and no major faunal species are reported. The project area does not appear to be on the migratory routes of animals and therefore, the construction of project will not affect migration of animals as well. Thus, construction of the reservoir as a part of the project, is not likely to have any impact on wildlife movement in the area.

10.4 IMPACTS ON AQUATIC ECOLOGY

**Impacts on riverine ecology**

The water for diversion for irrigation by the three dams will affect the water availability. As a part of the CEIA study the impacts on riverine due to reduction in water availability will be assessed and if required, the minimum flows shall always be released.

**Impacts on fisheries potential**

The proposed project would increase the water availability in the command area. As a result, there will be increase in potential for tank and pond fisheries. Currently, within the

command area, tank and pond fisheries is in vogue. Within the command area blocks there are about few fishing tanks in which pisciculture is being practiced. At present, due to lack of water, fishing is not very common, due to lack of water availability in the region. With the increased availability of water the tank and fisheries potential would improve. The average fish yield is of the order of 1 to 2 tonnes/ha/yr in fishing ponds. Thus, with introduction of extensive culture, the fish production is expected to increase, which is a significant positive impact.

## 10.5 IMPACTS ON NOISE ENVIRONMENT

### a) Construction Phase

**Noise due to construction equipment**

In water resource projects, the impacts on ambient noise levels are expected due to operation of construction equipment. It is a known fact that there is a reduction in noise level as the sound wave passes through a barrier. Thus, no increase in noise levels is anticipated as a result of various activities, during the project construction phase. There could be marginal impacts on the population residing in proximity to the major construction sites during construction phase as a result of various activities. However, based on past experience in similar projects, the impact however, is not expected to be significant.

## 10.6 IMPACTS ON AIR QUALITY

### a) Construction Phase

**Pollution due to fuel combustion in various equipment**

The operation of various construction equipment requires combustion of fuel. Normally, diesel is used in such equipment. The major pollutant which gets emitted as a result of diesel combustion is $SO_2$. The SPM emissions are minimal due to low ash content in diesel. The short-term increase in $SO_2$, even assuming that all the equipment are operating at a common point, is quite low, i.e. of the order of less than $1\mu g/m^3$. Hence, no major impact is anticipated on this account.

## 10.7 INCREASED INCIDENCE OF WATER-RELATED DISEASES

### a) Construction Phase

During construction phase or for permanent settlement, if adequate precautions are not taken, the vector-borne disease epidemiology may show sudden or long lasting change. Many of the immigrant population could be reservoir of infection for various communicable diseases. Once they settle in labour camps/colonies, there could be increased incidence of various diseases. This aspect needs to be looked into with caution, and efforts must be made to ensure that a thorough check up of the labour population congregating in the area is conducted. Those affected by any ailments need to be properly quarantined depending on the ailment with which they are suffering.

### b) Operation Phase

**Increased incidence of water-related diseases**

The association between irrigation development and the incidence of water related diseases such as malaria, etc is well established. The preferred environmental setting for vectors is fresh water open to sunshine or moderate shade. The habitats for larvae growth are permanent or semi-permanent standing fresh water such as small ponds, pools, standing agricultural water, permanent or semi-permanent fresh water such as open stretches or canals. Thus, the project may create favorable conditions for breeding of new pathogens or vectors such as mosquitoes, etc.

Most of the water borne diseases can largely be prevented by adequate hygiene. The experience of various project confirms the above mentioned hypothesis. In the project area, a sudden spurt in the incidence of malaria is expected, if adequate control measures are not taken up.

Improvement in availability of water for various uses, increased agricultural production, availability of diversified food, strengthening of educational and health facilities significantly improves public health in the project area. On the other hand, water resources development also has negative impacts, since, it could increase the habitat of certain vectors like mosquitoes. Thus, poorly planned and managed water resources projects could increase the prevalence of vector-borne diseases like malaria and filariasis.

## 10.8 IMPACTS DUE TO COMMAND AREA DEVELOPMENT

In project operation phase, the area under irrigation will increase significantly, with corresponding increase in agriculture production. This will improve the income levels. The increased income levels will have a quantitative effect on the quality of demand for various facilities, which will facilitate improvement in the infrastructure sector. The increased income levels would lead to demands for better communication, health, education and other services. The increased income levels would also provide an impetus for development of these facilities.

**Improvement in livestock**

During project operation phase, food grain production will increase alongwith increase of agriculture by products, which is usable as fodder. This will reduce the pressure on the existing forests or vegetation of the area, which is a significant positive impact.

**Employment generation**

The introduction of irrigation requires a greater amount of labour in fields. This would improve the employment scenario not only for the local farmers, but would also increase the demand for agricultural labour. With the increase in the irrigation intensity, manpower requirement in the agriculture sector would increase significantly.

## 11. RESETTLEMENT AND REHABILITATION PLAN

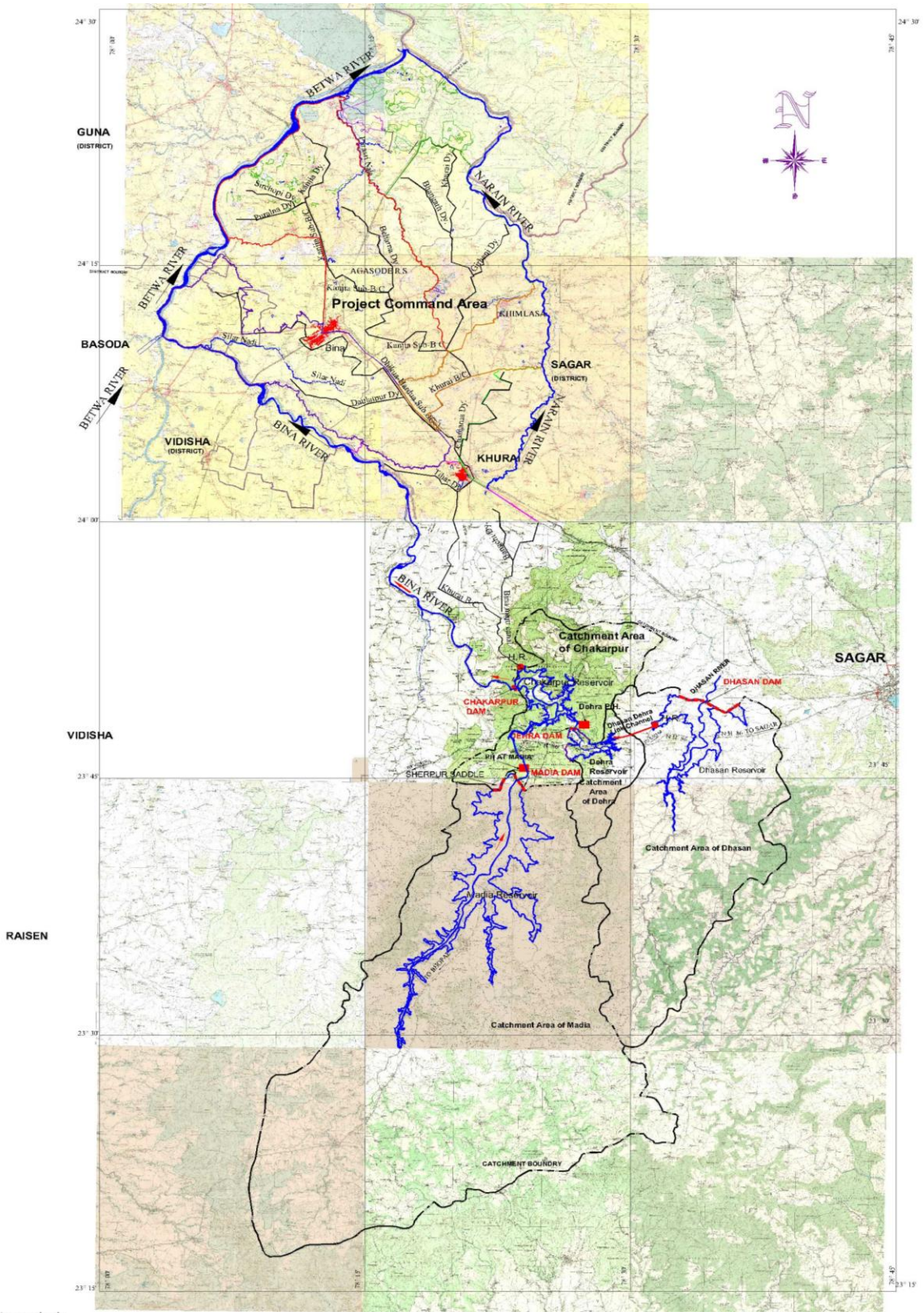
The project envisages acquisition of 11736.881 ha of land for various project appurtenances. Private land to be acquired is 9670.286 ha. The same shall be confirmed as a part of DPR preparation. A Resettlement & Rehabilitation (R&R) Master Plan highlighting the guidelines of land acquisition and provisions for rehabilitation measures shall be formulated. The "Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013". shall serve as a basis for preparation of the R&R plan for the project affected families.

**Annexure-I**

| S.No | Particulars | Madia | Dhasan | Dehra | Chakarpur |
|---|---|---|---|---|---|
| **I.** | **Location** | | | | |
| 1 | State | Madhya Pradesh | | | |
| 2 | District | Sagar | | | |
| 3. | River | Bina | Dhasan | Dehra Nala | Bina |
| 4. | Accessibility | 42 Km from Sagar on Sagar - Bhopal Road | 26 Km from Sagar on Sagar - Rahatgarh Road | 36 Km from Sagar on Sagar - Rahatgarh Road | 50 Km from Sagar on Sagar - Vidisha Road |
| 5. | Latitude | 23º45' 11" | 23°49'33" | 23°48' 11" | 23°50' 27" |
| 6. | Longitude | 78º 23' 24" | 78°33'49" | 78°26'37" | 78º23' 16" |
| **II.** | **Hydrology** | | | | |
| 1. | Catchment area, sq.km | 1109.84 | 424 | 62.5 | 187.8 |
| 2 | Maximum Annual Rainfall | 1640.7 mm | 1939 mm | - | 1840.3 mm |
| 3 | Minimum Annual Rainfall | 767.2 mm | 600.2 mm | - | 590.2 mm |
| 4 | Average Annual Rainfall | 1170.6 mm | 1223.5 mm | - | 1201.68 mm |
| 5 | Designed flood (PMF), Cumec | 6647.0 | 3182 | 932 | 8241.0 |
| 6 | Gross Yield, MCM | 407.7 | 161.40 | 23.70 | 70.70 |
| 7 | Available runoff at site: (MCM) | | | | |
| | i) Average Monsoon | 448.57 | 177.56 | 26.06 | 77.81 |
| | ii) Average Annual | 476.11 | 188.46 | 27.66 | 82.58 |
| | iii) 75% dependable Monsoon | 294.1 | 116.4 | 17.10 | 51.00 |
| | iv) 75% dependable Annual | 278.10 | 110.10 | 16.20 | 48.20 |
| 8 | Reservation for upstream usage | 10% | 10% | nil | Nil |
| 9 | Reservation for downstream usage | 5% | 15% | 5% | 5% |
| **III.** | **Reservoir Data** | | | | |
| 1. | Maximum Water Level, m | 500.2 | 497.9 | 492 | 452.5 |
| 2. | Full Reservoir Level, m | 500.2 | 497.8 | 491.6 | 451.5 |
| 3. | Submerged Area, ha | 7137.78 | 2432 | 754.6 | 1349.5 |
| i. | Private Land, ha | 6326.345 | 2189 | 478.9 | 880.6 |
| ii. | Other lands, ha | 680.455 | 243 | 53 | 98 |
| iii. | Forest Land, m | 130.98 | 0 | 378.64 | 462.52 |
| 4. | Dead Storage Level, m | 487.62 | 491.06 | 465.35 | 437.79 |
| 5. | River Bed Level, m | 481 | 482 | 462 | 429 |
| 6. | Top of Bund Level, m | 504.5 | 502.9 | 492 | 452.5 |
| 7. | Height of Dam, m | 23.6 | 20.9 | 32 | 26 |
| 8. | Gross storage (MCM) | 251.46 | 70.4 | 72.36 | 74.31 |

| S.No | Particulars | Madia | Dhasan | Dehra | Chakarpur |
|---|---|---|---|---|---|
| 9. | Live storage (MCM) | 249.03 | 67.15 | 72.35 | 72.89 |
| 10. | Dead storage (MCM) | 2.43 | 3.25 | 0.01 | 1.42 |
| 11. | Length of main Dam, m | 2069.694 | 4402 | 3509 | 751.682 |
| 12. | Saddles, Nos. | 1 (10.71m high) | nil | 2 ( 5m high) | 2 (8m & 3m high) |
| 13. | Total Length of Saddles, m | 1906 m | nil | (30m, 2148m,) | (131.884m & 516.65m) |
| 14. | MDD level, m | 492.5 | 492.5 | 484 | 439.5 |
| 11. | Feeder Channel Dhasan to Dehra (km) | | 5.0 km with average depth of cutting 8 m | | |
| **IV.** | **Hydropower** | | | | |
| 1. | Hydro Power Component | Yes | | Yes | |
| 2. | Head Available for Hydro Power, m | 39.75 m | - | 35.32m | - |
| 3. | Live storage for power (MCM) | 282 | 76.88 | 45.44 + (76.88 from Dhasan) | |
| 4. | Sill level of power intake | 483 | - | 473.96 | |
| 15. | MDDL | 492.5 | - | 484 | |
| 6. | Average Tail Water Level | 457 | - | 452.5 | |
| 7. | Type of Power House | Surface Dam | - | Surface dam | - |
| 8. | Install Capacity | 2 x 11 MW | - | 2 x 5 MW | - |
| 9. | Annual Energy, MU | 43.25 | | 11.93 | |
| **V.** | **Irrigation** | | | | |
| 1. | Canal network length, m | RBC-6.6km main canal with total canal network 533 km | | | |
| 2. | No. of canal structures | 251 | | | |
| 3. | CCA, ha | CCA of 84,200 Ha | | | |

## Annexure-II




**Site Plan for Various Components of Project**