CHAPTER 6
ASSESSMENT OF IMPACTS

6.1 GENERAL

Based on the project details and the baseline environmental status, potential impacts as a result of the construction and operation of the proposed Dibang Multipurpose Project have been identified. The Environmental Impact Assessment for quite a few disciplines is subjective in nature and cannot be quantified. Wherever possible, the impacts have been quantified and otherwise, qualitative assessment has been undertaken. This chapter deals with the anticipated positive as well as negative impacts due to construction and operation of the proposed Dibang Multipurpose Project.

6.2 IMPACTS ON LAND ENVIRONMENT

6.2.1 Construction Phase

Majority of the impacts are temporary in nature, lasting mainly during the construction phase and often little beyond the construction period. However, if these issues are not properly addressed, the impacts can continue even after the construction phase of a project. The time required for the construction of the project has been assumed as about 8 years. Though, impacts due to construction are, temporary in nature, but may attach significance due to the nature and intensity of the impacts.

The major anticipated impacts during **the construction phase** are as follows:

- Impacts due to Quarrying operations
- Impacts due to Operation of construction equipments
- Impacts due to Soil erosion
- Impacts due to Muck disposal
- Impacts due to Construction of roads

(i) Impacts due to quarrying operations

During DPR stage investigation of Dibang Multipurpose Project, availability of construction material was studied keeping in view the requirement of the construction material. About 0.74 lakh cum of shell material, 193 lakh cum of coarse aggregate, 96.50 lakh cum of fine aggregate and 0.26 lakh cum of impervious material will be required for construction of the project.

Consequently, area along either bank of Dibang river, covering 5 km upstream and 30 km downstream of dam axis was traversed to identify suitable quarry site/borrow areas. There are huge river shoals /fan deposits, having adequate quantity of natural aggregates around the project area and are located in the downstream of the proposed dam. Hence total requirement of the construction material is to be met from river shoal/fan deposits only.

(ii) Impacts due to operation of construction equipments

During construction phase, various types of equipment will be brought to the site. These include crushers, batching plants, drillers, earth movers, rock bolters, etc. The siting of these construction equipments would require significant amount of space. Similarly, space will be required for storing of various other construction equipments. In addition, land will also be temporarily acquired, i.e. for the duration of project construction for storing the quarried material before crushing, crushed material, cement, rubble etc. Efforts must be made for proper siting of these facilities. The various criteria for selection of these sites would be:

- Proximity to the site of use
- Sensitivity of forests in the nearby areas
- Wildlife, if any, in the nearby area
- Proximity from habitations

Efforts shall be made to select the site for locating the construction equipment in such a way that the adverse impacts on the environment are minimal. Efforts must be made to site the construction equipment, so that the residents of nearby villages are not adversely affected.

During construction phase, there will be increased vehicular movement for transportation of various construction materials to the project site. Large quantity of dust is likely to be entrained due to the movement of trucks and other heavy vehicles. However, such ground level emissions do not travel for long distances. In addition, there are no major habitations in the project area. Thus no significant impacts are anticipated on this account.

(iii) Impacts due to soil erosion

The runoff from the construction sites will have a natural tendency to flow towards river Dibang or its tributaries. For some distance downstream of major construction sites, such as dam, power house, etc. there is a possibility of increased sediment levels which will lead to reduction in light penetration, which in turn could reduce the photosynthetic activity to some extent as it depends directly on sunlight. This change is likely to have an adverse impact on the primary biological productivity of the affected stretch of river Dibang and its tributaries. The impact is likely to be greater for the smaller rivers/rivulets, where large flow is not available for dilution, or are seasonal in nature.

(iv) Impacts due to muck disposal

The total excavation quantity likely to be generated at the project will be around 177 lakh cum, out of which 59 lakh cum will be common excavation. Effectively, total rock excavation will be 117.8 lakh cum. Out of 117.8 lakh cum of total rock excavation, approximately 35 lakh cum will be used for production of aggregate and remaining 82.84 lakh cum will have to be disposed of. Adding 25% to 60% bulkage factor for common excavation and rock excavation, the quantity to be disposed of would be 198 lakh cum. Detailed calculation in table 6.1.

Table 6.1: Calculation of Muck to be Disposed Of

Sl. No.	Description	Quantity(cum)
1	Total Excavation (TE)	17686800
2	Common Excavation (CE)	5902440
3	Total Rock Excavation(TRE)=TE-CE	11784360

4	Reusable Quantity (for use as Aggregate) (RQ)	3500000
5	Disposable rock mass	8284360
6	Taking swelling factor of 60% for rock, disposable rock muck	13254976
7	Back fill/ fill quantity	673600
8	Disposable common muck=CE-BQ	5228840
9	Taking swelling factor of 25% for common disposable muck	6536050
10	Total muck to be disposed(10)=(6)+(9)	19791026
		Say, **198 lakhs**

The above said quantity of muck generated needs proper disposal, so that the disposed muck would not cause any ecological damage in the dumping area. In addition, necessary care will be taken to avoid any flushing down of the excavated material in the river during monsoon, as it may significantly bring down changes in the aquatic ecosystem of the river. Proper phytoremediation plan for muck disposal areas needs to be formulated and be applied during construction phase.

(v) Impacts due to construction of roads

The topography of the project area has steep slopes, which descends rapidly into narrow valleys. The conditions can give rise to erosion hazards due to net downhill movement of soil aggregates. The project construction would entail significant vehicular movement for transportation of large construction material and heavy construction equipments. Some of the roads (19.5 km length) in the project area, would require widening and many new roads (a total of 64 km length) would have to be constructed. The construction of roads can lead to removal of trees on slopes and reworking of the slopes in the immediate vicinity of roads which increases the vulnerability of the area to landslides, erosion gullies, etc.

The indirect impact of the construction of new roads is the increase in accessibility of hitherto undisturbed areas, resulting in greater human interferences and subsequent adverse impacts on the ecosystem.

6.2.2 Operation Phase

The total land required for the project is 5827.80 ha. The details are given in table 6.2

Table 6.2: Land required for the proposed Dibang Multipurpose Project

S. No.	Name of Project Component	Area (ha)
A.	Submergence area	4009
B.	Project area	250
C.	Project Components & Construction Facilities	
(i)	Area for Dam, DT, HRT, Pressure Shaft, Power House, TRT, cable crane on right bank & left bank	100.06
(ii)	Area for muck disposal, batch plant, switch yard & aggregate processing plant	20
(iii)	Area for NHPC, contractor camp & office	79.25
(iv)	Area for permanent Magazine opposite to Pathar Camp on left bank	2.5
(v)	Rest area for project	165.92
D.	Epali clay quarry	4.52
E.	Colony area	100
F.	Land for Rehabilitation purposes	137.02
G.	Road land -New Road & Widening of existing road	177
H.	Area for Towers for 66 KV Line from Chimari to Project site and substation at Chimari	0.2275
I.	Area for Right of Way for 66 KV Line from Chimari to project site area	81
J.	Project Components & Construction Facilities	
(i)	Area for DT outlet & TRT outlet are on right bank	13.3
(ii)	Area for muck disposal, fabrication yard & aggregate processing plant	40
K.	Eme river/Diri river deposit (As per Construction Survey Material Report)	167
L.	Nizamghat- Sirki (As per Construction Survey Material Report)	108
M.	Aya river/ Aka river fan Deposit	373
	Total	**5827.8**

6.3 IMPACTS ON WATER RESOURCES

The dam/reservoir is designed to store water. It immediately begins to accumulate sediments carried by river. As a result of siltation in the reservoir clear water flowing downstream causes channel degradation and stream bank erosion. Impoundment of sediments in the reservoir at the bottom and its suspension changes the water quality due to dissolution of the mineral depending on their solubility and pH of the water system resulting in obstruction to the passage of light due to increased turbidity. Quality of the water in the reservoir may be affected by accumulation, euthrophication from weeds, biomass decay, turbidity, pollution from agriculture, industrial and human wastes etc. The river water quality analysis at project sites indicates presence of high iron content basically due to geological formation at the project site as such as there is a possibility of iron built up in the reservoir. With the construction of dam there will be a direct impact on the flow regime on the downstream of the river. The ground water table in the vicinity of the reservoir is expected to rise. The seepages from the reservoir may also change groundwater flow regime in the area. The turbidity in reservoir will affect the biological activities and fish migration. Direct impact on fishery in downstream is envisaged due to change in flow regime.

6.4. IMPACTS ON WATER QUALITY

6.4.1 Construction phase

The major sources of water pollution during project construction phase are as follows:

- Sewage from labour camps/colonies
- Effluent from crushers

Sewage from labour camps

The project construction is likely to last for a period of 8 years. As mentioned earlier, about 5000 workers and 800 NHPC employees (including family) are likely to congregate during project construction phase. The domestic water requirement of the labour/employee population is expected to be of the order

of 0.40 mld @ 70 lpcd. It is assumed that about 80% of the water supplied will be generated as sewage. Thus, the total quantum of sewage generated is expected to be of the order of 0.30 mld. The BOD load contributed by domestic sources will be about 237 kg/day. Even if the sewage is discharged without treatment in river Dibang the flow required for dilution will be of the order of 9 cumecs. The minimum flows in river Dibang much higher than this flow, hence no major adverse impacts are anticipated.

However, it is proposed to treat the sewage generated from labour colonies before disposal. Normally, during project construction, the labour population is concentrated at 2 or 3 locations. Thus, the sewage/BOD loading would outfall into river Dibang at 2 or 3 locations. The sewage is proposed to be treated before disposal to avoid the deterioration of water quality of the receiving water body. During construction phase, normally large scale secondary treatment facilities are not commissioned, because they are rendered useless, once the construction activities are over. In the present project, it is proposed to commission adequate number of septic tanks for treatment of sewage. The details are covered in Chapter on Solid Waste Management of the EMP Report.

Effluent from crushers

During construction phase, at least two crushers, one near the dam site and another near the powerhouse site will be commissioned. The total capacity of the crusher is likely to be of the order of 120-150 tph. Water is required to wash the boulders and to lower the temperature of the crushing edge. About 0.1 m^3 of water is required per tonne of material crushed. The effluent from the crusher would contain high-suspended solids. The quantum of effluent generated is of the order of 12-15 m^3/hr. For the purpose of collecting the effluents, settling tanks will be installed in which the effluent from crushers will be stored for some time so that the suspended solids could settle and supernatant liquid could be disposed off through absorption trenches.

6.4.2 Operation Phase

The various aspects covered as a part of impact on water quality during project operation phase are:

- effluent from project colony
- impacts on reservoir quality
- eutrophication risks.

(a) Effluent from project colony

During the operation phase, due to absence of any large-scale construction activity, the cause and source of water pollution will be much different. Since, only a small number of O & M staff will reside in the area in a well-designed colony with sewage treatment plant and other infrastructural facilities, the problem of water pollution due to disposal of sewage is not anticipated. In the operation phase, about 500 families (total population of 2500) are likely to be residing in the project area. About 50 kiloliter/day of sewage will be generated @ 20 liter/person. It is proposed to provide biological treatment facilities including secondary treatment for the sewage so generated. The BOD load after treatment will reduce to 10 to 12 mg/l. Thus, no impacts are anticipated as a result of disposal of effluents from the project colony.

(b) Impacts on reservoir water quality

The flooding of previously forested and agricultural land in the submergence area will increase the availability of nutrients from decomposition of vegetative matter. Phytoplankton productivity can supersaturate the euphotic zone with oxygen before contributing to the accommodation of organic matter in the sediments. Enrichment of impounded water with organic and inorganic nutrients will be the main water quality problem immediately on commencement of the operation. However, this phenomenon is likely to last for a short duration of few years from the filling up of the reservoir.

(c) Eutrophication risks

Another significant impact generally observed in the reservoirs is the problem of eutrophication, which occurs mainly due to the disposal of nutrient rich effluents from the agricultural fields. The fertilizer use in the project area is

negligible, hence runoff at present does not contain significant amount of nutrients. Even in the post project phase, the use of fertilizers in the project catchment is not expected to rise significantly. Thus, in the post-project phase, problems of eutrophication, which is primarily caused by enrichment of nutrients in water, are not anticipated.

6.5 IMPACTS ON TERRESTRIAL FLORA

6.5.1. Increased human interferences

The direct impact of construction activity for any water resource project in a mountainous terrain, similar to that of the proposed project, is generally limited in the vicinity of the construction sites. A population of about 5800 people including technical staff and workers are likely to congregate in the area during the project construction phase. It can be assumed that the technical staff will be of higher economic status and will live in a more urbanized habitat, and will not use wood as fuel, if adequate alternate sources of fuel are provided. However, workers and other population groups residing in the area may use fuel wood (if no alternate fuel is provided) for whom firewood / coal depot could be provided. There will be an increase in population by about 5,800 of which about 4500 are likely to use fuel wood. On an average, the fuel wood requirements will be 10^{-3} m^3 per person per day. Therefore, the fuel wood requirement of 4500 labourers per year will be of the order of (10^{-3} x 365 x 4500) = 1643 m^3. The wood generated by cutting one tree is about 3 m^3. Thus, every year, fuel wood equivalent to about 548 trees will be cut for meeting fuel wood requirement, if no alternate sources of fuel are provided. The workers may also cut trees to meet their requirements for construction of houses, furniture. Normally in such situations, lot of indiscriminate use or wastage of wood is also observed. Hence, to minimize felling of trees by the labourers, alternate fuel supply facilities have to be provided.

6.5.2. Acquisition of forest land

The total land requirement for the project is 5827.80 ha, of which 5056.50 ha is under forest cover (including private land with forest cover). For this land,

compensatory afforestation will be undertaken by the State Forest Department. Compensatory Afforestation scheme shall be prepared by the forest department as a part of forest clearance proposal. Nine species of plants are recorded under the category of endangered species which require measures for conservation. Propagation of these nine species has been proposed over 50 ha of land under Biodiversity Conservation and Management Plan.

6.6. IMPACTS ON TERRESTRIAL FAUNA

6.6.1 Disturbance to wildlife

FRL of the proposed reservoir is at El 545 m and length of the reservoir is about 43 km which is confined to the river gorge. Animals like Mishmi Takin, Serrow, Snow Leopard and Himalayan Black Beer are found at high altitude in the catchment and as such no major impact is anticipated on these animals. Normally the animals easily change their niche to other forested areas. At the same time, measures such as installation of check posts with adequate communication equipment to prevent poaching, development of butterfly park etc. are proposed in the Biodiversity Conservation and Management Plan.

During construction phase, a large number of machinery and construction labour will have to be mobilized. This activity may cause some disturbance to the wildlife population. The operation of various construction equipments is likely to generate significant noise, especially during blasting. The noise may scare the fauna in the region and force them to migrate to other areas. A few stray animals do sometimes venture in and around the project site. Thus, to minimize any harm due to poaching activities from immigrant labour population, strict anti-poaching surveillance measures need to be developed, especially during project construction phase. The same have been delineated in the Biodiversity Conservation and Management Plan.

6.6.2. Impacts on migratory routes

The faunal species observed in the project area are not migratory in nature. The construction of the proposed Dibang Multipurpose Project will form a reservoir, and is not expected to have any impact on the migratory route. The

river in the pre-project scenario, runs through the gorge portion, and acts as a barrier to the movement of fauna; as a result no major migratory route has developed. Thus, no adverse impact on migratory routes is anticipated as a result of the proposed project.

6.6.3. Impacts on Mehao and Dibang Wildlife Sanctuaries

Mehao Wildlife Sanctuary is located in south-east direction at a distance of about 11 km from reservoir periphery. Likewise, Dibang Wildlife Sanctuary is located in north-east direction at a distance of about 35 km from tail end of the reservoir. Since, sanctuaries are quite away and no portion of these wildlife sanctuaries is getting affected, as a result of the proposed project, hence no impact on fauna is anticipated as a result of the construction and operation of the proposed project. Moreover, an intervening distance of about 11 km and 35 km between project site and the above referred ecologically sensitive areas, provides adequate buffer for the protection of the sanctuaries from adverse impacts due to various construction activities.

The location of Mehao and Dibang Wildlife Sanctuaries is given in Map 6.1

6.7 IMPACTS ON AVI-FAUNA

a) Construction phase

The project area and its surroundings are quite rich in avi-fauna. However, water birds are not very common in the area. The main reason for this phenomenon is that water birds generally require quiescent or slow moving water environment. However, in the proposed project area and its surroundings due to terrain, conditions water flow is swift, which does not provide suitable habitat for the growth of water birds. With the damming of the river, a reservoir of an area of about 4009 ha will be created, with quiescent/tranquil conditions. The reservoir banks will have wet environment throughout the year which can lead to proliferation of vegetation e.g. grass, etc. along the reservoir banks. Such conditions are generally ideal for various kinds of birds, especially, water birds. This is expected to increase the avi-faunal population of the area.

b) Operation phase

During project operation phase, the accessibility to the area will improve due to construction of roads, which in turn may increase human interferences leading to marginal adverse impacts on the terrestrial ecosystem. The increased accessibility to the area can lead to increased human interferences. Since significant wildlife population is not found in the region, no major adverse impacts are anticipated on this account.

6.8 IMPACTS ON AQUATIC ECOLOGY

6.8.1 Construction phase

Due to construction of the Dibang Multipurpose Project large quantity of building material like stones, pebbles, gravel and sand would be needed for construction of various project appurtenances. Significant amount of material is available in the bed of river Dibang and its tributaries. It is proposed to extract the construction material from borrow areas in the river bed. Various clay quarries and river shoal deposits have been identified for excavation of construction material from the river bed of river Dibang The extraction of construction material, affects the river water quality by increasing the turbidity levels. This is mainly because of the fact that during excavation of material from river, the dredged material gets released during:

- excavation of material from the river bed.
- loss of material during transport to the surface.
- overflow from the dredger while loading
- loss of material from the dredger during transport.

The cumulative impact of the above is increased turbidity level. Good dredging practice can however minimize turbidity. It has also been observed that slope collapse is the major factor in increasing the turbidity levels. If the depth of cut is too high, there is slope collapse, which releases a sediment cloud, which goes outside the suction radius of dredged head. In order to ensure that this does not happen, the depth of cut should be restricted such that:

y H/C < 5.5

where

y - unit weight of the soil

H - depth of soil

C - Cohesive strength of soil

The dredging and deposition of dredged material is likely to affect the survival and propagation of micro benthic organisms. The macro-benthic life, which remains attached to the stones, boulders etc. gets dislodged and is carried away downstream by turbulent flow. The areas from where construction material is excavated, benthic fauna gets destroyed. In due course of time, however, the area gets recolonized with benthic fauna. The density and diversity of benthic fauna, is however, much lesser as compared to the pre-dredging levels.

The second important impact is on the spawning areas of cold-water fisheries. Almost all the cold-water fish breed in the flowing waters. The spawning areas of these fish species are found amongst pebbles, gravel, sand etc. The eggs are sticky in nature and remain embedded in the gravel and subsequently hatch. Any disturbance of stream bottom will result in adverse impacts on fish eggs. Even increase in fine solids beyond 25 ppm will result in deposition of silt over the eggs, which would result in asphyxiation of developing embryo and also choking of gills of young newly emerged fry. Thus, if adequate precautions during dredging operations are not undertaken, than significant adverse impacts on aquatic ecology are anticipated.

Impacts due to discharge of sewage from labour camp/colony

The proposed hydropower project would envisage temporary and permanent residential areas to accommodate labour and staff engaged in the project. Drying pond will be made where the domestic wastewater will be drained and dried on open space.

Impacts due to human activities

The increase of human activities in the project area, results in enhancement in indiscriminate fishing including use of explosives. The use of explosive material to kill fish in a pool would result in complete loss of fish and other aquatic life making a river stretch completely barren. Indiscriminate fishing will reduce fish stock availability for commercial and sport fishermen. These aspects have been adequately covered in the Environmental Management Plan (Chapter 5 of EMP report).

6.8.2 Operation Phase

Impacts due to damming of river

The damming of River Dibang will result in creation of 4009 ha of submergence area. The dam will change the fast flowing river to a quiescent / lacustrine environment. The creation of a pond may bring about a number of alterations in physical, abiotic and biotic parameters, both in upstream and downstream of the proposed dam site, if proper mitigatory measures are not ensured. The micro and macro benthic biota is likely to be most severely affected as a result of the proposed project.

The positive impact of the project will be the formulation of a water body which can be used of fish stocks on commercial basis to meet the protein requirement of region. The commercial fishing in the proposed reservoir would be successful provided all tree stumps and other undesirable objects are removed before submergence. The existence of tree stumps and other objects will hinder the operation of deep water nets. The nets will get entangled in the tree stumps and may be damaged.

Since construction of the dam affects the flow of water in the river, the river bed below the dam site gets invariably affected and many a time a long stretch of river bed down stream of a dam gets affected due to reduction in the quantum of water. However, in case of Dibang Multipurpose Project, the Power House is to proposed to be constructed very close to the dam and as such there are very low chances of the down stream of the dam getting dried up. However, the minimum flow of water required for the maintenance of

aquatic flora and fauna, especially fish, be maintained in the downstream of the dam atleast upto tail water discharge point. Proper measures for fish conservation and management have been proposed in the EMP report.

The construction of dam also will not affect the water requirement of the population residing in the downstream areas. This population generally depends upon the local streams and springs for drinking purpose and for other domestic uses. There is also no competitive use of water downstream of dam for industrial purposes. Therefore, the impact of damming on the downstream areas is not anticipated.

Impacts on migratory fish species

The obstruction created by the dam would hinder the migration of certain commercial species especially the Mahseers (from downstream to upper reaches) and *Schizothorax* (from upper reaches to the lower reaches). These fishes undertake annual migration for feeding and breeding. Finding their migratory path obstructed due to high dam, they are expected to congregate below the dam wall and will be indiscriminately caught by the poachers.

The *Schizothorax* species during winter months migrate from headwaters as far as down near flood plains in search of suitable feeding and breeding grounds. The sampling of river Dibang both upstream and downstream of the proposed dam site for macro-benthic life gave 4 units/sq.m. of fry of *S. richardsonii.* This observation further strengthens the fact that *Schizothorax* sp. migrate during winter months. With the onset of summer seasons, these species migrate upstream. These species from henceforth would congregate in the reservoir. It is expected that in due course of time these species will adapt themselves to the changed habitat. The annual occurrence of winter fishery of *Schizothorax* in Dibang river system as far as downstream up to the flood plains will be reached to a very low level and may result in vanishing from their earlier winter home. Proper mitigatory measures, therefore, have been proposed in the EMP report.

6.9 IMPACTS ON NOISE ENVIRONMENT

Noise due to Construction Equipment

In a water resource project, the impacts on ambient noise levels are expected only during the project construction phase, due to operation of various construction equipments. Likewise noise due to quarrying, blasting, vehicular movement will have some adverse impact on the ambient noise levels in the area. The noise level due to operation of various construction equipments is given in Table 6.3.

Under the worst case scenario considered for prediction of noise levels during construction phase it has been assumed that all these equipment generate noise from a common point. The increase in noise levels due to operation of various construction equipment are given in Table 6.4.

Table 6.3: Noise level due to operation of various construction equipment

Equipment	Sound Level (dBA)
Unsilenced pile diver	110
Unsilenced scraper/grader	94
Unsilenced pneumatic drill	90
Unsilenced compressor	85
Cranes	82
Generator	82

Table 6.4: Increase in noise levels due to operation of various construction equipment

Distance (m)	Ambient noise levels (dBA)	Increase in Noise level due to construction activities (dBA)	Noise levels due to construction activities (dBA)	Increase in ambient noise level due to construction activities (dBA)
100	40	76	76	36
200	40	70	70	30
500	40	62	62	22
1000	40	56	56	16
1500	40	52	52	12
2000	40	50	50	10
2500	40	48	49	9
3000	40	46	47	7

There are no major habitations in the nearby areas of project site. It would be worthwhile to mention here that in absence of the data on actual location of various construction equipments, all the equipments have been assumed to operate at a common point. This assumption leads to over-estimation of the increase in noise levels.

It is a known fact that there is a reduction in noise level as the sound wave passes through a barrier.

The transmission loss values for common construction materials are given in Table 6.5.

Table 6.5: Transmission loss values for various construction materials

Material	Thickness (inches)	Decrease in noise level (dBA)
Light concrete	4	38
	6	39
Dense concrete	4	40
Concrete block	4	32
	6	36
Brick	4	33
Granite	4	40
Wood Bamboo		15

The walls of various houses will attenuate at least 15 to 30 dBA of noise. In addition there is attenuation due to the following factors.

- Air absorption
- Rain
- Atmospheric in homogeneities and atmospheric turbulence.
- Vegetal foliage.

Thus, no substantial increase in noise levels is anticipated as a result of various activities during the project construction phase. The noise is also generated due to blasting during tunneling operations. However, it is not likely to have any effect on habitations.

6.10 AIR POLLUTION

In a water resources project, air pollution occurs mainly during project

construction phase. The major sources of air pollution during construction phase are pollution due to fuel combustion in various equipments, emission from various crushers and fugitive emissions from various sources.

6.10.1 Pollution due to fuel combustion in various equipments

The operation of various construction equipments requires combustion of fuel. Normally, diesel is used in such equipment. The major pollutant, which gets emitted as a result of combustion of diesel, is SO_2. The SPM emissions are minimal due to low ash content in diesel. The short-term increase in SO_2, even assuming that all the equipments are operating at a common point, is quite low. Hence, no major impact is anticipated on this account on ambient air quality. However, plan for air quality management is required to be formulated especially for the construction stage of the project in which there will be large movement of vehicles and operation of various equipment, generators etc. which may impair the air quality of the project area

6.10.2 Emissions from various crushers

The operation of the crusher during the construction phase is likely to generate fugitive emissions, which can move even up to 1 km in predominant wind direction. During construction phase, two crushers are likely to be commissioned at major construction sites. During crushing operations, fugitive emissions comprising mainly the suspended particulate will be generated. Since, there are no major settlements close to the project area, no major adverse impacts on this account are not anticipated. However, during the layout design, care should be taken to ensure that the labour camps, colonies, etc. are located on the leeward side and outside the impact zone (say about 2 km on the wind direction) of the crushers.

6.10.3 Fugitive emissions from various sources

During construction phase, there will be increased vehicular movement. Lot of construction material like sand, fine aggregate will be stored at various sites. Normally, due to blowing of winds, especially when the environment is dry, some of the stored material can get entrained in the atmosphere. However, such impacts are visible only in and around the storage sites. The impacts on

this account are generally insignificant in nature.

6.11 IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT

6.11.1 Construction Phase

The construction phase will last for about nine years. The adverse impacts on ecosystem due to congregation of labour force and project staff during the construction phase have been detailed in the respective sections dealing with various disciplines of the environment.

During construction phase, the basic problem will be related to management of large population which migrate to the construction area in search of jobs. Those who would migrate to this area are likely to come from various parts of the country having different cultural, ethnic and social backgrounds. Such a mixture of population has its own advantages and disadvantages. The advantages include exchange of ideas and cultures between various groups of people which would not have been possible otherwise. Due to longer residence of this population in one place, a new culture, having a distinct socio-economic similarity would develop which will have its own entity.

The benefits however, are always not a certainty and depend on several factors. Often, they are directly related to the way construction phase is handled by the project authorities and their sensitivity to various socio-economic problems that could develop during this phase. Work opportunities will drastically improve in this area.

The availability of infrastructure is generally a problem during the initial construction phase, though the construction workers can be compensated for certain facilities like health, education, etc. The facilities of desired quality are often not made available in the initial stages. The adequacy of water supply, sewage treatment, housing, etc. should therefore be ensured before and adequate measures would be taken at the very start of the project.

6.11.2 Operation phase

The proposed project involves acquisition of Jhum lands and other lands. The impacts due to acquisition of these lands have been covered separately in

R & R Plan of EMP Report. A detailed R&R Plan for Project Affected Families has also been suggested.

6.12 INCREASED INCIDENCE OF WATER-RELATED DISEASES

The construction of a reservoir replaces the riverine ecosystem by a lacustrine ecosystem. The vectors of various diseases breed in shallow areas not very far from the reservoir margins. The magnitude of breeding sites for mosquitoes and other vectors in the impounded water is in direct proportion to the length of the shoreline. The construction of the reservoir would increase the shoreline by many times as compared to the pre-project shoreline of river Dibang under submergence. Thus, the construction of the proposed reservoir would enhance the potential breeding sites for various diseases vectors. There are chances that incidence of malaria may increase as a result of the construction and operation of the proposed project. In addition to the construction of the reservoir, the certain factors viz., (i) aggregation of labour; (ii) clearance of forests; (iii) excavation, and (iv) inadequate facilities in labour camp, would also lead to the increased incidence of malaria in and around the project area.

Aggregation of labour

About 5800 labourers and technical staff will aggregate in the project area during construction phase. Most of the labour will come from various parts of the country. The labourers would live in labour colonies/camps provided by the Contractor. Proper sanitary facilities are generally provided. However, some of the labour coming from other areas could be the reservoir for various diseases. Hence, a proper surveillance and immunization schedule, health management system needs to be developed for the labour force as well as project affected families/locals residing in the project affected villages.

Clearing of forests

A total area of about 4009 ha of the area will be coming under reservoir submergence. Most of the area is forest cover. The forests and undergrowth should be cleared before reservoir filling. The clearance of the forests in certain circumstances is an effective anti-malaria measure. Since, it cannot be

said with certainty the exact nature of impacts on increased incidence of water-related diseases, efforts must be made to implement measures to control the increased incidence of vector-borne diseases.

Excavations

The excavation of earth from borrow pits etc. is one of the major factor for the increase in prevalence of malaria. After excavation of construction material, the depressions are generally left without treatment where water gets collected. These pools of water, then serves as breeding grounds for mosquitoes. The flight of mosquito is generally limited up to 1 to 2 km from the breeding sites. Since no habitation/settlement areas are located within 1 to 2 km from the reservoir periphery, outbreak of major malarial epidemic is not anticipated. However, labour camps etc. could be vulnerable to increased incidence of malaria, if proper control measures are not undertaken.

Inadequate facilities in labour camps

The labour population generally lives in slum type conditions, with inadequate facilities for potable water supply and sewage treatment and disposal. This could lead to outbreak of epidemics of water-borne diseases. Adequate measures health management and sanitation will therefore be required to be framed for the labour population.