

**CHAPTER-9
ENVIRONMENTAL AND ECOLOGICAL ASPECTS OF THE PROJECT**

9.0 General:

To assess environmental, ecological and socio-economic issues of the proposed link, NWDA engaged the consultancy services of M/S, Consulting Engineering services (India), Pvt. Limited, New Delhi. Based on environmental, ecological and socio economic surveys conducted along the reservoirs and entire stretch of tunnel as well as data collected from primary and secondary sources, impacts on environmental, ecological and socio-economic components have been identified.

9.1 Environmental and Ecological Aspects

Impacts are categorise as impacts due to projects location, design, construction and operation stages

9.1.1 Impacts due to project location

9.1.1.1 Impacts on population

The submergence areas of the reservoirs include human settlements in the project area. A total of 24 villages are affected either partly or fully as given in table 9.1. Most of the project affected population belongs to the weaker section as majority under submergence area belongs to scheduled tribe (ST) category.

**Table 9.1
Population/Families affected ***

Name of Reservoir	No. of villages	Population	No. of Families
Bhugad	14	3046	503
Khargihill	10	1484	220
Total	24	4530	723

Mitigation measure

- A comprehensive package must be provided under R& R plan
- National Policy on Resettlement and Rehabilitation for "Project Affected Families-2003 (NPRR-2003) may be adopted for the families affected due to submergence.

9.1.1.2 Impacts on forest land

Impacts on ecology due to proposed reservoirs includes the submergence of 1624 ha of forest land as detailed in table 9.2

Table-9.2

S N	Land	Bhugad reservoir			Khargihill reservoir			Total		
		Maha- rashtr a	Guja - rat	Tota l	Maha- rashtr a	Guja - rat	Tota l	Maha- rashtr a	Guja - rat	Total
1	Forest land	428	462	890	734	0	734	1162	462	1624
2	Cultiva- ble land	383	413	796	552	0	552	935	413	1348
3	River portion	105	112	217	272	0	272	377	112	489
	total	916	987	190 3	1558	0	155 8	2474	987	3461

The forest area under submergence of Bhugad reservoir falls in Dharmapur and Harsul forest ranges. The entire submergence area of Khargihill reservoir falls in Dahanu forest range of Thane district.

Impact of submergence on wildlife

The Impact of wildlife comes from the loss of habitat resulting from the submergence of forests. However large forest area is available in the surrounding region for migration of wildlife from the area coming under submergence. Hence impact will be of minor in nature. Moreover, the creation of permanent waterfront will be **beneficial** for wildlife existing in the surrounding forest.

Impact on Endangered & Rare Species

In the neighbouring forests of Bhugad and Khargihill reservoirs, three endangered and rare species of wildlife (Schedule-I) are reported viz. Caracal (*Felis caracal*), Leopard cats (*Felis bengalensis*) and Leopard (*Panthera pardus*). As large forest areas are available in the surrounding region, these animals would migrate from the submerged forests. Hence **no significant impact** is expected.

Impacts on Vegetation due to Tunnel Construction

There will be no vegetation loss due to the tunnel construction. Therefore it will not affect the existing forest.

Mitigation Measures

- Adequate compensatory afforestation to compensate the loss of forest.
- Plantation in the available balance open spaces is proposed.
- More valuable tree species could be planted.

9.1.1.3 Impacts on Natural Resources

There are no national parks, wildlife reserves, sanctuaries and other protected areas in the project area. Hence there will be no likely tangible impact.

9.1.1.4 Impacts on Grazing land

There are not permanent green pastures under the submergence area, so no impact can be assured.

9.1.1.5 Impacts on Agricultural Land

Agricultural or Cultivable Land to the tune of 1348 ha as given in Table-9.1 this may change in land use pattern by resettlement of population and submergence of agricultural land.

Mitigation Measure

Project affected families will be compensated against the loss of their cultivable land.

9.1.1.6 Impacts on Mineral resources, Historical and Cultural Monuments

As no mineral resources or mining activities, historical or cultural monuments exist in the proposed project area, no impact is considered.

9.1.2. IMPACTS DUE TO PROJECT DESIGN

9.1.2.1 Hydrological Balance

The ground water table in the adjoining areas of the project location is expected to rise due to the reservoirs. Water logging is not expected. This is a **beneficial impact**.

9.1.2.1 Impacts on Commuting Networks

As there are no major Highways or Railways passing through the project location, no impact can be assured on commuting networks.

9.1.3 Impacts during Construction Phase

Impacts on various environmental components during construction phase are given in following paras.

9.1.3.1 Impacts on Topography & Geology

The project area lies in zone-III of the seismic map of India, with a moderate risk of potential damage to the structures due to earthquake.

Mitigation Measures

- Adoption of suitable seismic design of the project components will mitigate some of the environmental impacts.

9.1.3.2 Impact on Soil

All major construction activities tend to create certain changes in the soil of the area. As such, the construction activities are proposed to be bounded within the project area, which is limited, and the amount of productive soils included in the proposed site is marginal. Therefore the impacts will be minimum.

Mitigation Measures

- Backfilling the excavated soil and compacting it to regain its original state
- Appropriate measures like plantation, and turfing would be undertaken to arrest soil erosion.

9.1.3.3 Impact on Land Use

Land requirement for construction of dam can alter the land use pattern in the immediate vicinity of the project site. The on-site land use will more or less have a temporary impact in terms of fugitive emission from handling of construction material.

Mitigation Measures

- The excavated material/construction debris would be used for construction of dams and roads.
- Dumping areas will be biologically reclaimed.
- Appropriate dust suppression measures will be implemented within the project site.

9.1.3.4 Impacts on Hydrology and Water Use

The water demand during construction period will be met from the sources within the project area and, therefore, **no impacts** are expected on other users.

9.1.3.5 Impacts on Water Quality

Large quantity of water will be used in the construction process, of which a significant portion will drain out as wastewater. Such waters may form stagnant pools and aggravate soil erosion. Stagnant pools of water promote breeding of mosquitoes and create generally unsanitary conditions.

Mitigation Measures

- Construction activities/erosion would be limited to small area.
- Drains from construction sites will be land to sedimentation pits.
- Proper sanitation facilities shall be provided at the construction site.

9.1.3.6 Impacts on Air Quality

Particulate matter would be the predominant pollutant affecting the air quality during the construction phase. Mostly transportation vehicles and construction machineries will generate undesirable gaseous pollutants. However, this would not lead to any tangible effect, as the expected traffic volume is low.

Mitigation Measures

- Regular inspection of haul roads and construction site should be carried out to remove the construction debris.
- The amount of earth generated from cutting shall be used to the maximum possible extent as filling material.
- Low emission construction vehicle and generator should be used.

9.1.3.7 Impacts of Noise

During the construction phase, noise will be generated due to movement of vehicles, blasting, and operation of light and heavy construction machineries that are known to emit sound pressure levels with moderate to high decibel value. Since the site is located away from villages/settlements so there will be no significant impact of noise or pollution on the local people.

Mitigation Measures

- Construction would be located away from the sites and major road traffic.
- Impacts of noise shall be minimized through adoption of adequate protective measures.
- Low noise construction equipment shall be used.

9.1.3.8 Impacts on Ecology

The existing site is a piece of vacant land consisting of very few sparsely distributed tree species. Thus, the site development works will not lead to any significant loss of forest. The water quality of the surface water bodies is not likely to change significantly due to the construction activities, **no tangible impact** on the aquatic life is expected.

Impact on Aquatic Life

Aquatic fauna including fishes, waterfowl, water snakes and amphibians will increase. This is a **beneficial impact**.

9.1.3.9 Impact on Socio-Economics

Employments Opportunities

Most of sizeable labour force will be drawn from neighborhood; no change in demographic profile is anticipated. Only for a few skilled personnel, brought to site from outside the locality. A quantitative statement based on 'Peak Labour Strength' could not be made, as no information was available.

Trading Opportunities

Some construction materials will be procured locally and some other through other sources, Hence, there is a possibility of generation of local trading opportunities.

Impacts of Migration

In the absence of the sufficient semi-skilled and skilled workers amongst the local population, migration of such skills is inevitable. In such cases, the local population feels alienated and neglected.

Displacement of People due to submergence

As detailed earlier, a total number 24 villages and 723 families having a population of 4530 persons will be affected from the submergence of Bhugad and Khargilhil reservoirs.

Mitigation Measures

- Significant number of semiskilled and unskilled labourers would be recruited from the nearby areas. To create some employment opportunities people.
- Most of the construction work is labour intensive.
- Proper housing/accommodation would be provided in the construction township for the skilled personnel.
- Community development programmes will be undertaken aiming at to provide earning opportunities.
- Suitable rehabilitation and resettlement (R&R) plan for the affected people will be implemented.

9.1.4 IMPACTS DURING OPERATION

9.1.4.1 Impact on Soil

Soil erosion is an environmental factor. Which is likely to degrade cultivable land within the catchment area.

Mitigation Measures

- Soil conservation measures like catchment area treatment to minimize removal of topsoil and to avoid siltation of dam and reservoir shall be taken.

9.1.4.2 Impact on Land Use

The operation of the plant will induce impacts on the land use pattern of the surrounding area over a period of time, mainly in the form of shift from agricultural and rural residential use to industrial, commercial and urban residential use. Therefore, it is expected to induce some changes of the existing land use pattern of the surroundings.

9.1.4.3 Impacts on Hydrology

The flow in river fluctuates frequently and abruptly depending on the rainfall received in the catchment. Controlled discharge of certain amount of water through the spillway will stabilize the flow in the river downstream of the dam.

9.1.4.4 Impacts on Water Use

A total quantity of 577 MCM is proposed for diversion to Pinjal river (287 MCM from Bhugad reservoirs, 290 MCM from Khargihil reservoir both at 100% dependability) a quantum of 332 MCM from Pinjal river reservoir is also proposed thus total 909 MCM of water is proposed to meet the domestic and industrial water requirement of Greater Mumbai city. This is a **beneficial impact** to the population of Greater Mumbai by overcoming the shortage of drinking Water supply. A provision of 91 MCM of water through spills releases in river channel of Damanganga has also been kept to meet committed downstream requirement of Madhuban reservoirs during non-monsoon period, there will **no appreciable impacts** on water use.

9.1.4.5 Impacts on Water Quality

As there will no wastewater discharge, there will be **no impact** on water quality.

9.1.4.6 Impacts on Meteorology

Impounding of large volume of water may raise the humidity, lower the air temperature and probably enhance the precipitation of the region. However, these are to be monitored after completion of the project for confirmation.

9.1.4.7 Impacts of Noise

There will be no machine/industrial Noise during the operation therefore; **no impact** of noise is likely to be felt by the local public.

9.1.4.8 Impacts on Socio-Economics

The labour force involved during construction & operation may involve more skilled manpower which may be migrant in nature. However due to low number of such migrant the impact on the demographic profil of the area will be negligible.

Tourism

The construction of proposed reservoir/dam will make the environments more pleasant and help to develop tourism this is a **beneficial impact**.

Economic Boost Up

Large beneficial impacts in terms of gross economic yield shall accrue. The benefit accrued shall be obviously considerable in local as well as regional context.

9.2 ENVIRONMENTAL MANAGEMENT PLAN

For proper implementation mitigation measures, following environment management plan (EMP) has been suggested.

9.2.1 EMP for construction Phase

The EMP for construction phase should comprise the following

- Dust suppression measure such as sprinkling of water to be carried out regularly during construction material handling/overhauling activities.
- Stringent construction material handling/overhauling procedures.
- Suitable drainage system with traps for arresting the sediment load of waste water for its proposed disposal into the main natural drainage system around the site.
- Adequate safety measures complying to be occupational safety manuals to prevent accidents/hazards to the construction workers.
- The construction personnel exposed to high noise levels shall be provided with protective gears such as ear-muffs. The labour sheds shall be located away from the construction site.
- Housing facilities for all construction workers shall be provided with the following amenities.
 - a) Adequate potable water supply
 - b) Sanitary facilities such as dry pit latrines
 - c) Solid waste collection and disposal system
 - d) Primary health facilities at construction site
 - e) Electrification and fuel for cooking

9.2.2 During Operation

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

- Maintenance of green belt in and around the project area
- Adequate safety measures complying to the occupational safety manuals to prevent accidents/hazards to the workers.
- Providing suitable human management and stable working conditions in order to alleviate socio-economic unrest.
- Undertaking appropriate periphery and community development programmes in the vicinity
- Undertaking all necessary pollution control measures to maintain the emissions and discharges within the prescribed/stipulated limits.

9.2.3 Details of Management Plan

The following plans has been proposed under environmental Management plan

- i. Greenbelt Development plan
- ii. Compensatory Afforestation Plan
- iii. Forest Protection Plan
- iv. Wildlife Management Plan
- v. Solid Waste Management Plan
- vi. Dumping & Borrow area Management Plan
- vii. Catchment Area Treatment Plan
- viii. Fisheries Development Plan

9.3 Environmental Management Cell

The environmental Management Cell (EMC) will act as a co-ordinator for environmental matter and supervise the proper implementation of the EMP.

Table-9.3

Unit – Amount in lakh

S. No.	Item	Unit	Rate	Bhugad		Khargihill	
				Qty.	Amount	Qty.	Amount
1.	Restoration of land in construction area.	L.S.			5		5
2.	Health delivery system	L.S.			5		5
3.	Conservation of flora and fauna :-						
	Compensatory afforestation & development of degraded forest (twice area of forest)	ha	0.07	1780	125	1468	103
4.	Green belt of main projects site	L.S.			10		10
5.	Drainage & sanitation (sewage disposal & storm drainage etc.)	L.S.			3		3
6.	Pollution monitoring				3		3
	Total (2002-2003)				151		129
	TOTAL					280	

9.4 Post- Project Monitoring Plan

To identify the effectiveness of mitigative measures suggested in preserving the environmental quality in the area. The parameter to be monitored has been listed out in respect of water quality soil quality and ecology.

9.5 Budget for EMP

The budgetary cost estimate of the EMP works out to 2.80 crores for implementation of environmental measures as given in table-9.3.

9.6 Resettlement & Rehabilitation plan

The main objective of R&R Plan is to resettle and rehabilitate the displaced persons/families in a manner that will help them regain/improve their socio-economic status, at least that of prior to the project, if not better. Also develop a step by step process dealing with every aspects of R&R such as, compensation for land and assets, mechanism for grievance redressal, allotment of land plot at resettlement sites, development of infrastructure facilities at relocation sites, synchronization of assistance disbursement during the transition phase, training for skills improvement, etc. All the guidelines given in National Policy on Resettlement & Rehabilitation (2003) would be followed.

9.6.1 Number of Projects Affected Persons (PAPs)

The construction Bhugad reservoirs and Khargihill reservoirs will affect 723 families which stand to loose 1348 ha of cultivable land as given in table 9.1 & 9.2 .

9.6.2 Compensation

Compensation amount for the families losing cultivable land is given in table 9.3 . The amount is based on Rs. 23000 per ha as compensation for land and Rs. 2,000 per ha for standing crops. The total comes to Rs. 337.00 lakhs, as given in table 9.4.

Table-9.4

S. No.	Particulars	Land (ha.)	Rate (Rs/ha)	Compensation (Rs. Lakhs)
1.	Compensation for cultivable lands	1348	23,000	310.04
2.	Compensation for standing crops	1348	2,000	26.96
	Total			337.00

The actual compensation package is to be finalized in consultation with the district administration.

Assistance

Besides the compensation of cultivable land the following assistance will also be provided

- A house plot of 200 sq.m size will be provided to each affected families free of cost
- Affected/displaced families will be entitled to retrieve material from their houses being displaced.
- House construction assistance of Rs. 1,00,000 to each PAF losing home stead.
- The total estimated cost of the assistance comes to Rs. 885.91 lacs as given in table 9.5

Table-9.5

S. No.	Particulars	Unit	Quantity	Rate (Rs)	Compensation (Rs.lakh)
1	Cost of land for resettlement site	Ha	36.15	23,000	8.31
2	Land development cost	ha	14.46	1,00,000	14.46
3	House construction assistance	PAFs	723	1,00,000	723.00
4	Assistance for shifting to the new site	PAFs	723	2,000	14.46
5	Rehabilitation grants	PAFs	723	16,000	115.68
6	Miscellaneous & contingencies		L.S.		10.00
	Total	-	-	-	885.91

9.6.3 Infrastructure Developments

The following civic amenities and facilities are required to be developed at resettlement sites by the Implementation Authority.

- Piped water supply for drinking purpose
- Primary school with playground in each resettlement village
- Tar topped internal approach roads and link roads to the main road
- Electric supply at least one point at each house as per Jawahar Jyoti Yojana
- Sewer network and latrines in each house
- Land for market and future expansion of the resettlement village

One-community buildings in each resettlement village.

In addition, several existing services facilities are required to be provided at resettlement sites. These are:

- Four Primary health centers (PHCs) with free medical, immunization, and family planning facilities
- Middle & secondary schools at resettlement sites or in the nearby area which would serve displaced population
- 4 Post offices with telephone facilities

Approximately 4530 persons from 723 families need to be resettled. The total expenditure on development of infrastructure & Area development activities works out to Rs.526.1 lacs & Rs.19.5 lacs respectively as given in table 9.6 & 9.7 .

Table-9.6

S. No.	Facilities	Criteria	Total	Unit cost (Rs. Lakh)	Total cost (Rs.lakh)
1.	Water supply	For each resettled site	9 nos	0.80	7.2
2.	Primary school	1 in each resettled village	5 nos	8	40
3.	Approach road	-	17 Km	24	408
4.	Lighting	For each resettled village	2nos	32.2	64.4
5.	Community building	1 in each resettled village	2nos	3.25	6.5

	Panchayat Ghar				
Total					526.1

**Table -9.7
Cost of Area Development Activities**

S.No.	Item	Cost (Rs. Lakhs)
1.	4 PHCs (2 each for Bhugad & Khargihill) @ Rs.3.25 lakhs/PHC	13
2.	2 Post offices @ 3.25 lakhs/P.O.	6.5
	Total	19.5

9.6.4 Land Acquisition

Land is normally acquired under the provisions of the land acquisition act 1894. It include the following activities:-

- Preparing land plans for acquisition with details about the total holding and the area affected.
- Appointment of the Competent Authority.
- Issue of notices as per the Act for acquisition
- Announcement of compensation award as per the Act.
- Issue of cheques in public places prior to taking possessions.
- Affected persons shall be allowed to salvage the material from the demolished structures.

9.6.5 Institutional Arrangement

Institutional arrangement required for the project would be as follows:

- Establishment of a R&R Unit within the implementing Authority and to be headed by Resettlement and Rehabilitation Officer (RRO)
- Appointment of NGO
- Formation of District Level Committee (DLC)
- Formation of Grievance Redressal Committee (GRC)
- Appointment of Competent Authority (CA)
- Appointment of M & E Agency

9.6.5.1 R&R Unit

Implementation of Resettlement and Rehabilitation component would be the overall responsibility of R&R Unit and headed by RRO (appointed/designated) by the Implementing Authority. The responsibilities of RRO include policy guidance, planning, implementation and monitoring, contingency planning R&R related programmes and reporting during the R&R implementation.

9.6.5.2 NGO Partnership

The NGOs will work as a link between the project and the affected community. It will educate PAP,s on the need to implement the project on aspects relating to land

acquisition and R&R measures and ensure utilization of various grants being extending to them under the R&R entitlement package. The selected NGO will be responsible for following

- Development rapport with the displaced persons and the project authorities.
- Develop micro level plans for R&R in consultation with the displaced persons and the project authority.
- Explain options available to displaced persons for their R&R and assist them in making their choices
- Assist displaced persons in getting compensation for their land & properties acquired
- Assist displaced persons identify suitable land for relocation
- Assist project authorities in making arrangements for smooth relocation of displaced persons.
- Ensure that benefits due to the displaced persons under R&R policy are met with
- Ensure proper utilization of various grants to displaced persons available under R&R package.
- Assist displaced persons in getting benefits from various government development programmes, particularly income generating programmes
- Assist displaced persons in redressal of their grievances in appropriate forum

9.6.5.3 Districts Level Committee (DLC)

Districts Level Committee (DLC) headed by District Magistrate shall be formed as an integral part of the implementation of the R&R activities. The DLC would facilitate the implementation of resettlement action plan with local inputs and participation.

9.6.5.4 Grievance Redressal Committee (GRC)

The Grievance Redressal Committee shall be forum at District Head Quarter in which the project lies. GRC would be the forum for the affected persons where appeals against the compensation award and R&R assistance can be brought and get resolved. In case the grievance is not addressed in this forum, affected/displaced persons would be entitled to move to court of law. Therefore, the purpose of forming the GRC is to address the problems of affected/displaced persons at non-judicial level i.e., outside the court and facilitate the smooth progress of the project.

The Committee will meet regularly (at least once a month) during implementation of the R&R activities. The Committee shall ordinarily deliver its decision within a month of the registration of a case.

9.6.5.5 Competent Authority

The Competent Authority shall be appointed by the Central/state Government through the notification in the official gazette to perform the functions of the competent authority for such area as may be specified in the notifications.

9.6.5.6 Monitoring and Evaluation (M&E) Agency

An independent external agency would be hired by the implementing Authority to monitor and evaluate the implementation of R&R activities. Based on the study suitable measures shall be suggested, if required.

9.6.6 Relocation

Resettlement sites may be identified and selected by the implementing authority in consultation with oustees or representative of oustees. However, the implementing authority may appoint an NGO (which has been the practice in most bank funded projects in India) to facilitate the work of the implementing authority and assist oustees in resettlement rehabilitation.

The resettlement and Rehabilitation Plan provides for allotment of land to each family. The resettlement and rehabilitation planning shall start immediately after the declaration is published in the Official Gazette U/s 6 of the LA Act.

9.6.7 Rehabilitation

The rehabilitation involve the following activities

- Verification of affected/displaced persons for various assistance
- Providing information to affected/displaced persons to make informed choice about the income Generation (IG) program.
- Training for upgradation of skills for IG program
- Payment of the assistance to synchronise with the release of compensation paid to affected/displaced persons
- Income generating activity for each affected/displaced person to be planned by the affected/displaced persons in consultation with the NGO.

9.6.8 Participation of PAP's

As a part of participatory planning, regular interaction with affected/displaced persons will facilitate the smooth progress of R&R activities.

9.6.9 Budget for R&R

The Budget for implementing R&R plan is estimated as Rs.1431.51 lacs. tentively.

The proposals for R&R are tentative and subject to modifications at later stages of R&R implementation.