



1.0 EXECUTIVE SUMMARY

1.1 Introduction on Rajura Larger Minor Project

Government of Maharashtra (GoM) has been giving utmost importance for developing irrigation projects for transforming the underutilized dry lands into perennial green fields and enriching lives of people, particularly in the drought prone areas. The Rajura Larger Minor Project is one among such projects.

There have been persistent demands and agitations by farmers of the backward areas of Chandur Bazar, Morshi and Amravati tahasils in Amravati district for assured surface-water irrigation facility, as their areas are totally dependent on mercy of monsoon and frequently facing droughts.

Soils of the command area proposed under this project and the region in which it falls belong to Purna alluvium group. Groundwater is available only in limited quantities that too at greater depths. Even its quality is poor while having higher concentrations of calcium carbonates, dissolved solids and hardness; and not-agreeable for irrigation. Hence groundwater is not potable but being used for irrigation to a limited extent. Though the soils of this area are not much-suitable for irrigation with the local groundwater as the source, these are found to be suitable for irrigation with application of surface water. Hence, GoM is making all possible efforts for tapping all surface water sources to the possible extent; and constructing dams, barrages and lift irrigation schemes across the rivers and nalas in this saline soil region. Rajura Larger Minor (LM) Project across Rajura Nala near Rajura village in Chandur Bazar Tahasil is one such project proposed in the saline soil belt of Amravati district.

Besides tapping the yield from Rajura Nala catchment areas, it has been proposed to divert some waters of Nagjhira Nala (Kashi River) by constructing a pickup weir across it in north of Belura village and discharging its waters into Rajura Nala through a feeder canal. The combined waters of Rajura Nala and Nagjhira Nala would be stored at Rajura Dam and provide irrigation facility to 908 ha command area and 0.800 Mm³ water for drinking and industrial purposes. Thus this project would facilitate the farmers for taking 2 crops in a year and improve their socio-economic conditions while enriching their lives.

1.2 Benefits of Rajura LM Project

The following are the anticipated benefits from this project:

- With provision of assured and quality surface water for irrigating 908 ha ICA, this project would transform the lives of about 5000 people in the backward area and enrich their quality of living;
- About 0.80 Mm³ water will be supplied for drinking or industrial purposes in the nearby areas of the project;
- Project would provide immense benefits to its command area and would have multiplier-effect in development of the region;
- Irrigation through application of good surface water on the soils having higher concentrations of calcium carbonates would considerably dilute the prevailing salts in soils; and would facilitate improved cropping patterns and achieving higher agricultural productivity;
- Percolation of surface water into subsurface would dilute the prevailing higher concentrations of calcium carbonates and salts thus improving the groundwater quality;



- Deeper groundwater resources will be recharged to some extent due to percolation of surface water into subsurface;
- The prevailing deep groundwater levels would never pose any problem associated with water-table rise after provision of irrigation;
- Seepages from canal would be minimum as the terrain has gentle slopes; and only shallow canals not requiring deep cuttings or major embankments will be developed;
- Least drainage problems are anticipated due to availability of adequate ground slopes to drain-out excess water from fields;
- Absence of reserved forests or ecologically sensitive areas in the project area.

1.3 Description of Rajura LM Project and its Salient Features

Rajura LM Project is proposed near Rajura village due to its ideal location for storing the required water within minimum submergence area. Location of the pickup weir across Nagjhira Nala in north of Belura village is finalized due to favourable nala bed level and ground levels. This site allows diversion of Nagjhira waters into Rajura Nala through a feeder canal by gravity, however with minimum cutting of ground for formation of canal. Submergence area of pickup weir at the selected site is minimal. Locations of dam, pickup weir, feeder canal and project catchment areas are shown in Figure-1.3 and the command area is shown in Figure-1.4 in Chapter-1. The salient features of this project are presented in **Table-1**.

TABLE-1
SALIENT FEATURES OF RAJURA LARGER MINOR PROJECT

Sr. No.	Head	Particulars of Rajura LM Project	Particulars of Pickup Weir on Nagjhira Nala
1	Location	Rajura Village	
	Latitude	21° 01' 30" N	
	Longitude	77° 54' 00" E	
	Toposheet No.	55 G/16	
2	Name of Water body	Rajura Nala (local Nala)	Nagjhira Nala (Kashi River)
	River basin	Tapi	Tapi
	Sub-basin	Purna	Purna
	Gross catchment area	32.50 sq km	17.25 sq km
	Classification of catchment area	Good	Good
4	Rainfall		
	Influencing rain gauge stations	Chandur Bazar	
	50% Dependable monsoon rainfall	59.63 cm	
5	Yield		
	50% Dependable Runoff	17.14 cm	
	50% Dependable yield	8.529 Mm ³	
		8.669 Mm ³ including 4.73% Post-Monsoon Flow	
	Net yield available for water planning	6.79 Mm ³	
	Annual utilization	6.79 Mm ³	
	Upstream Reservation (MI Project)	0.365 Mm ³	



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Sr. No.	Head	Particulars of Rajura LM Project	Particulars of Pickup Weir on Nagjhira Nala
6	Losses		
	Evaporation Losses	1.719 Mm ³	
	Silt Losses (at 6 ham/ 100 sq km / year)	1.79 Mm ³	0.038 Mm ³
7	Storage Capacity		
	Gross storage at Full Reservoir Level (FRL)	5.827 Mm ³	0.162 Mm ³
	Live storage	5.334 Mm ³	0.162 Mm ³
	Dead storage	0.493 Mm ³	0 Mm ³
8	Controlling Levels		
	Nala Bed Level (NBL)	340.750 m	357.030 m
	Dead Supply Level (DSL)	344.950 m	357.030 m
	Minimum Draw Down Level (MDDL)	346.250 m	357.030 m
	FRL	350.750 m	361.500 m
	Highest Flood Level (HFL)	352.750 m	361.500 m
9	Details of Dam		
	Type of dam	Rolled Filled Earthen Dam	Rolled Filled Earthen Dam
	Maximum height of dam	13.00 m	5.97 m
	Length of dam	2130.00 m (including waste weir)	60.00 m
	Bottom Width of COT at Gorge portion	5.00 m	
	Bottom Width of COT at rest of Dam	3.00 m	
10	Spillway		
	Type of spillway	Side Channel type Non-Gated type	Central Channel Gated type
	Location	Left side of dam (RD 1925-2046 m)	RD 210-270 m
	Flood Discharging Capacity	324.00 Cumecs	
	Length of Waste Weir (spillway)	121.00 m	60.00 m
11	Head Regulator (HR)		
	Type of Head Regulator	Well type	
	No. of Regulators	One No.	
	Location of HR	On right bank of nala at RD 660 m	
12	Utilization		
	Irrigation withdrawal	6.79 Mm ³	
	Water supply	0.800 Mm ³	
	Evaporation losses	1.719 Mm ³	
13	Canal		
	Length of Main Canal (RBC)	7.50 Km	
	Irrigable Command area under RBC	908.00 ha	
14	Land Requirement for Project		
	Submergence area	214.68 ha	15.12 ha
	Private land	214.68 ha	15.12 ha
	Government land	Nil	Nil
	Submergence ratio	23.64 (< 25%)	16.43%
15	Command Area		
	Gross Command Area (GCA)	1257.00 ha	127.00 ha
	Cultivable Command Area (CCA)	1069.00 ha	108.00 ha
	Irrigable Command Area (ICA)	908.00 ha	92.00 ha (Lift Irrigation)
	Irrigable Command Area of Project	1000.00 ha	

Sr. No.	Head	Particulars of Rajura LM Project	Particulars of Pickup Weir on Nagjhira Nala
	Tahasils benefited	Chandur Bazar, Morshi and Amravati (Amravati district)	Chandur Bazar
	Intensity of Irrigation	85.0%	
15	Cost Economics		
	Total estimated cost	Rs. 4478.87 Lakhs	
	Cost/ Mm ³ of Gross Storage	Rs. 666.00 Lakhs	
	Cost/ TCM of Gross Storage	Rs. 66600.00 Lakhs < Rs. 108837 Lakhs (Three Times Prevailing Norm for Saline track)	
	Cost/ ha of ICA	Rs. 447.887 Lakhs	
	Benefit Cost (BC) Ratio	Not Applicable as the project area is in saline track	
	Economical Rate of Return	Not Applicable	

1.4 Necessity of EIA & EMP

Rajura Larger Minor Project is an irrigation project for providing irrigation facility to 908 ha ICA; hence this requires an Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP); and environmental clearances from the Maharashtra State Environment Impact Assessment Authority (MSEIAA). In order to meet the statutory requirements, the EIA and EMP have been prepared by covering the following major aspects:

1. Establishing the existing environmental and socio-economic conditions in the project area through review of literature and also conducting primary environmental monitoring, covering 3 seasons of year 2012;
2. Environmental Impact Assessment i.e. assessing the anticipated impacts of Rajura LM Project on various environmental parameters;
3. Environmental Management Plan for outlining mitigation measures for limiting any likely adverse environmental and social impact due to the project and to ensure the environmental conditions in the project area would improve further for environmentally sustainability and in no-circumstances, these would deteriorate;
4. Social Assessment for assessing the socio-economic impacts of the project on the project affected persons due to land acquisition from them;
5. Rehabilitation Action Plan for improving the socio-economic conditions of the project affected persons;
6. Suggesting a Command Area Development Plan;
7. Reviewing the requirements of Catchment Area Treatment Plans in view the project area falls in the zone not-prone to severe soil erosion;
8. Identification of critical environmental and socio-economic attributes requiring monitoring during operational phase; and developing a suitable post-project monitoring program;
9. Providing a framework for institutional strengthening and implementation of the suggested mitigation measures.



1.5 Baseline Environmental Status

The existing baseline environmental conditions and social aspects pertaining to the project area are established through review of secondary data and also by conducting primary field surveys covering environmental components of meteorology, ambient air quality, noise levels, soil quality, groundwater table fluctuations, aquatic and terrestrial ecology during pre-monsoon and post-monsoons seasons; and water quality during 3 seasons viz. pre-monsoon, monsoon and post-monsoons seasons of EIA period. Land use pattern and socio-economic conditions of project affected persons have been studied once during the study period.

1.5.1 Physiography of the Project Area

The catchment as well as command area of the project has gently sloping terrain falling towards Nagjhira Nala and Rajura Nala. No tank or pond exists in the project command area.

1.5.2 Geology

The only geological formation at the dam site, its catchment and command areas is alluvium. No other geological formations or minerals are known to occur in any part of the project area.

1.5.3 Seismicity

In the seismic zoning map of India, the Rajura Project site falls in Zone-II, with a basic horizontal seismic coefficient of 0.029, which is not considered to be prone for severe earthquakes.

1.5.4 Meteorology & Climate of Project Area

The climate of project area is characterized by general dryness throughout the year except during the southwest monsoon season. The project area falls in the 'Scarcity' Agro-climatic zone and the rainfall completely depends on vagaries of monsoon. This area frequently faces severe drought conditions resulting in partial or complete failure of crops.

The Cold season prevails from December to the middle of February. This is followed by hot season which lasts till the end of May. June to September is the south-west monsoon season and the two months October and November, constitute the post-monsoon representing the retreating-monsoon.

May is the hottest month while December is the coldest month. Based on the IMD, Amravati observatory monitored data during 1997-2009 the lowest temperature recorded was at 5.3⁰ C on 27th February 2000 while the highest temperature was recorded at 46.6⁰ C on 5th June 2003.

The area remains dry during the pre-monsoon and winter, whereas during the monsoon and post monsoon season an increase in moisture levels in air takes place. The morning least relative humidity varied from 30% during pre-monsoon to the highest maximum of 97% during monsoon. The evening relative humidity ranged from least 14% during pre-monsoon to the highest of 93% during monsoon.



The average annual rainfall of project area during 1997-2009 was 662.75 mm. The highest rainfall of 1000.7 mm was recorded in 1999 and the lowest 60.0 mm in 2009. The heaviest rainfall during any 24 hours duration was received on 14th June 2001 measuring about 194.8 mm.

Winds are light to moderate in other seasons and during south-west monsoon these become stronger. The mornings are calm as compared to the evenings.

1.5.5 Air Environment

Rajura LM Project is an irrigation project hence the impacts related with air pollution are minimal and exclusively prevail during construction phase. Baseline ambient air quality monitoring was conducted at 6 locations covering vicinities of the dam site, proposed canal alignment and other areas in different directions from the dam site during Pre-monsoon and Post-Monsoon seasons of 2012. This revealed that all tested air quality parameters such as PM₁₀, PM_{2.5}, SO₂, NO₂ and CO were within permissible limits conforming to the National Ambient Air Quality Standards prescribed by CPCB for rural/residential areas.

1.5.6 Noise Environment

Noise monitoring was carried out at 6 locations of the study area during pre-monsoon and post-monsoon seasons. This revealed the maximum Leq ambient noise levels at different locations of the study area varied from 46.9 to 51.2 dB(A) during day time. These were found to be within the permissible levels for rural and residential areas.

1.5.7 Soil Environment

Soils of project area belong to the Purna alluvium and are deep blackish in colour. These are good in fertility but contain slightly higher levels of calcium carbonates.

During EIA period, 6 soil samples were collected from different locations of the project area during Pre-monsoon and Post-monsoon seasons and were tested for their physic-chemical characteristics. These showed slight alkaline conditions with reference to pH, which is a common phenomenon in this area. None of the soil samples showed acidic conditions. In these soils nutrients of organic carbon and phosphorus are low. Potassium is very-high and nitrogen is very-low. The remaining soil quality parameters are well-within permissible limits. This indicates that the area is free from pollution, but deficient in some nutrients.

1.5.8 Water Environment

Pedhi River, Nagjhira Nala and Rajura Nala are the only water courses traversing in vicinities of project area. Nagjhira and Rajura Nalas are smaller streams merely flowing during rains, hence become dry during other periods. Pedhi River is non-perennial and the flows are mostly confined to monsoon and some part of post-monsoon. During pre-monsoon season even this river would go dry.

Groundwater is available in limited quantities that too at more depths. As the project area consists of thick alluvium, only marginal groundwater fluctuations take place during the Pre-monsoon and Post-monsoon seasons. As assessed by Groundwater Surveys and Development Agency, GoM, very few wells are feasible in this region.



During EIA period, primary water table fluctuations have been measured at 10 open wells during Pre-monsoon and Post-monsoon seasons of 2012. Occurrence of groundwater at more depths ranging between 7 m - 18 m below the ground level (BGL) has been found. Among the monitored wells, only marginal groundwater table fluctuations ranging between 0.8 m – 1.7 m have been noticed during Pre-monsoon and Post-monsoon seasons. In view the project area is situated in thick alluvial region where only marginal water table fluctuations take place, this area is not likely to experience drastic water table rise after introduction of irrigation facility. Hence no problems associated with increased groundwater tables such as water logging or its induced soil salinity in the post-irrigation period are anticipated.

Groundwater quality in the project region is moderate with slightly higher levels of calcium carbonates, dissolved solids and hardness, while making this water not much agreeable for drinking, however suitable for irrigation for growing saline-resistant crops.

For establishing water quality, 6 groundwater samples from different locations of the project area were collected during three seasons of 2012 and analyzed. Groundwater quality reveals presence of slightly more levels of calcium carbonates, dissolved solids, hardness in some analyzed samples. However these are within the permissible limits for irrigation on normal soils. It is anticipated, after introduction of irrigation in the area, due to percolation of surface waters into sub-surface, the dissolved solids and hardness in groundwater will be diluted to some extent by improving groundwater quality and also soil quality.

Three surface water samples covering all three water bodies were collected during monsoon when water was available in these. During post-monsoon some water was available only in Pedhi River; hence sampling could be possible from this. No sampling was possible during post-monsoon season from any of the water body, as these went dry. Water quality of all surface water bodies revealed neutral conditions. Due to absence of any industrial activity in the project area there is no interference of industrial or chemical pollution which is established due to non-detectable levels of heavy metals in surface as well as groundwater. Minimal levels of fecal pollution in surface water areas were noticed attributing to anthropogenic activities in vicinities of rivers and nala.

1.5.9 Land Use Pattern

Land use pattern of the project catchment area, command area and also the area falling within 10 km radius around the project location has been established based on digital interpretation of satellite imageries by deploying GIS techniques.

It is revealed that crop land is the most predominant land use accounting to 79.68% of total area followed by the lands with or without scrubs (12.28%) and current fallows (5.44%). Almost all current fallows are normally cultivated, however left as current fallows during certain times. The field surveys and ground-truthing conducted in the project command area revealed that almost all current fallows are agricultural lands and cultivated in one or the other season though at times these are left as fallows. Inclusive of these current fallows the agricultural lands works out to 85.12% of the project area.



1.5.10 Ecology

There are no natural forest growths in any part of the project area. Also there are no wildlife sanctuaries or protected areas within 10 km from the project area.

Baseline ecological conditions in project area have been established based on review of secondary information; and also by conducting primary field surveys at 5 terrestrial sampling sites representing different physiognomic and habitat categories, during pre-monsoon and post-monsoon seasons. Aquatic sampling was undertaken during Post-monsoon season at 2 aquatic sites.

Altogether 121 plant species have been recorded during the study period. Considerable biotic interferences and anthropogenic disturbances resulted in dry conditions while limiting the vegetation to xerophytic species. Although clear cutting of trees was not observed in sampling areas, disturbance in terms of grazing has been found. The tree cover is sparse and consists of native and exotic species. No endangered or threatened species of plants having significant conservation value have been reported either in the submergence area or command area of the project.

Pedhi River revealed presence of different species of algae, phytoplankton and zooplankton. Biotic community composition revealed their mesotrophic conditions having neutral or moderately rich nutrients and absence of pollutants.

Fauna of the study area mostly consists of some commonly occurring species. No rare or endangered species of fauna are reported. About 61 bird species are reported from this area, mostly along the water courses. Most of the birds belong to Schedule IV. Only House crow is listed in Schedule V. No birds belonging to Schedule VI i.e. endangered, threatened, vulnerable categories are observed in the study area.

About 10 species of mammals mostly belonging to Schedule-II to IV have been reported from the project area. Only house-rat is found to be in the Schedule-V category. About 11 species of reptiles belonging to Schedule-II and IV categories, and about 8 types of fishes are reported. About 17 species of butterflies have been noticed during field studies.

1.5.11 Healthcare Systems

Chandur Bazar town at 10 km distance has a Rural Hospital. Belura village at 5 km distance has a dispensary. A Primary Health Centre (PHC) is located at Talvel at about 13 km from Rajura. All larger villages in command area have health sub-centres. Private clinics are not reported from any village. As a whole, the prevailing healthcare conditions are reasonable.

Few malarial diseases are reported from the project area, mainly due to stagnation of water in dirty pools near the existing bore-wells in villages; and also water-storage habits of people. More occurrences of malaria have been reported during May and November representing the monsoon and post monsoon seasons. No epidemics such as JE have been reported during the past five years.

Regular anti-malarial activities such as spraying are regularly taken-up. For preventing mosquito breeding, biological control measures such as culturing Guppy fish in hatcheries in some selected locations is being practiced.



Besides administering medicine to the patients, Passive Surveillance by collecting blood smears and undertaking intensive mass surveillance activities are carried out regularly.

1.5.12 Demography and Socio-Economics of Command Area

As per 2001 Census, 4401 people were residing in 5 villages of the project command area. The total male population worked out to about 51.94% and the females to about 48.06%. The sex ratio, which is expressed as the number of females per 1000 males, was observed to be about 925, which is considered to be low.

About 32.92% of population in the command area belonged to Scheduled Castes (SC), while 4.86% of population belonged to Scheduled Tribes (ST) thus indicating that socially very-backward castes constituted to about 37.78% of total population.

The command area experienced a moderate literacy rate of 72.42%. The male literacy rate, i.e. the percentage of literate males to the total males worked out to be 78.87%. The female literacy rate, which is an important indicator for social change, was observed to be 65.44%.

Only about 47.21% of population was engaged as workers in different occupations. The main workers and marginal workers constituted to about 33.92% and 13.29% of total population respectively. Agricultural labourers were most predominant among the main workers as well as marginal workers; followed by the Cultivators and others. The main and marginal agricultural labourers worked out to about 18.52% and 11.70% of population respectively, thus indicating that about 30.22% population are Agricultural labourers. The main and marginal cultivators worked out to about 11.77% and 1.02% of population respectively, thus indicating that only about 12.79% of population are cultivators.

The command area is devoid of any industry hence only about 0.50% population is engaged as household industrial workers. About 3.46% people are engaged in other occupations.

1.5.13 Land Acquisition & Rehabilitation Issues

About 216 ha private land presently used for cultivation on both banks of Rajura Nala and Nagjhira Nala would be required for the project. This land is owned by 318 private landowners (PAFs). After land acquisition for the project many PAFs would become landless while many others would lose only a part of their landholding, and still possess some land even after land acquisition.

Rajura village presently inhibiting 189 families will be totally affected due to construction of the project though this does not fall in submergence area. Hence this village requires evacuation and resettlement in a proposed new gaonthan (resettlement colony). All families affected due to the project would be paid compensation and given rehabilitation and resettlement benefits in accordance with the Maharashtra Project Affected Persons Rehabilitation (MPAPR) Act, 1999.

Land required for the project would be acquired either through direct negotiations with the land owners or under provisions of Land acquisition Act. The land losers would be provided rehabilitation benefits in accordance with the MPAPR Act.



1.5.14 Places of Historical and Archaeological Importance

No religious place or monument notified by Archaeological Survey of India or by Maharashtra State Archeology Department exists in any part of the project area.

1.6 **Environmental Impact Assessment**

Rajura LM Project will provide immense benefits to the drought prone area by means of providing assured irrigation facility. This is not anticipated to cause major adverse environmental impacts due to its smaller size. However a few minor impacts related with drainage may take place, if appropriate management measures are not implemented.

1.6.1 Impacts during Construction Phase

Project activities undertaken during construction phase such as levelling of sites, construction of dam and pickup weir, excavation of feeder canal and main canal, transportation and stacking of excavated material from the project sites, etc. result in some short-time impacts as described below.

- **Impact on Ambient Air Quality**

During construction period, on account of construction activities, operation of DG sets and plying of heavy earth moving vehicles dust levels in atmosphere get increased. Also the gaseous emissions from vehicles and DG sets cause increase in gaseous pollutants at the project sites. These impacts are felt only for a short-time hence purely temporary in nature. No village or human settlement would be affected due to air pollution as the nearest village Katsur is located at 4 km distance from the dam site.

Burning of firewood/fuel by the construction workers for their cooking might cause some impacts in the villages where they are residing.

- **Impact on Noise Levels**

The major noise generating activities during construction phase are excavation, operation of construction equipment and plying of construction vehicles. Blasting is not involved in this project due to presence of only alluvium. The anticipated noise levels are about 80-90 dB(A) at active construction sites during active construction period, hence would have some impacts on construction workers at the construction site and wildlife in its vicinities. These would cause temporary shifting of wildlife from vicinities of the dam site to other nearby areas. Noise impacts are not anticipated in any village due to their distances from the project site.

- **Impact on Wildlife**

Due to disturbances during construction period the prevailing wildlife at the dam site and pickup weir site would move away from their original habitats to the nearby locations along the nalas having better or similar habitat conditions. Though this is an adverse impact, this would have only a temporary impact as the habitat requirements of local wildlife are general and ample better areas for their habitats are available in nearby areas.



Excavated feeder canal and main canal act as barriers for movement of wildlife and people who used to move freely, hence an adverse impact. These however would cross the canal by using proposed new bridges across the canal. Wildlife may get confused initially and forced to traverse for longer distances for crossing the canal. However, subsequently these would get accustomed and cross the canal without any confusion. Hence this would be a temporary impact.

1.6.2 Impact during Operational Phase

All adverse environmental impacts associated with project construction stage would be ceased after completion of the project.

1.6.2.1 Positive Impacts

- **Impact on Social Environment**

During operational phase, this project would provide immense benefits to farmers of this drought prone area by means of dependable and assured irrigation facilities. This will enable the farmers to take at least 2 crops with enhanced cropping pattern and crop yields in place of their taking a single crop at present. Large number of agricultural labourers who are getting wage labour only for a few weeks in a year at present, will secure assured employment for about 6-9 months in a year. Fisheries development in project reservoir would lead to enhanced income to the fisher-folk having access to the fisheries. All these are positive impacts due to the project, and would transform the living conditions of people in the command area; and the fisher-folk near the project site having fishing rights in the project reservoir.

Besides providing irrigation facility and direct employment to the entire command area, this project would indirectly create impetus to the development of agro based and allied ancillary industries and infrastructure development in the project area; and provide direct and indirect employment to a considerable number of people. This will lead for overall economic development with a multiplier-effect in this backward area and will enhance revenue accruals to the State exchequer.

- **Impact on Land Use**

The project will transform large extents of dry lands in the drought prone areas into lush green irrigated fields by providing assured irrigation facilities. Besides economic development, this project would also enhance scenic beauty in the command area with lush green fields. The proposed tree plantations around the dam and along the canals will improve aesthetic beauty.

- **Impact on Surface & Groundwater Resources**

Under the crop planning of this project, only the allocated water for this project would be utilized as per the actual water requirement of crops. Hence this would not cause any adverse impact on the downstream water resources, competing water users or riparian-rights of the downstream areas.

Due to presence of water in project reservoir, canals and fields of command area, percolation of water into the sub-surface would take place. This would recharge the subsurface by raising the groundwater tables marginally.



- **Impact on Groundwater Quality**

With application of surface water for irrigation on the project area soils having higher levels of calcium carbonates and percolation of nala water to sub-surface some dilution of these pollutants in command area soils and groundwater sources would take place. These conditions would improve soil and groundwater quality to considerable extent, which is a positive impact due to the project.

- **Impact on Ecology and Bio-Diversity**

Due to formation of reservoir and storing of water, ecological conditions of the reservoir area will be improved with presence of aquatic life. The terrestrial ecological conditions along the nala banks will be substantially improved by providing fodder and nesting facilities for the wildlife. Also due to the anticipated groundwater recharge, vegetation in the area will be enhanced, which is a positive impact. Availability of water in the project reservoir and canals; and plantations around the dam and along canals would attract more birds and enhance presence of avifauna in the region.

There are no rare or endangered species of flora and fauna or migration-routes of avifauna in the project area. Hence impacts related with these sensitive aspects are not involved in this project. No adverse impacts are anticipated on downstream aquatic life in Rajura Nala due to regeneration flows from the dam.

- **Impact on Climate**

On account of presence of water for more duration in the reservoir, canals and irrigated fields relative humidity levels in atmosphere will be increased to some extent and temperature levels would be fallen marginally in this summer-scorch region.

- **Impact on Water Resources**

By storing nala water which otherwise was draining-out to the downstream areas, this project will enhance water resources in the region by creating a reservoir. In view only the allocated yield will be utilized, this project will not create any adverse impact on the downstream users.

- **Impact on Aesthetics**

Formation of reservoir and canals will create water fronts in the area and will improve aesthetic values in this otherwise dry area. The reservoir may serve as a picnic spot, when water is available in it. The proposed tree plantations around the dam and canal will enhance scenic beauty around them.

1.6.2.2 Likely Adverse Impacts

- **Impact on Soil**

Entire command area has moderate slopes and soils have moderate infiltration rates. The ground water tables in command area are never likely to rise to such an extent by causing any problem associated with water logging and the resultant soil salinity. Even if such problem is resulted at any future date, this can be mitigated with suitable surface and sub-surface drainage arrangements.



- Impact due to Excess Use of Fertilizers and Pesticides

In the post-irrigation scenario, farmers may tend to use more fertilizers and pesticides, and excessive use of these may result in soil and water pollution. Hence, it should be essential to use the fertilizers and pesticides in a judicious manner without causing soil and water pollution.

- Impact on Human Health

With presence of water for more duration, the humidity levels in the atmosphere will be slightly increased. This may lead to some vector borne diseases in the area. Also due to possible proliferation of mosquitoes and snails, some water borne diseases are likely to result when water is present in the reservoir.

1.7 ENVIRONMENT MANAGEMENT PLAN

Rajura LM Project would have some adverse social and environmental implications though these are anticipated to be the minimum. To further minimize the environmental losses and negating these adverse impacts to the possible extent through technical judgment and implementation of appropriate mitigation measures, an Environmental Management Plan is developed.

1.7.1 Environment Management Plan during Construction Phase

The following mitigation measures during construction period are needed:

- Undertaking excavations and construction activities at project sites while giving utmost care to the environmental aspects and safety measures;
- Carrying out construction activities only during daytime in order to avoid noise impacts on the surrounding areas;
- Undertaking dust control measures such as water sprinkling on haul roads;
- Maintaining the diesel powered construction vehicles properly, for minimizing smoke emissions;
- Adopting appropriate noise attenuation measures for minimizing noise levels in the area;
- Providing noise protection devices like earmuffs and earplugs to the workers operating the high noise generating equipment;
- Using the generated earthen material (muck) from project sites for construction of earthen dam;
- Stacking the surplus material in identified muck disposal sites, with appropriate slopes, in a systematic manner;
- Compacting the muck dumps and undertaking plantations on them for minimizing erosion; Providing adequate number road bridges of appropriate dimensions wherever canal severs the existing road/cart track;
- Providing footbridges wherever the existing traditional paths are severed due to canal construction;
- Providing cooking fuel to construction workers through contractors to prevent felling of trees for fire wood for their cooking; and
- Providing adequate sanitation facilities for male and female workers separately and connecting them to septic tanks.



1.7.2 Management Plan during Operational Phase

The following mitigation measures would be required during operational phase of the project:

- Undertaking tree plantations at foot of the dam in its downstream side, and along the canal;
- Growing grasses and undertaking plantations on muck dumps for their strengthening and preventing their erosion;
- Nurturing the plants at least for 3 years through Social Forestry Department, GoM till the plants become self-sufficient;
- Providing sub-soil drainage at the places if water logging is anticipated;
- Imparting training to farmers for optimal use of fertilisers and pesticides as per the actual requirements of crops based on scientific evaluation of fertility status of soils; and preventing their excessive use, which otherwise may adversely affect the crops;
- Implementing crop-cycling for improving organic matter in soils and giving slight inputs of nutrients for enhancing crop yields;
- Undertaking periodic water quality testing of Rajura Reservoir and Pedhi River and taking appropriate measures if the water quality is not meeting the standards;
- Ensuring no illegal felling of trees takes place in vicinities of project sites;
- Minimizing movement of inspection vehicles and excessive blowing of horn and lighting during night time to avoid disturbances to wildlife in project area;
- Undertaking strict law enforcement measures for conservation of wildlife near the dam and along canal;
- Undertaking appropriate measures for development of fisheries and aquatic life in the reservoir;
- Preventing excessive growth of aquatic weeds in reservoir and canal for controlling nutrition levels; and allowing free-flow of water in canals;
- Creating fisheries hatcheries and culturing fish in project reservoir for creating employment to people and also improving water quality in reservoir; and
- Undertaking Watershed Management Plans by the Agriculture Department GoM, only if it assesses such plans are required and only when surplus funds are made available, in view the project catchment area is not prone for severe soil erosion.

1.7.3 Command Area Development

Command area development programmes encompassing integrated development of water resources, judicious method of water application, suitable soil and crop management practices and scientific scheduling of irrigation, mainly including the following to be implemented:

- Adopting suitable watershed management and soil conservation measures like land development or land shaping, smoothening, grading and forming earth bunds and land levelling;
- Constructing appropriate sizes of field drains;
- Providing efficient surface drainage for removal of excess water which may occur due to heavy rains/ seepage from canals or excessive irrigation;
- Providing efficient sub-soil drainage for removing excess water from sub-soil areas, if it occurs;
- Stabilizing, strengthening and deepening the existing natural drains to possible extent for enabling them to rapidly carry excess water from fields; and



- Restoring soil quality with gypsum or chemical treatment, only if these are affected due to water logging.

1.7.4 Public Health Management

Public Health management measures include:

- Undertaking adequate curative and preventive measures for eliminating the risk of outbreak of any water borne and parasitic disease in the area;
- Strengthening the Ramtirth Primary Health Centre and other healthcare facilities by appointing adequate number of medical and paramedical staff;
- Maintaining good environmental, health and sanitation conditions at construction areas; and
- Carrying out regular surveillance and health improvement programs by the Health Department for preventing health disorders in project area.

1.8 Post-Project Monitoring and Management

During post-project monitoring period, for effective environmental management in terms of soil and water quality in the project area some representative areas need to be monitored. Developing an Environmental Management Program under the Coordination Committee of Water Resources and Agriculture Departments, GoM and implementing the identified mitigation measures in problematic areas would safeguard environmental conditions in the project area.

1.9 Organization for Environment Management

The Superintending Engineer of Upper Wardha Project Circle would implement the proposed Environment Management Plan in coordination with various other departments of GoM.

1.10 Budgetary Allocation for Environmental Measures

The total cost of Rajura Larger Minor Project is estimated to be about Rs. 4478.87 lakhs. Of this about Rs. 6.606 lakhs will be used for tree plantations in vicinity of dam and along the canal. As per irrigation norms, it is presumed that about 356 ha (one-third of 1069 ha CCA) might require land drainage. For implementing drainage measures Rs. 2.49 lakhs has been proposed.

1.11 Conclusions

Rajura Larger Minor Project will provide assured surface water irrigation facility to about 908 ha ICA. With its immense benefits to the drought prone areas of Amravati district, this project would contribute for overall socio-economic and infrastructure development of the region. By supplying considerable quantities of food and non-food products, this project would be beneficial even to the areas away from the project site.

In view Rajura LM Project would provide irrigation facility to saline soils; Benefit Cost Ratio is not applicable to this project.