1.0 Summary & Conclusion

Mohgaon irrigation Project is a Project of Department of Water Resources in Mahakusral region of Madhya Pradesh with annual irrigation of 3928 Ha. It comprises two construction features i.e. Dam & Reservoir. As per the availability of water, the project is planned to irrigate 1990 Ha in Rabi & 1938 Ha in Kharif with annual irrigation of 3928 Ha i.e with irrigation intensity of 121.50.%

The River Sarpa is a tributary of Kanhan River which meets River Godavari in district Chhindwara M.P.

The total catchment area of the proposed project at dam site is 234.00 Sq km.

The study area of the project is as follows

- 10 km radius around the project area from the periphery of the project site

<table>
<thead>
<tr>
<th>No</th>
<th>Details</th>
<th>Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cultivable command area</td>
<td>1990 Ha</td>
</tr>
<tr>
<td>2</td>
<td>Net Catchment Area</td>
<td>234.00 Sq.km</td>
</tr>
<tr>
<td>3</td>
<td>Dam Length</td>
<td>1060 m</td>
</tr>
<tr>
<td>4</td>
<td>Maximum Height Above GF</td>
<td>29.56 m</td>
</tr>
</tbody>
</table>

Submergence and catchment area for the dams & reservoirs, command areas and riverine area in the downstream of the reservoirs, enroute of link canal and its command and areas of backwater influence in the upstream. However, only direct draining tributaries and nalas in the reservoir are to be considered as part of the project.

The project has about CCA of 1990 ha; this will lead to increase in cropping as well as irrigation intensity. As a result barren land will be converted into productive agricultural land.

The project has about 1990 ha of command area. The left bank canal is 4.35 km and right 9.90 km long with 1 and 6 distributaries from main canal, will irrigate 3928 ha in Chhindwara district.

The project comprises of the following composite dam comprising of concrete gravity dam, earthen dam, gated ogee type spill way, energy dissipater in the form of bucket or stilling basin. Height of Mohgaon dam is 29.56 m.

There have been no recorded cases of subsidence in the area. Similarly, no landslides have been reported from the area in the past.

The area is susceptible to erosion from air, availability of water will enable creation of windshields of plants providing protection against wind-erosion. Lack
of water has resulted lack of erosion and weathering by water. Adequate protection against water-erosion will be taken up by creating soil and water conservation measures in the command area.

A drought is manifestation of extreme adverse climatic condition and is a common phenomenon in the area. Creation of a moderately-sized water body will shrink the frequency and intensity of droughts in the area.

2.0 Salient Features of the project as reported are as follows:

i) No major industries are located in the area.
ii) No thermal power house is located in the project area.
iii) No mineral resources are located in the project area.
iv) As all the villages in the project area are not accessible by all weather roads no prominent developmental activities are seen in these areas. The living conditions of the people of these villages are very pathetic only 20% to 25% of the population is having agriculture as their occupation, lack of any developmental activities in the area has deteriorated the condition of the people.
v) At present, ground water is being used by the villagers from the tube wells. The wells are generally deep (6 to 22 m) and subterranean water is available in them.

Table 11.3 Reservoir Details

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Catchment Area</td>
<td>234 Sqkm</td>
</tr>
<tr>
<td></td>
<td>Geology</td>
<td>Partly wooded &amp; Hilly</td>
</tr>
<tr>
<td>2</td>
<td>Mean Mansoon Yield</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. 75% dependable annual Mansoon Yield</td>
<td>32.30 MCM</td>
</tr>
<tr>
<td>3</td>
<td>Gross Storage Capacity</td>
<td>24.56 MCM</td>
</tr>
<tr>
<td>4</td>
<td>Dead Storage Capacity</td>
<td>4.28 MCM</td>
</tr>
<tr>
<td>5</td>
<td>Live Storage Capacity</td>
<td>20.28 MCM</td>
</tr>
<tr>
<td>6</td>
<td>Percentage of gross storage to normal mansoon 75% dependable yield</td>
<td>82.00%</td>
</tr>
<tr>
<td>7</td>
<td>Percentage of Gross storage to Gross Capacity</td>
<td>17.00%</td>
</tr>
<tr>
<td>8</td>
<td>Full Tank i.e. T.B.L</td>
<td>411.50 M</td>
</tr>
<tr>
<td>9</td>
<td>Maximum water level i.e. M.W.L</td>
<td>411.50 M</td>
</tr>
<tr>
<td>10</td>
<td>Top of bank level i.e. T.B.L</td>
<td>414.50 M</td>
</tr>
<tr>
<td>11</td>
<td>Lowest sill level i.e. L.S.L</td>
<td>400.80 M</td>
</tr>
<tr>
<td>12</td>
<td>Nalla Bed Level</td>
<td>384.94 M</td>
</tr>
</tbody>
</table>
### Table 11.4 Dam Details

<table>
<thead>
<tr>
<th></th>
<th>Length of Dam</th>
<th>Masonry</th>
<th>Maximum height of Dam</th>
<th>Quantity of Earth Work</th>
<th>a. Length of waste weir</th>
<th>b. Maximum discharge of Waste Weir</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1060 M</td>
<td>113.00 M</td>
<td>29.56 M</td>
<td>913000 cum</td>
<td>90.0</td>
<td>2209 Cumec.</td>
</tr>
</tbody>
</table>

### 3.0 Baseline

Based on the scoping, data on the existing environment was collected to understand the environmental setting of the proposed project site. Various environmental parameters are classified into broad categories such as ecological, physical and human resources.

Following base line levels of appropriate environmental parameters which could be significantly affected by the implementation of the project were collected for this study.

### 3.1 Meteorology

There is a Meteorological observatory in the Chhindwara District and data recorded by this observatory is considered as representative to explain the meteorological conditions of the project area.

### 3.2 Temperature

Based on the information collected for the period 2006 to till date, the maximum and minimum temperature observed are 42.0 °C and 6.2°C respectively.

### 3.3 Humidity

The summer is extremely dry, especially in the afternoons when relative humidity of less than 20% is common. During the monsoon season the moisture content in the air is high; the humidity will fall well below 50% with the withdrawal of the monsoon by the end of September.

### 3.4 Water Resources

Sarpa River is a tributary of Kanhan River, which falls in river Kanhan. The Sarpa River originates near Jamalpani village of Chhindwara District, Madhya Pradesh. The total length of the river from its origin to dam site is 50 Km which lies in Madhya Pradesh. The basin of Sarpa River covers the areas of Betul and Chhindwara District of Madhya Pradesh. It is bounded by Vindhyan range.

The annual rainfall of the state of M.P. varies from 2000 mm in the central parts to 600 mm in the central part of the state.
Average rainfall of the Chhindwara district is 871.86mm

3.5 Air Environment

There are nine ambient air-sampling locations were selected for assessment of the existing status of air environment for the parameters SPM, PM10, SO2, NOx & CO.

Ambient Air Quality Monitoring is carried out for post monsoon and winter seasons. Relatively higher concentrations of Particulate Matter are recorded during winter season. Among all the locations maximum concentrations of Particulate Matter are recorded near 'Mohgaon Village' during winter season. This may be due to population pressure in that location and domestic and transportation activities. However, SPM and RSPM concentrations are observed below NAAQS at all the locations and both seasons.

The SO2 and NOx concentrations are observed far below the NAAQS. This may be due to there are no significant industrial and transportation activities in the study area. Regarding Carbon monoxide and Methane concentrations were found to be very low. This may due to no significant sources of such emissions is found in the study area.

3.6 Noise Environment

There are 7 noise monitoring locations were selected.

Recording of Noise levels is carried out for winter and Post monsoon seasons on hourly basis covering both day and night timings at 7 locations. Noise monitoring locations are identified based on various Noise generating sources and their intensity.

From the all the recorded Noise levels, it reveals that relatively higher noise levels are recorded during day time particularly at location Mohgaon which is 53.6 dB (A). This relatively higher value is due to domestic and commercial activities. During night timings, relatively higher noise levels are recorded near Mohgaon (42.6dB (A)) and Nandewani (41.8 dB (A)).

3.7 Water Environment

There are 14 water samples were collected for assessment of the existing status of water environment as per the IS 10500 & IS 2296 standards. Out of 14 samples there are 7 surface water and 7 ground water samples.

Water samples are collected at selected locations during monsoon, Post monsoon and winter seasons covering both ground and surface water sources. Sample collection, storage and analysis is carried as per the applicable IS and
APHA methods. Chemical analysis is made for the required parameters and results are compared with prescribed standards.

Based on the results of the water quality, it can be concluded that the water can be used for drinking after aeration and chlorination. The water is also suitable for irrigation purpose.

### 3.8 Land Environment

There are total 9 soil samples were collected for assessment of the existing status of soil. Twenty seven parameters were analyzed.

Soil samples are collected for winter and post monsoon seasons. During winter season samples are collected at 9 locations. During Post Monsoon season, The pH of the soil extract varied from 6.18 to 7.83. In terms of soil pH the soil characteristics varied from ‘Slightly acidic’ to ‘slightly alkaline’ in nature. The EC varied from 219 to 1340 µS/cm. Organic carbon in soils ranged from 0.16 to 1.98 revealing the distribution from less to more than sufficient. Nitrogen values ranged between 89 kg/ha to 337 kg/ha. Distribution of available nitrogen in soils is found to be less to sufficient levels. The Phosphorus levels ranged between 12 to 39 kg/ha indicating its presence from low to medium sufficient quantity. Soil potassium varied from 124 to 189 kg/ha which is less to Medium levels.

During winter season, the pH of the soil extract varied from 6.27 to 7.96. In terms of soil pH the soil characteristics varied from ‘Slightly acidic’ to ‘moderately alkaline’ in nature. The EC varied from 222 to 1357 µS/cm indicating average type soils. Organic carbon in soils ranged from 0.12 to 1.91 revealing the distribution from less to more than sufficient. Nitrogen values ranged between 88 kg/ha to 316 kg/ha. Distribution of available nitrogen in soils is found to be low to sufficient levels. The Phosphorus levels ranged between 10 to 38 kg/ha indicating its presence from low to medium sufficient quantity. Soil potassium varied from 119 to 182 kg/ha which is less to sufficient level.

### 3.9 Biological Environment

#### 3.9.1 Vegetation

A very small portion of the forest comes under submergence in the project. Most of the area in the submerged portion is either fields and bed of the river.

#### 3.9.2 Fauna

The project area does not have dense forest cover and thus is not habituated by many animals. Only jackal, monkey and fox, are found in the forest area near the project site.
3.9.3 Fisheries

Fish is one of the most important species of the aquatic fauna as well as important source of protein in human food. Since, topographical and climatologically condition of Sonar River varies from tropical to moderate temperature region. There are significant variations in the fish species observed at different elevations. Normally the varieties of fish Ktla, Rohu, Bam, Padan are normally observed, Fisheries, horticulture development would be responsible separately.

3.10 Socioeconomic Environment

The total population of the 10 km radius of Dam area is 34973. Total literate population is 21190 among the total population 34973 and the illiterates population is 13783.

3.11 Socio-Economic Aspects and Preparation of Rehabilitation & Resettlement.

The total area under the Dam submergence is 301.75 Ha. There is only one village (Nandewani) which will be submerged partially.

There are 10 villages of Chhindwara district will get benefited after the proposed project establishment.

4.0 Environmental Impact Assessment

The project details were superimposed on the existing environmental setting of the area to understand the impact of the project on the environment. The final decision to proceed with the proposed project to abandon the project generally depends on a variety of factors. The perception and value judgment of the decision makers play an important role in the final selection of a specific alternative of the methods available for impact assessment; check list has been utilized in the present study.

4.1 Preconstruction stage

The impacts during pre-construction stage are mainly due to loss of land, Rehabilitation and Resettlement of Project affected personnel, loss of vegetation and trees.

4.2 Land acquisition

Any infrastructure project requires land to implement its activity, hence the land coming under the study area has to be acquired by the project proponent. The land has to be acquired as per the Land Acquisition Act 1984. Due to land acquisition people residing loose their houses and property. There is likely to be
disturbances in the people and the environment due to the project. This impact will induce anxiety on people regarding the compensation.

4.2.1 Resettlement of project affected people

The construction of dam results in displacement of people. During planning stage large numbers of people who are residing in the path of the dam are forced to relocate. The livelihood of people living in the area is affected.

4.3 Impacts during Construction stage

4.3.1 Land clearing fill and soil compaction

Site clearance involves cutting trees in the reservoir area this leads to decrease in plantation. The flora and fauna present in the region decay and new water is filled. The upstream water flows polluted, without oxygen in deeper parts, water smells rotten because of sulphurous hydrogen disposal. Although, certain period of time the stream will be forms a new a healthy ecosystem.

4.3.2 Mobilization of heavy equipment and bridge material

Air pollutants such as dust, vehicular emissions, emissions from DG sets etc., increased movement of vehicular traffic contributes to the impairment of air quality in the project area and also damages to road. Air pollution occurs due to loading/unloading and stocking of construction materials. The vibrators used for concreting and diesel generator sets during construction will produce noise. These activities are expected to generate noise levels in the range of 80-95 DBA and it can affect the personnel working at the site and the wildlife movement in nearby forest areas.

4.3.3 Mobilization and workers recruitment

The peak labour requirement during the execution of project will be around 1000, hence it is also anticipated that some labours migrate from neighboring villages for job in construction of dam and some will migrate to the area to provide other requirements such as shops, repairing facilities etc., The local people should be given priority to work in the project; any lack in the priority will create negative perception among local people.

4.3.4 Base camp, storage and temporary shed

The solid waste generated in the form of garbage, oil drops from garage and workshop, sewage from labour camps affect the water quality by runoffs and create health risks at construction sites and may lead to water borne diseases. Common water borne disease identified was typhoid, ascariasis, diarrhea and malaria. Therefore continuous monitoring of water quality is essential.
4.3.5 Sand rock and gravel excavation

Excavation of rock sand and gravel lead to modification of physiography and topography of the area. The impact on the ambient environment is likely localized and short term in nature. Noise from the earth movers and during blasting operations is expected to alter the ambient noise levels.

4.3.6 Dam and Weir construction

Weir is a small overflow type dam commonly used to raise the level of river or stream. The construction of weir will reduce upstream water velocity that leads to increase in siltation. They pose barriers to migrating fishes. Utilization of heavy equipment increase dust and noise due to construction activity. The flow of dust and solid waste degrade water quality. Decrease of water flow in river will lead to degradation of aquatic biota and reduce the availability of water to wild life. Ground water table is expected to rise in the area surrounding the proposed dam, this will benefit drought prone areas and the availability of water to wells and tube wells for irrigation purposes will increase.

4.3.7 Construction and irrigation networks and farm road

Soil excavation and compaction, transportation of full materials and spoiling of embankment soil will induce dust, noise which in turn cause discomfort among people living in the vicinity. Water logging results from periodic flooding, over irrigation, drainage over flow, seepage from canal and inadequate surface drainage condition.

4.3.8 Réservoir Inondation

As a result of dam construction and holding of sediments in reservoirs, sediment feeding of downstream channel or shore beaches is prevented. Corrosions may occur. Water is stagnant in reservoir therefore the transfer of sediments is avoided by this way this will reduce the life of the reservoir. Sediment which is full of nutrients is not able to flow downstream, hence the land will be devoid of nutrients hence reducing soil fertility. The population and growth of aquatic biota (fish and plankton) is found to be reduced. Migration of fish is decreased. Normal passing ways of territorial animals are hindered since the dam work as barrier. Meantime the upstream fish movement aiming ovulation and feeding is prevented and thus fish population decreases significantly.

4.4 Impacts during Opération stage

4.4.1 Opération of réservoir

During operation of reservoir the river water will be dammed up, hence degrading water quality. Growth of aquatic biota is reduced. A disturbance in migration of fishes is noted. Pollution of surface water results from silting and
sedimentation, nutrient leaching, and agricultural run-off. Runoffs from areas of intensive agricultural practices using chemical fertilizers, insecticides and pesticides may lead to eutrophication in the receiving water body. Major cause of eutrophication is nutrient loading in the form of nitrogen (ammonia) urea, nitrate, nitrites, and phosphorus through agricultural run-off, sewage and fertilizer residue. Eutrophication may cause marked changes in the biota as a result of nutrient enrichment. This would affect the surface water quality through decrease in dissolved concentration, pH, increase in biochemical and chemical oxygen demand, BOD, COD chloride, nitrogen, phosphorus etc. alteration in the dissolved oxygen concentration may lead to mortality of fishes. Rise in ground water level of villages surrounding the proposed reservoir will have beneficial impact in terms of availability of ground water for domestic and agricultural needs of the local people. However contamination of ground water through percolation of fertilizers or pesticides may adversely affect public health through spread of water borne diseases. The fishes can be damaged while passing the floodgates. Drainage of marshes and other water accumulations and the excavation works causing changes in the stream bed structures affect the aquatic creatures, even resulting to their death.

4.4.2 Réservoir maintenance

Use of grease/lubricants/oils for crust gate with the water flow will alter the water conditions. The substance form layer on the water surface and interferes with the aquatic ecosystem there by the people and cattle depending on water for drinking will also be affected. Therefore regular monitoring of the water quality in the reservoir should be carried out.

4.4.3 Opération of irrigation network

Crop production is increased which in turn increase the farmers’ income. With the increase in crop production fertilizer and pesticide usage will be more hence it degrades river water quality. With abundance flow of water in the region a substantial increase of aquatic plant in irrigation networks is noted.

4.4.4 Water distribution

River is the major source for irrigation and drinking for rural people in the surrounding area. Due to construction of dam there will be substantial increase in availability of water for both irrigation and drinking purposes. Regular monitoring of water quality will reduce water borne diseases. Some adverse impacts can also be identified like improper distribution of water leads to conflict between water users, therefore leading to disturbance to irrigation network.
5.0 Environmental Management Plan (EMP)

Based on the environmental base line condition and project inputs the adverse impacts are identified and measures suggested as a part of environmental management plan for their amelioration.

5.1 Mitigation measures during pre construction stage

The following environmental protection/mitigation measures shall be adopted during the pre construction stage of the project. Land has to acquired based on the economic status of the project and proper beneficiary measures have to be given to the people who are affected due to implementation of the project as per the rehabilitation and resettlement plan. A proper land use plan should be carried out to prevent the impact on human activity.

5.2 Mitigation measures during construction stage

The following environmental protection/mitigation measures shall be adopted during the construction stage of the project:

- a. The contact of construction materials with river flow should be avoided.
- b. Hazardous substance should be handled as per the Hazardous Waste (Management and Handling Rule) 1989.
- c. Adequate number of toilets which are connected to soak pits or other sewage treatment facilities must be provided.
- d. Water should be sprinkled during construction material handling/overhauling activities to suppress dust. It should be ensured that the construction debris is removed on a regular basis.
- e. Dust barriers should be erected around the site to minimize the spread of dust.
- f. All machinery should be switched off when not in use.
- g. Low sulphur diesel should be used for all machinery, no machinery to be used with fuel not specified by manufacture (eg. Use of kerosene in petrol engines cannot be allowed)
- h. All equipments and vehicles used shall adhere to the standard emission norms, and should be regularly serviced. All vehicles must have valid emission certificates, and their service and maintenance should be carefully monitored.
- i. Care to be taken that all surplus excavated material is used to either level low lying areas, improve the environment of the surrounding area, or be suitably disposed of in a designated landfill or other facility.
- j. The workers have to be trained in procedures for handling/overhauling materials.
- k. A suitable drainage system with traps for should be setup for arresting the sediment load of waste around the site.
- l. Adequate safety measures complying with the occupational safety manuals should be provided to prevent accidents/hazards to the
construction workers.
m. The construction personnel who are exposed to high noise levels shall be provided with protective gears such as ear-muffs.
n. The labour camps shall be located away from the construction site with following amenities and it should be situated 300m away from river.
   - Adequate potable water supply
   - Sanitary facilities such as dry pit latrines
   - Solid waste collection and disposal system
   - Primary health facilities at construction site
   - Electrification and fuel for cooking

5.3 Mitigation measures during operation stage

5.3.1 Reservoir maintenance

Reservoir should be kept clean and leak testing by conducting inspection should be done regularly. The objective of the plan is to maintain the water quality and keep the reservoir sustainable by periodic clearing of weeds in storage tanks, trimming shrubs and maintaining fence lines and buildings free from weeds.

5.3.2 Operation of irrigation network

Improper irrigation practices will degrade the water quality and this affects the fish pond farms. Therefore the objective of this plan is to increase farmer’s income and prosperity, keep river water quality and to train farmer in using water and organic fertilizer Optimize water utilization depending on cropping pattern, optimum utilization of fertilizer and pesticide.

5.3.3 Water distribution

The objective of the plan is to supply right quantity of water at the right time, address equity issue, conflict resolution and enhance usefulness of irrigation water to farmers.

6.0 Environmental Monitoring Programme

It is necessary to continue monitoring certain critical parameters so as to verify the adequacy of suggested environmental management plan to anticipate any environment problem so that effective mitigate measures could be implemented monitoring program of critical parameters have been suggested.

6.1 Water quality monitoring

The parameters to be monitored are pH, turbidity, conductivity, DO, SS, phosphates, nitrates, aquatic flora and fauna. It has to be monitored once in three months at upstream and downstream of the dam. The water quality
should meet the PCB standards. The Physico-chemical and bacteriological parameters like pH, turbidity, DO, suspended solids, total coliforms, flora and fauna should be monitored once in 3 months while biological parameters like flora and fauna should be monitored in each season.

6.2 Change in land use pattern

The land use pattern has to be carefully monitored for muck disposal areas, borrow pits, temporary camp sites, landfill sites, waste dump etc. for post-construction activities once in three years.

6.3 Maintain Biodiversity

Any change must be justified in terms of economics and acceptable by all the sections of society. Water resources development that meets the needs of the present generation without compromising the ability of future generation to meet their own needs will alone be considered as a sustainable development. It is therefore realized that the water resources projects should be planned, implemented and managed in such a way that the future demands of the growing population have to be met with minimum disturbance to the existing ecosystem along with the incorporation of adequate control measures at appropriate stages to mitigate the adverse effects, if any to maintain the sustainability of the system in long run.

7.0 Benefits of the Project

The Mohgaon irrigation project provides irrigation for an area of 3928 Ha in the drought prone areas of Chhindwara district of Madhya Pradesh. This will go a long way to help the impoverished people of the region.

Water is a critical natural resource without which life cannot survive. The advantages of construction of dams includes

- Improve crop production providing irrigation to crop land
- Control flood waters to protect people and property
- Adequate supply of water for irrigation and household consumption during dry spells
- Agriculture extension and horticulture development
- Veterinary extension and animal husbandry development
- Improved pisciculture
- Permanent waterfront for wildlife
- Recreation like fishing, camping and water sporting in the reservoir
- Improvement in overall quality of life
- River navigability
- Prevent flooding during rainy season