- A vertical type slide gate of size 0.3 m x 0.3 m for flushing out shingles from the intake chamber.
- A set of trash rack bay of size 2.7 m x 3.1 m inclined at 80 degree with horizontal at the forebay cum desilter.
- A vertical type slide gate of size 0.3 m x 0.3 m at the end of forebay cum desilter for flushing silt.
- A double disc gate valve of internal diameter 0.53 m at the start of penstock.
- Two number vertical lift slide gates of size 0.9 m x 1.0 m at the TRC to isolate the units.

9. Infrastructure and Construction Facilities

A suitable site on the right bank of Chuzachhu has been identified for setting up of construction camp, site office and the construction facility. The muck disposal areas have been identified nearby the excavation sites to reduce the lead distance or reuse the material for backfill of trenches.

10. Construction Method, Equipment Planning and Schedule

The construction method, equipment planning and construction schedule have been framed taking into account the various challenges associated with accessibility and high altitude. The winter months in Lunana from November until April is extremely cold with minimum recorded temperature of up to -15 degree Celsius. Accordingly, the working period of 6 months starting from May to October has been considered for planning and construction scheduling with working duration of 8 hours per day. As the construction works coincide with the monsoon months and considering the available rainfall data of Thanza, the work progress of 80% has been considered in framing project schedule. Moreover, the concreting works are not recommended below 5 degree Celsius as per IS 7861 Part 2 due to restrictions in concrete shrinkage and setting time.

In view of the site specific challenges and limited working period, most works are planned to be carried out using fuel driven equipment and deployment of light weight construction machineries to ease transportation and mobilization. Some of the construction equipment proposed are mini-excavators, stone crusher, tractor, Pionjar breakers, concrete mixers, welding sets, dewatering pumps, power chainsaws, mini-diesel generator and max puller – most of which can be transported by heavy lift helicopter. The total estimated weight of the above construction equipment is about 8.0 MT.

The entire project works are planned to be completed in about 334 days including testing and commissioning of Electro-Mechanical equipment. The construction will spread over two working seasons. While the actual works are scheduled from the month of May, some of the machineries and construction materials are planned to be mobilized around March and April in order to gain time for the main works. The project schedule has been prepared using Labour Material Coefficient (LMC 2017) of Bhutan Schedule of Rates and has been developed in Primavera P6. The construction schedule is attached as **Annexure IV.**

The manpower planning has been carried out with the intent to complete all major civil works in the first working season so as to reduce re-mobilization of manpower during the second working season. The overall manpower of all categories works out to about 83 including 9 personnel of the project management team.

The transportation of construction equipment, materials for civil, HM and EM are mostly planned to be air lifted by helicopter in order to allow adequate facilitation of required items at all work fronts except for items such as fuel due to safety regulations. Further, the entire cement, estimated at 278 MT, for the project construction is planned to be carried by horses/yaks since the cost comparison indicates cheaper rate of cement transportation by horses by a factor of about 5. The total weight of materials, including food items for personnel, needed to be transported by helicopter and horse/yaks works out to about 390 MT and 292 MT respectively. 5,840 trips to be made by horses/yaks can be managed by existing resources in Laya, Lunana, Sephu ,Khatoed, Khamaed and Goenshari without severely impacting transporting of regular supplies to the area.

11. Power Transmission and Distribution

The power generated at 415 V from the power plant will be stepped up to 33 kV for transmission and distribution to different villages of Lunana. Two scenarios have been studied for the transmission and distribution - including and excluding Wachey village. The total line length including electrification of Wachey village is about 32 km and excluding Wachey village is about 23 km. The total transmission and distribution cost is higher by about 32.40 % when Wachey village is included.

12. Environmental and Social Impact Assessment

As mandated by the Environmental Assessment Act 2000 and Regulation of Environmental Clearance of Projects, 2016, a full-fledged Environmental and Social Impact Assessment