

ENVIRONMENTAL MANAGEMENT PLAN

The INO tunnels and caverns are to be located in Bodi West Hills, near Pottipuram village and the surface facilities in the Government promboke land in the village. Any Eco-system will get disturbed due to any development. The impacts due to the developmental process cannot be completely eradicated, but the same can be controlled to the maximum extent possible. The Environmental management plan aims to mitigate the impacts due to the development.

Main Impacts of INO Project

The perceived main impacts of the INO Project on the eco system are

- (i) Cut & cover reach formation and tunnel in weathered rock
- (ii) Muck disposal from tunnels and caverns - Muck transit yard.
- (iii) Dust generation.
- (iv) Impact of men and machineries over land, air and water
- (v) Surface structure/ facilities

(i) Cut & cover reach formation and tunnel in weathered rock

As good rock is not available in the initial reaches of Access tunnel (Ch 0 to Ch 157) this portion will be a cut & cover reach. The earth, weathered rock/ soft rock are to be excavated with sufficient side slopes for RCC tunnel construction and after that construction, excavated earth/ weathered rock will be dumped over the tunnel. During this construction, there will be atmospheric pollutions due to dust and also increased noise due to construction machineries.

The use of explosives in this reach for controlled blasting will be limited, as the major excavation will be by earth moving equipment. As this open construction will be completed within 3 months, the impact will be temporary one. However water sprinkling system to suppress the dust and carrying out the work during the day time will be ensured. The reach from chainage 157 to chainage 197 will be tunnel formation under weathered rock. In this reach, controlled blasting will be ensured and the construction phase will proceed cautiously as in the case of earthen tunnel. Beyond Ch 197 the tunnel will be a regular one under hard rock tunnel. The vibration due to the control blasting in the initial reaches of Access tunnel will be negligible and it cannot be felt in the nearby habitat (T.Pudukottai Village) which is at 1.2 km from the Tunnel portal.

The calculation to prove the above aspect is as follows:

Assessment of ground particle velocity as per clause 4.1 of Bureau of Indian Standards: IS 6922-1973.

For safety of structures from threshold damage, the permissible peak particle velocity

- (i) In soils, weathered or soft rock 50mm/sec
- (ii) Hard rock 70mm/sec

Ground particle velocity calculated at the tunnel entry location (which is at 1.2 km from the Pudukottai village) in the proposed project site when blasting are:

Table 1 - Ground particle velocity

Location	Peak particle velocity
At the middle of cut & cover reach	16.94mm/sec < 70mm/sec
At 200m inside the tunnel	7.12mm/sec < 70mm/sec
At 1000m inside the tunnel	0.95mm/sec < 70mm/sec
At 2000m inside the tunnel	0.40mm/sec < 70mm/sec

(ii) Muck disposal from Tunnels and Caverns – Muck Transit yard

About 2.3 lakh cu.m. of excavated rock muck will be generated during the formation of Caverns and Tunnels. A portion of muck will be utilized for the project construction work. However, the disposal of such huge quantum is considered as the main issue from the environmental management point of view. The best solution will be disposing off the entire muck as it is generated daily. The assistance from District Revenue authorities may be availed. The residual stock of tunnel muck may be kept in the muck transit yard, for the gradual disposal in course of time. Tunnel muck transit area of 20,000 sq.m. will be made into 2 segments, of 10,000 sq.m. each, to facilitate simultaneous loading and lifting of tunnel muck by the dumpers/ tippers at any point of time. In order to retain the muck stack, retaining walls in random rubble masonry will be constructed upto 4 m height. GCI sheet will be provided over masonry for another 4 m height to prevent the flying of dust during the loading/ lifting operations.

(iii) Dust Generation

Dust generated during blasting of tunnels & cavern formation, muck transport, loading/ lifting at muck transit yard and in the crusher unit for BG metal and crusher sand will be suppressed as follows:

Table 2 - Dust Suppression Methods

Methodology	Purpose
Tunnels and Caverns excavation - Dust dilution Wetting of broken material	Adequate wetting is extremely important for dust control. The vast majority of dust particles created during breakages are not released into the air, but, stays attached to the surface of broken material. Wetting this broken material ensures that dust particles stay attached. The broken material is to be wetted uniformly.
Muck Transit area- Airborne capture of dust	Through water spraying
Crusher unit - Dust Collectors	Dust sucking units play valuable role

(iv) Impact of Men and Machineries over Land, Air and Water

Environmental Impact of men at the project will be minimized by engaging local labourers to avoid migration. The labourers will be educated on the need for environmental protection and they will not be permitted to venture in to forest for collection of firewood and other sundry works. The labourers will be provided LPG or Kerosene. They will not be permitted to raise cattle for milk at any cost. Instead, Govt. 'Aavin' milk will have to be arranged by the contractor.

New vehicle will be insisted for the muck disposal to reduce pollution. The loaded vehicles carrying excavated muck will be arranged to be covered with tarpaulins to prevent flying of dust particles from the tunnel muck while being discharged at the dumping yard. The rising dust will be suppressed by sprinkling of water. Compressed air will be utilized in the sprinkler system to economize the water consumption.

During construction period, the EPC Contractor will arrange supply of water through tanker (5 tankers a day) for all underground and surface activities. During operation period a dedicated water supply from Mullaperiyar river, already in place, provided for by will be effected by Tamil Nadu Water Supply and Drainage Board (TWAD) will be used. Hence there will not be any ground water extraction. More over the project area is grey area and ground water availability is low.

(v) Surface structures/facilities

- The DG set to be provided at the utility building will be of 'Silent' type. Suitable Acoustics have to be provided in the building and also appropriate flora have to be planted to reduce the impact of noise emanating from machineries.
- Since the tunnel portal & muck disposal yard are located within the project site, the nearby village (viz.) T.Pudukottai will not be affected in any way due to the plying of loaded dumpers and tippers.
- The sullage water and sewage water from the cavern and surface structures will be suitably treated and dispersed at suitable locations, well away from the water bodies. The sludge from the septic tank or STP will be arranged to be cleared periodically through Municipal lorries of Theni/ Kambam.

The Environmental Monitoring Cell constituted by the project proponent will ensure implementation of the Environmental Management Plan (EMP) during construction and operation phase.

More details may be found in the DPR prepared by TANGEDCO (Nov 2010) at http://www.ino.tifr.res.in/ino//OpenReports/INO_civil_dpr.pdf.