Draft Report

(After incorporating the comments of the Commission)

GUIDELINES FOR SCRUTINY & APPROVAL OF COMMISSIONING SCHEDULE OF THE HYDRO ELECTRIC PROJECTS OF A DEVELOPER

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1. DEFINITIONS

In these guidelines, unless the context otherwise requires,

- **'Act'** means the Electricity Act, 2003 (36 of 2003);
- **'Applicant'** means the generating company who has made an application for scrutiny and approval of commissioning schedule of Hydroelectric Power Projects.
- **'Application'** means the application along with annexure and enclosures made to the Commission for scrutiny and approval of commissioning schedule of Hydroelectric Power Project.
- **'Authority'** means the Central Electricity Authority referred to in sub-section (1) of section 70 of the Act.
- **'Beneficiary'** in relation to a generating station means the person purchasing electricity generated at such a generating station whose commissioning schedule is being approved under these Guidelines
- **'Commission'** means the Central Electricity Regulatory Commission referred to in sub-section (1) of section 76 of the Act;
- **'Critical Path'** means the longest chain of successive related activities without any float i.e. allowable delay and therefore decides the total completion period of the project. Obviously, there has to be at least one such path.
- **'Date of Commercial Operation or COD'** means :

  (a) In relation to a unit of hydro generating station, the date declared by the generating company from 0000 hour of which, after notice to the beneficiaries, scheduling process in accordance with the Indian Electricity Grid Code is fully implemented, and in relation to the generating station as a whole, the date declared by the generating company after demonstrating peaking

capability corresponding to installed capacity of the generating station through a successful trial run, after notice to the beneficiaries:

Note :

1. In case the hydro generating station with pondage or storage is not able to demonstrate peaking capability corresponding to the installed capacity for the reasons of insufficient reservoir or pond level, the date of commercial operation of the last unit of the generating station shall be considered as the date of commercial operation of the generating station as a whole, provided that it will be mandatory for such hydro generating station to demonstrate peaking capability equivalent to installed capacity of the generating unit or the generating station as and when such reservoir /pond level is achieved.

2. In case of purely run-of-river hydro generating station if the unit or the generating station is declared under commercial operation during lean inflows period when the water is not sufficient for such demonstration, it shall be mandatory for such hydro generating station or unit to demonstrate peaking capability equivalent to installed capacity as and when sufficient inflow is available.

- **'Commissioning Schedule'** means the schedule described under clause 4.1.2 below.
- **'Float'** mean the measure of amount of time by which the start or the finish of an activity can be delayed, without affecting project finish date.
- **"Force Majeure"** means

  An event or circumstance or combination of events and circumstances including those stated below that wholly or partly prevent or unavoidably delay an Affected Party in the performance of its obligations , but only if and to the extent that such

events or circumstances are not within the reasonable control, directly or indirectly, of the Applicant and could not have been avoided if the Applicant had taken reasonable care or complied with Prudent Utility Practices:

(i). Any act of God, including lightning, drought, fire, explosion, earthquake, volcanic eruption, landslide, flood, cyclone, typhoon, tornado, thunderstorm, exceptionally heavy rains, cloud burst or snowfall;

(ii). Any explosion, accident, breakage of facilities, plant or equipment, structural collapse or a chemical contamination caused by a person not being the Affected Party (or an Affiliate, contractor or any other person acting under the direction or control of such Affected Party) and not being due to inherent defects in the Project ;

(iii). Any epidemic, plague or quarantine;

(iv). Meteorite crash, air crash, objects falling from sky, or other flying devices or vehicles, pressure waves caused by aircraft or aerial devices travelling at supersonic speed, shipwreck, train wrecks;

(v). Any act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, blockade, embargo (including, causing unavailability or shortage of fuel or materials), revolution, riot, insurrection, civil commotion, religious strife, communal violence, act of terrorism, extremist action or politically motivated sabotage or abduction;

(vi). Radioactive contamination or ionizing radiation;

(vii).

(viii). Expropriation, requisition, confiscation, nationalization, export or import restrictions, requirements, action or omissions to act on the part of any Government Instrumentality or any person controlled by a Government

Instrumentality, provided such adverse action or inaction did not result from the non-compliance of any applicable Law by the Affected Party;

(ix).

(x). Archaeological findings that were not reasonably foreseeable;

- **"Generating company"** means any company or body corporate or association or body of individuals, whether incorporated or not, or artificial juridical person, which owns or operates or maintains a hydro generating station
- **Investment approval means date of approval by PIB, BoD/Management of the company, as the case may be, which shall not be beyond 45 days from the date of availability of all major statutory and other clearances which are essentially required for start of construction of the project.**
- **'Project'** – means a hydro generating station and includes all components of generating facility such as dam, intake water conductor system, power generating station and generating units of the scheme, associated transmission system, as apportioned to power generation.
- **'Run-of-river generating station'** means a hydro generating station which does not have upstream pondage;
- **'run –of-river generating station with pondage'** means a hydro generating station with sufficient pondage for meeting the diurnal variation of power demand;
- **'Storage type generating station'** means a hydro generating station associated with large storage capacity to enable variation of generation of electricity according to demand;

  'Zero date' means the date of "Investment Approval" which is start date of commissioning schedule.

2. BACKGROUND

2.1. Under Section 79(1) (a) read with Sections 61 & 62 of the Electricity Act, 2003, the Commission regulates the tariff of generating companies owned or controlled by the Central Government.

2.2. Under Section 79(1) (b) read with Sections 61 & 62 of Electricity Act 2003, the Commission regulates tariff for hydroelectric projects of generating companies other than those owned or controlled by the Central Government as specified in clause 79(1)(a) of the Act, if such generating companies enter into or otherwise have a composite scheme for generation and sale of electricity in more than one State.

2.3. Govt. of India has formulated a new 'Hydro Power Policy-2008', leading to certain amendments to the 'Tariff Policy' dated 31st March-2008 and subsequent amendments thereof. Under the provisions of the amended Tariff Policy, it is stated that, in case the project site of a hydro generating station is awarded to a developer by a State Government by transparent two stage process of bidding, such a developer has the option to sell 40% of its power by merchant sale and remaining 60% through long term PPAs for which tariff will be determined by the Appropriate Commission. However, this figure of 60% would get enhanced by 5% for delay of every six months in commissioning of the last unit of the project against the scheduled date approved by the Appropriate Commission before commencement of the construction. The time period for commissioning of all the units of the project shall be four years from the date of approval of the commissioning schedule by the Appropriate Commission. However, the Appropriate Commission may, after recording reasons in writing, fix longer time period for large storage projects and run-off-the river projects of more than 500 MW capacity. Adherence to the agreed timelines to achieve the fixed commissioning schedule shall be verified through independent third party verification.

2.4. With due regard to the above, CERC in its Tariff Regulations for the control period 2009-14 has, under the fourth Proviso to the Regulation 7 (2), provides as follows:

2.5. "Provided also that the Commission may issue guidelines for scrutiny and approval of commissioning schedule of the hydro-electric projects of a developer, as envisaged in the tariff policy as amended vide Government of India Resolution No 23/2/2005-R&R (Vol.IV) dated 31st March 2008."

3. *SCOPE & EXTENT OF APPLICATION OF THESE GUIDELINES*:

3.1. These guidelines shall be applicable for Generating Company as specified in clause 79(1)(a) & 79(1)(b) of the Act.

3.2. Generating Company, as specified in clause 3.1 above, shall be required to submit and obtain approval from the Commission on the commissioning schedule, before commencement of the construction.

4. *PREPARATION OF COMMISSIONING SEHEDULE OF THE PROJECT*

4.1. Responsibility of the Generating Company:

4.1.1. Generating Company would prepare a detailed commissioning schedule of the project.

4.1.2. Commissioning Schedule would be in the form of a Bar / PERT chart showing logical relationships between various tasks and time estimates for each major component, placed against a time line(year & month basis), leading to achieving 'date of commercial operation or COD' of last unit of hydro generating station. Format in which the commissioning schedule shall be prepared and submitted to the Commission is attached at Annexure – 1 (The activities/durations/ quantities indicated in the Schedule attached at Annexure-I are meant for illustration only)

4.1.3. Commissioning schedule prepared by the Generating Company would include the activities involved in the construction phase of the project and will not contain any pre-construction activities (Like Financial Closure, Land acquisition, Award of work, any statutory clearance required for the project etc).

4.1.4. Along with the commissioning schedule, Generating Company would also be required to furnish a Detailed Note, giving the justification of basis for the development of the project schedule. The detailed justification note should provide information such as those listed below:

4.1.4.1. Project Description: This section of the justification note would briefly and concisely provide a high-level description of the project covering the following aspect associated with the project:

- Type of the project (run of river, storage, pumped storage, multipurpose)

- Location of the project area including longitude and latitude and district(s) and tehsil/ village etc.
- Access by air/rail/road/ferry, sea port & other communication facilities available in area.
- Salient Features of the Project.
- Assessment of infrastructure facilities available & required to be developed, giving due consideration to :
    - Access roads : Roads to the project, Roads in the project area
    - Construction power requirement and action plan being envisaged to meet up the requirements of construction power
    - Workshops/ Explosive Magazines/ other necessary infrastructure required to be developed at project site.
    - Identified sources of Construction materials & their transportation plan.
- General climatic conditions in the project area.
- General description of topography, geology & geotechnical features of the project area and the anticipated geological conditions likely to be encountered during the construction/excavation of various component of the project.
- Land required for the project construction – forest land, Private land and government land.
- Relief & rehabilitation aspects associated with the project giving due consideration to population being affected by the project.
- Inter State / Inter-national aspects
- Defense angle, if any.

4.1.4.2. Work Break down Structure: The work breakdown structure (WBS) as defined in preparing the commissioning schedule would be included in this section of the justification note. Following documents/drawings would be also be furnished :

- General layout of the Project showing the various components, access roads, dumping sites, quarry area etc.
- Detailed Layout of each project component Viz: dam and spillway / barrage / weir / appurtenants / auxiliary works/water conductor system/ power house, etc.
- Project Work Break down Structure (A project Work break down associated with a hydro electric project is shown in Annexure-2, for illustration. Same can be modified to suit the needs of the existing project).

4.1.4.3. Planning Basis : The planning basis describes the methodology and resources used for determining the project schedule, and would cover following aspects :

- Method – statement for execution of each work package defined in WBS. This would lead to Activity identification ("Activity" is defined as identifiable jobs, in each work package of WBS, which consumes time & resources and is required for completion of each work package. For eg "Excavation of Adit", "Excavation of tunnel from one of the available face" are termed activities). It would also give details regarding
  - Quantity estimate for identified activity (in terms of same "unit of measure" as those intended to be used to measure the progress of that for that task.
  - Construction methodology Planned for execution of the activity.

- Duration estimating - Establish duration required to complete the activity and derive the planned production rates for executing the activity. Schedule activity durations should be established by consideration of the quantities and planned production rates, giving due consideration to other project factors that might affect productivity such as anticipated geological conditions or seasonal impacts, site accessibility etc.
- Sequencing of the activity for execution in relation to other activities defined. Activities of other lying on the non-critical path should be planned to match the critical path as parallel activities to match the completion of critical items.

4.1.4.4. Critical Path: The purpose of completing this portion of the document is to inform the stake holders of the current critical path(s) (It is possible for a commissioning schedule to have more than one critical path). Sufficient details shall be provided to describe the activities on the critical path, so that all project participants can focus on the areas that could potentially affect the outcome of the project.

The major common components of a Hydro Project that can come on critical path of the projects are listed below (This list indicative only, prepared on the basis of past experience).

- The Main Dam/ Barrage (especially in case of Dam –toe Power Houses)
- Head race Tunnel – This component has proved to be critical in majority of projects executed in the country.

Following details should be provided for various activities required for the completion of the components of the project lying on the critical path.

- Geological Conditions**:** Geological conditions likely to be encountered during the execution of work along with an explanation how the potential impact of anticipated geological conditions has been addressed in the commissioning schedule.

- Planning and evaluation of working cycle**:** Evaluation of the working cycle time for the critical activities. For estimating the cycle time for excavation of particular face of tunnel/shaft by Drilling & Blasting method, format as attached at Annexure – 3, can be used.

- Equipment Planning: Determination of plant and equipment requirement which will depend on (i) Topography of the area, (ii) Accessibility to various spots of working area (ii) Speed of construction to be based on planned production rates (IV) Construction methodology to be adopted for. Commonly used construction equipment in a hydropower projects are :
    - Hydraulic Drill Jumbos (1 to 3 boom)
    - Hydraulic Excavators (0.2 to 5.2 cum)
    - Loaders
    - Dozers
    - Dumpers (12T to 35 T)
    - Raise Borer/Climber 45 20 25
    - Concrete Batching plant (30 to 360 cum/hr)
    - Aggregate Processing Plant (50 to 600 TPH)
    - Tower Crane (6.5 to 10 T)
    - Shutter with travellers
    - Dry Shotcrete machines

- Wet Shotcrete machines
- Cranes (5 T to 60T)
- EOT/ Gantry Cranes (other than those required for PH) (10T to 30T)

- Material Planning: Requirement of all types of materials to be enlisted. Monthly and yearly requirements be determined and productive and procurement capacity planned accordingly.

5. *SUBMISSION OF COMMISSIONING SCHEDULE TO COMMISSION FOR EXAMINATION.*

5.1. Responsibility of the Generating Company:

5.1.1. Generating Company would prepare and submit the commissioning schedule to Commission for its scrutiny & approval in compliance with the provisions of the Tariff Policy and subsequent amendments thereof, before commencing the construction at project site.

5.1.2. The generating company would submit the commissioning schedule to the commission along with all the required documents atleast 15 weeks prior to "Zero date" declared by the generating company in its commissioning schedule

5.1.3. Following documents would be submitted along with the commissioning schedule:

- A detailed justification note, providing the basis for schedule preparation (as defined in clause 4.1.5).
- Copy of concurrence accorded by Central Electricity Authority/State Authority, as may be applicable.
- Copy of all the Statutory Clearances obtained by the Generating Company.

- The application made shall be supported by affidavit of the person acquainted with the facts stated in the application.

5.1.4. The developer shall submit 3 sets of commissioning schedule along with other submittal to the Commission, as per the application procedure given in clause 5.2.

5.1.5. The comments / queries raised by the Commission on the submitted commissioning schedule, after the initial scrutiny (5.3.1), shall be promptly replied by the Generating Company preferably within a period of 1 week and not more than 2 weeks.

5.1.6. After the commissioning schedule has been accepted by the commission on the basis of initial scrutiny, the Generating Company shall give a detailed presentation on all aspects of schedule preparation within 2 weeks.

5.2. <u>Procedure for submission of Commissioning Schedule by the Generating Company to the Commission :</u>

5.2.1. The application for scrutiny & approval of commissioning schedule shall be made to the Secretary, Central Electricity Regulatory Commission, 7th Floor, Core-3, Scope Complex, Lodi Road, New Delhi-110003.

5.2.2. The application shall be submitted to the commission along with all the documents as detailed in clause 5.1 above.

5.2.3. The Commission shall post the application along with the proposed commissioning schedule on its website within a week from receipt of the application by the Commission .

Provided that any commercial or sensitive information as may be informed by the Generating Company to the Commission as being detrimental to the interest of the Generating Company and which is also exempted from disclosure under the RTI Act, 2005, shall not be posted on the website.

5.2.4. The suggestions and objections on the Application, if any, shall be filed before the Secretary, Central Electricity Regulatory Commission, 7th Floor, Core-3, Scope Complex, Lodi Road, New Delhi-110003 (or any other address of the Commission) by any person, with a copy to the Generating Company, within 2 weeks of such Application being posted on the website.

5.2.5.

5.2.6. The Generating Company shall file his comments on affidavit on the suggestions and objections, if any, with an advance copy to the person who has filed the suggestions and objections on the application.

5.3. Procedure to be adopted by the Commission for accepting the application for scrutiny and approval of commissioning schedule.

5.3.1. After the Generating Company file his comments on affidavit on the suggestions and objections, if any, the commission would scrutinize the contents of the submitted application, to check whether all the information, data etc, essentially required for scrutiny & approval of commissioning schedule has been included as per the Checklist-1 (appended with these guidelines). This scrutiny shall be completed within 1 week from the date of submission of the affidavit by the Generating Company.

5.3.2. In case the submitted commissioning schedule does not contain essential inputs or is found to be incomplete in certain respects, the commission shall either return back the commissioning schedule or seek the required clarification

from the Generating Company which shall be submitted by the Generating Company within 1 week of the clarification sought.

5.3.3. After the Generating Company re-submits the commissioning schedule or provides clarification to the Commission as sought above (5.3.2), commission shall again scrutinizes the submittals and can seek further clarification till it is prima – facie satisfied that commissioning schedule can be accepted for scrutiny and approval. Commission would take 1 week to finish its initial scrutiny, from the date of receipt of clarifications from the Generating Company.

5.3.4. After the commissioning schedule has been accepted by the commission on the basis of initial scrutiny, the Generating Company shall give a detailed presentation on all aspects of schedule within 2 weeks to the Commission, in presence of the persons who had filed the suggestions and objections on the proposals made in the application.

5.3.5. After the Generating Company gives the presentation to the Commission on the various aspects of schedule, Commission shall take another 1 week to scrutinize the available information and admit the submitted schedule for its scrutiny & approval, under intimation to the Generating Company.

6. SCRUTINY OF COMMISSIONING SCHEDULE

6.1. Responsibility of Generating Company:

6.1.1. Clarifications sought by Commission on the submitted commissioning schedule shall be promptly replied by the Generating Company preferably within a period of 1 week and not more than 2 weeks, failing which the commissioning schedule shall stand returned to the Generating Company, who would have to follow the procedure for submission of schedule afresh.

6.2. Procedure to be adopted by the Commission for scrutiny of Commissioning schedule.

6.2.1. Scrutiny & approval of commissioning schedule of a Hydro Electric Project is an interactive process and involves appraisal of various aspects like Infrastructure, Inter-state & International Aspects, Resettlement Aspects, Geology, Construction methodology proposed to be adopted etc.

6.2.2. To discharge its obligation, the Commission may interact or consult other Government agencies/ experts/consultants, as it may deem appropriate.

6.2.3. Under normal circumstances, commission would scrutinize and accord approval to the Commissioning Schedule within 4 weeks from the date of admission of commissioning schedule by the commission.

6.2.4. **Aspect to be reviewed while scrutinizing the commissioning schedule :**

6.2.4.1. Completeness: The schedule must be comprehensive in scope including all predecessor and successor work activity relationships from the start construction, coordination & interface between all project disciplines, execution and upto achieving the date of commercial operation (COD).

6.2.4.1.1. Based on the type of scheme, commissioning schedule would be scrutinized to assess that all components required for completion of the project has been taken into consideration while preparing the schedule.

The typical components associates with various types of scheme are listed in **Annexure – 4**.

6.2.4.1.2. Identification of Activities & logical sequencing to create the Network diagram & coordination between various project disciplines : Process of identification of activities & rearranging them in logical sequence, requires the study of methodology of execution, which would be reviewed based on the details provided in the justification note. The commonly adopted construction methodologies for various components, along with the key activities which are required to be included in the schedule is attached at Annexure -5.

Review of Tunneling excavation rate by drilling & blasting method (in case Tunnel is a critical Activity): Historical data has proved that excavation of Head race tunnel in an hydroelectric power project is the most critical activity in most of the projects and has often delayed the commissioning of the project, due to various geological problems encountered. The probable time for completion of tunneling projects has been grossly underestimated in many cases. Estimated time period of tunnel excavation can be assessed on the basis of Estimated Cycle Time required for excavation of tunnel/shafts as per format given in Annexure 3. **However, based on general grading of rock classification, normally obtained rate of tunneling has been given at** Annexure 6 **for reference.**

6.2.4.2. **Reviewing Dam Concreting Schedule (In case Concrete dam is found to be critical activity eg Dam –toe power house):**

6.2.4.2.1. **Selection of Construction Systems** :

- There **are various solutions to the construction systems which must be approached and studied on the comparative basis** in order to choose the most adequate and most economic, providing that the quality and time limit conditions are fulfilled.
- When searching for the best solution in planning the construction plant for the dam construction, its corresponding output and cost should be kept in mind in order to take the best advantage of its use. These installations include all of the fixed or mobile machines.
- In other words, there should be no bottlenecks hindering progress and output should be somewhat higher in each stage of the progress without over sizing in any one of them.

6.2.4.2.2. Reviewing Dam Concreting Schedule :

A) Assessing the Concreting equipment Installation Capacity : Determining the optimum size of the concrete mixing plant required for a dam is an iterative process. For these calculations, it is necessary to establish the real production rate obtainable in peak months.(i.e under optimum dam conditions when foundations for most blocks have been completed, when concreting in an area with sufficient number of large-surface blocks and without the threat of rain, flood or frost).

To work out the peak production rate obtainable in peak month:

1	Total Quantity of Concrete to be placed in dam below spillway crest level (Both overflow & non over flow blocks)	
a)	In the blocks lying in the river channel	

b)	In the Blocks not lying in the river channel	
1. Total 1(a)+1(b)		
2	Total Quantity of Concrete to be placed in dam above spillway crest level (Both overflow & non over flow blocks)	
3	Total Quantity of Concrete in Dam (1)+(2)	
4	Total No of months available after river diversion & onset of next monsoon season	
a)	No of Months available for good weather conditions	
b)	No. of Months available for bad weather conditions	
4. Total 4(a)+4(b)		
5	Average Monthly rate of production required* (1) / (4)	
6	Expected production rate in month of bad weather conditions (40-60% of value arrived at "5" above)	
7	Peak production rate required in good weather conditions, after adjusting the effect of "bad weather conditions"	

*Generally it has been the practiced in the dam construction, that the blocks are raised upto spillway crest level in the period available between the river diversion & onset on next flood season.

Based on the Monthly production rate worked out above, the peak hourly yield can be worked out after applying suitable coefficients. (Normally 1 month = 25 days & 1 day = 16-20 hrs).

B) Assessing the minimum rate of pouring concrete in the Dam : Apart from attempts to apply continuous concreting method, concrete dams are usually

executed in blocks. Furthermore, in order to eliminate the heat produced by setting, in layers of upto 3 mtrs (usually restricted to 1.5mtrs), 3 days (72hrs) are usually left before pouring the next layer of same block. Simultaneously for adequate compaction through vibration, these layers must be concreted in 50 - 60cm thick sub-layers. In many cases this aspect is used to strike a balance between the sizing of the installations concrete laying capacity.

The required rate of pouring concrete (Based on the Cold Joint formation) can be worked out as per following expression :

Q = (Z x W x B) (n+1) / T, where

Q = Rate of pouring concrete to avoid Cold joint formation

T = Time interval, in which Block sub layers must be poured (2-3 hrs depending upon climate and cement characteristics.

H = Height of each lift

Z = Height of each Sublayer (50 – 60 cm)

W = Width of each sub-layer

B = The width of dam block in which concrete is being poured

n = no of sub layers in each lift = H/Z

Based on the value of “Q” as worked out above and peak hourly yield as worked in paragraph “A” above, the number of , allowable independent work areas in the dam can be worked out.

Concreting Schedule for each independent workable area:

The format for working out the daily concreting schedule based on the information worked out above is shown below :

Date & Month		Block 1				Block - 2				Total	
Month	Day	LIFT	ELEVATION		Cum	LIFT	ELEVATION		Cum		
			FROM	TO			FROM	TO		Daily	Month
Month-1	1										
	:										
	31										
Month-2	1										
	2										
	:										
	31										

It is to be ensured that that daily total & Monthly total matches the average values worked out in paragraph “A” above.

Factors to be considered while scheduling the lift in each block :

- Admissible thickness of layer. (usually = 1.5m)
- Interval between concreting successive layers of same block. (72 hrs, i.e. 3 days)
- Maximum acceptable difference in elevation between adjacent blocks during construction in order to avoid possible risk of instability and unforeseen deformations (usually 9m).

6.2.4.3. Weather impact considerations: An important element of the construction planning is to identify seasonal weather periods that could potentially impact the construction work. Construction schedule work activities that are susceptible to these weather impacts, particularly critical path activities should be assigned to that weather calendar. The potentially adverse weather time frames should be included in the construction planning and incorporated into the schedule. From past experience it has been observed that the average monthly production rate during the adverse weather time frames usually ranges between 40 – 60% of good weather conditions.

6.2.4.4. **6.2.4.4. The review of tunneling excavation by 'Drill & Blast' method and review of 'Dam Concreting Schedule' is based on the fact that in most of the hydro projects, either of these two items are on critical path. However, there may be any other components of the project like pressure shaft or powerhouse etc. which can be on the critical path. Furthermore, alternative construction methodology and equipment proposed / deployed would also play a major role in defining construction schedule. Such items would also need elaboration for scrutiny of the commissioning schedule.**

7. *APPROVAL OF THE COMMISSIONING SCHEDULE:*

7.1. Procedure to be adopted by Commission in conveying approval of the Commissioning Schedule.

7.1.1. As per the provisions of the Tariff Policy time period for commissioning of all the units of the project shall be four years from the date of approval of commissioning schedule by the commission. However, the Commission may, after recording reasons in writing, fix longer time period for large storage projects and run-off-the river projects of more than 500 MW capacity, after prudence check based on the methodology given in clause 6.

7.1.2. The intimation regarding accord of approval of the commissioning schemes is conveyed to the Generating Company, Ministry of Power, Planning Commission, other concerned Government Departments, State Govt. and "Designated Agency or an expert" chosen by the Generating Company from the list of designated agencies/Experts as notified by the Central Commission from time to time for vetting the capital cost of project.

7.1.3. Commission shall convey its approval within 4 weeks from the date of admitting the commissioning schedule for scrutiny & approval.

7.1.4. The Commission reserves the right to revoke the approval, if the conditions stipulated in the Office Memorandum conveying the approval are not complied with to the satisfaction of the commission

8. REVISED APPROVAL OF THE COMMISSIONING SCHEDULE

8.1.1. Commissioning schedule once approved by the Commission shall not be revised under any circumstances, except under the condition where the work has been delayed for the reasons beyond the control of the Generating Company including but not limited to geological surprises or , under the directives of the competent government authority or due to force majeure condition.

8.1.2. If the construction work has been stopped under the directives of the competent government authority or force majeure, Generating Company would be required to submit the revised commissioning schedule along with appropriate justification for its approval by the commission, after as soon as work resumes at the site.

Annexure

ANNEXURE 1

(FORMAT FOR PREPARATION & SUBMISSION OF SCHEDULES)

ANNEXURE -2

(WORK BREAK DOWN STRUCTURES FOR TYPICAL H.E. PROJECT)

ANNEXURE -3 - FORMAT FOR ESTIMATING CYCLE TIME REQUIRED FOR EXCAVATION OF TUNNEL / SHAFTS BY DBM

General Information About Tunnel / shafts			
Name of The Tunnel / Face to be excavated :			
Shape of the tunnel :			
Length & Size of Tunnel	Length (Rmt)		X-sectional Area (Sqm)
Length of Excavation in Good Conditions (Class I,II,III) (Rmt)			
Length of Excavation in Poor Conditions (Class IV, V) (Rmt)			
Total Length of Tunnel to be excavated (Rmt) :			
Operation involved in Tunnel excavation activity	**Good Conditions**	**Poor Conditions**	**Remarks**
1. Time required for Drilling (Min)			
2. Time for Loading the Blast holes (Min)			
3. Time for Blast (min)			
4. Ventilation Time (min)			
5. Time take for Primary Scaling (min)			
6. Time required for Mucking (Min)			
7. Time for fixing rockbolt (min)			
8. Time for Shotcreting (min)			
a) Total time required for tunneling operations (1+2+3……7+8), {less any overlap time} (min)			
b) Allowance (to cater for idle time/ machine breakdown etc) (Min)			
Total Time cycle time (a)+(b) (Hrs)			
Estimation of Total time duration required for excavation of tunnel			
Time required for completing Excavation (Hrs)			

Total time required for excavation of tunnel (good conditions + poor conditions) - Hrs		
Total Days required to Excavate tunnel (assuming 24hrs/day ,		
Average rate of progress (m/day)		

ANNEXURE – 4: TYPICAL COMPONENTS INVOLVED IN VARIOUS HYDROELECTRIC POWER SCHEMES **(Ref Clause: 6.2.4.1.1)**

1) **Power Station on Power Channel :** The components required for arrangements are :
   a) Diversion weir across the Stream with necessary river control & training works
   b) Head Regulator for the canal with a raised sill at intake
   c) Desilting Basin & Outlet canal for carrying deposit silt
   d) Transition to canal and control gate
   e) Power Channel
   f) Forebay & Intake
   g) Penstock
   h) Power Station
   i) Tail race.

2) **Power Station below High Dam :**
   a) River Diversion arrangement
   b) Dam
   c) Penstock
   d) Power Station
   e) Tail race channel

3) **Power Station at the end of tunnel & penstock :**
   a) River diversion structure
   b) Dam
   c) Intake structure for the power tunnel
   d) Desilting Basin & Silt flushing tunnel.
   e) Power Tunnel

f) Surge tank where the tunnel ends and penstocks branch off

g) Valves on each penstock D/s of surge tank for isolated penstock

h) Penstock for each machine individually.

i) Power Station

j) Surge Tank if required on the tailrace

k) Tail race tunnel or open channel

ANNEXURE – 5: COMMONLY ADOPTED CONSTRUCTION METHODOLOGY & ASSOCIATED KEY ACTIVITIES:

(Ref Clause: 6.2.4.1.2)

1. **Activities involved in excavation of tunnel & Caverns by Drilling and Blasting:** Most of the underground excavation in rock is still performed using drilling & blasting techniques. Sequence of excavation of various underground structures depends on area of cross section of the excavation is given in Fig –1.

1.1. Maximum Length of tunnel face : From the past data, it is observed that under normal circumstances,

1.1.1. The long term average of tunnel excavation from a single face varies between 80-100m / month.

1.1.2. Under normal circumstances and if the site conditions permit, the maximum length of length of tunnel to be excavated from single face should be limited to 2.5- 3.0 km. However there are examples, where the length of single face has exceeded these limits.

1.2. Full-face tunneling method:

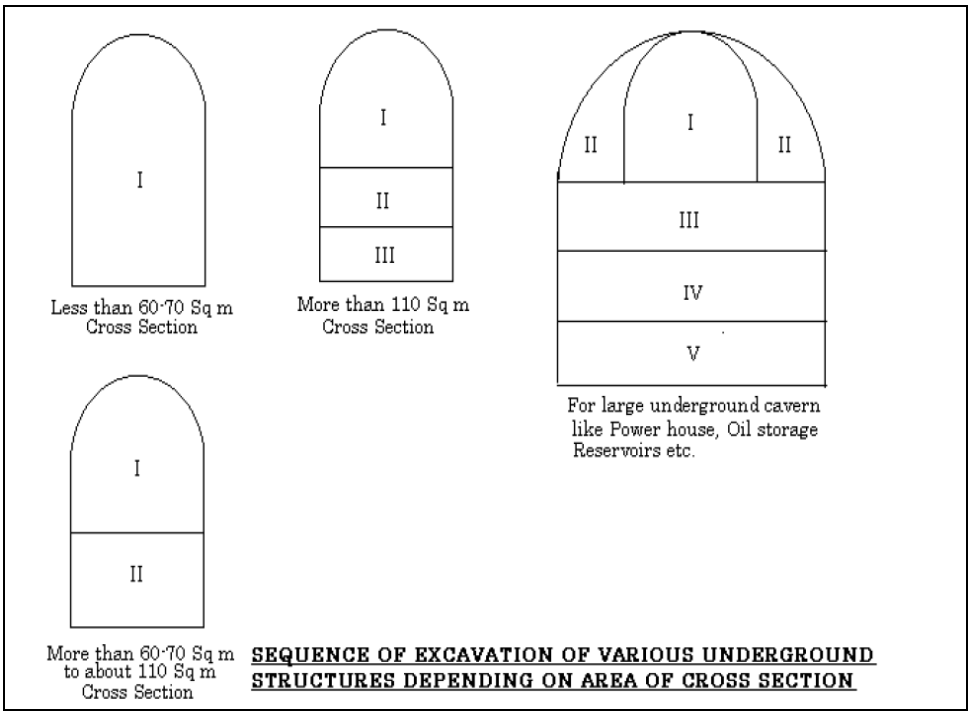
1.2.1. For tunnels generally smaller than 60 – 70 m^2 cross-sections, full-face excavation gives maximum economy and efficiency. Full-face excavation is applicable for tough rock having little jointing. Thus in the schedule, there would be only one activity showing the full face excavation of the tunnel.

1.3. Top heading and bench method:

1.3.1. For medium tunnel more than 60 – 70 m^2 area of cross section, normally top heading and benching sequence are adopted. In this method, driving an upper heading across the full width, one third to half of the final tunnel section. The lower section is removed later by benching. Top heading is generally driven throughout the full length of the tunnel before benching begins. In some operations the bench blasting is carried out simultaneously, but at another location within the tunnel.

1.3.2. For excavation of very large underground cavern (Power House / Desilting Basin etc), invariably one or two access tunnels are be provided. Generally it is ensured that this access tunnel is provided at the top of the cavern. Depending upon the size of underground cavern, another access tunnel may also be provided at an intermediate level. Its sizes will depend on the mucking equipment to be used and machinery to be taken inside for installation.

As the width and height of a cavern is bigger than most tunnels, the normal practice is to excavate fist the top portion of the cavern up to the arch (A central drift, followed by it widening) and concrete the arch (ir required as is done in DC generally). This is necessary to render the whole working area safe from any rock falls, which are likely to take place due to wider and flatter arches. After the arch is concreted, the benches may be removed in one or more operations, depending on the height of cavern and the nature of rock.



SEQUENCE OF EXCAVATION OF VARIOUS UNDERGROUND STRUCTURES DEPENDING ON AREA OF CROSS SECTION

1.4. Estimating the excavation cycle time

The typical cycle of excavation by blasting is performed in the following steps:

- Drilling blast holes and loading them with explosives.
- Detonating the blast, followed by ventilation to remove blast fumes.
- Removal of the blasted rock (mucking).
- Scaling crown and walls to remove loosened pieces of rock.
- Installing initial ground support.
- Advancing rail, ventilation, and utilities.

When assessing the cycle time for excavation of Tunnel / shaft by drilling & blasting method (Annexure –4(i)), time for above mentioned operation is required to be estimated, to arrive at the cycle time for excavation.

2. **Activities involved in excavation of vertical shafts:** Vertical shafts may be sunk usually from top to bottom but when access at the bottom is available the following methods may be more, beneficial for excavation. The method to be used will also depend upon geology, size and seepage of water:

2.1. A small pilot of about 2 to 3 m dia may be first excavated from top to bottom and then the shaft may be widened throwing the muck down the pilot shaft, which may be mucked from the bottom by suitable mucking equipment.

2.2. Instead of sinking a pilot from the top, a small pilot shaft of about 2 m diameter may be excavated upwards to using a raise climber serve as a pilot shaft. Then as in the, method given at (a), the shaft may be widened and the muck thrown

3. Activities involved in excavation of Inclined Shafts / tunnels: Inclined shafts or tunnels may be sunk from top to bottom or if access is available, from bottom *to* top or from both top and bottom. If the depth of the shaft is more than 300 m generally an intermediate adit may be provided for opening additional working faces. The method to be used will also depend upon geology, size and seepage of water. The following are the general methods for sinking inclined tunnels and/or shafts:

3.1. From *Bottom Upwards with Full Face*- This method consists of raising the shaft from the bottom and as such, the muck after blasting rolls down by gravity.

3.2. From Top Downwards with Full Face-In this -method, all the operations are carried out from top downwards, as in sinking a vertical shaft. The sinking of the inclined shaft is more difficult than sinking a vertical shaft.

3.3. From Bottom upwards with Pilot Heading-This method is adopted when the size of the shaft is quite big. First a pilot heading at the lower level is driven from bottom upwards. After the pilot is complete, widening is started from top and carried down. Thus, .in both the operations the muck is allowed to fall down so that it can slide along the slope by gravity up to the bottom of the shaft, from where it is removed by loaders, This method has most of the advantages of the methods given in 3.1 and 3.2 above.

4. **Activities involved in Concrete lining of Tunnels & Shafts :**

4.1. Appropriate time for placing the concrete lining :

4.1.1. For tunnels generally smaller than 60 m^2 cross-section, the lining activity is taken up after the completion of excavation.

4.1.2. For tunnel more than 60 – 70 m^2 area of cross section, concrete lining of tunnel can be planned to be taken up simultaneously with the excavation.

However, the concrete lining would lag sufficiently behind the excavation face (about 500m), so as to avoid the damage to concrete due to blasting.

4.1.3. For lining of very large underground cavern (Desilting Basin etc), more than one of stage of benching is involved, to limit the size of shutter, the arch portion of the tunnel may be planned to be completed, and before it becomes inaccessible. The later stages of benching can be planned after the completion of concreting in the arch portion of the tunnel.

4.2. Sequence of Lining: The sequence of concrete placement for tunnel lining depends upon the shape of the tunnel, its size, the nature of the rock strata and the type of form work and other plant & equipment used. The sequences generally adopted for lining in tunnel are :

4.2.1. Placing concrete to form the kerbs first, followed by side walls and arch and finally invert: This sequence is suited for horse shoe shape, D-shaped and other flat bottom & wide tunnels (> 4m). This sequence has the advantage that all operations of concreting kerb, placing of shutters and lining of sides & arches can be done with minimum disturbance to track lines on the floor and for the movement of other traffic. The track lines and other service lines are removed and invert concreting is done last. This method permits the concreting of sides and arch simultaneously with excavation with suitable gap.

4.2.2. Placing concrete to form the invert first followed by sides and arch: This sequence is adopted where the bottom of tunnel is narrow (upto 4m) or when the section is circular.

4.2.3. Placing concrete for the invert, side wall and arch all at one time: This sequence is possible only in small and circular tunnels. It is difficult to be adopted in ordinary course and may be resorted to only where construction programme demands it.

4.3. Type of Lining (continuous/ non- continuous)

4.3.1. Non – continuous lining using Travelling Non-telescoping Form Work : for this type of forms, concrete for the sides and arch may be placed in one continuous operation. The traveler which carries the form structurally forms a part of form work. The forms are made in units of 6 to 12 m long and van be struck and reassembled quickly depending on the requirement of construction traffic and matching concreting equipment. Forms are removed after 16-24 hrs from the placing of last batch of concrete. In case of, lining being carried out simultaneously with excavation, progress of 108-120m / month can be anticipated, using a 12m long shutter for 7m dia horse shoe shape tunnel (300mm thick lining) . In case of lining is carried out non concurrently with excavation, the progress between 180-300m/ month can be anticipated, using 12m long shutters for 7m dia horseshoe shape tunnel(300mm thick lining).

4.3.2. Continuous lining using Travelling Telescoping Form Work : - This is so designed that the back unit can be collapsed and moved forward through the front unit without disturbing it. With these type of shutters a progress

of 800-900m/month can be anticipated using 60m long (10segments of 6m length) for a 7m dia horse shoe shape tunnel (300m thick lining).

5. **Concrete Dam :**

5.1. Excavation: Open excavation is of major importance for concrete dams, due to the setbacks that unfavorable circumstances in this area can cause to the construction schedule. Following points are taken into consideration programming for open excavation for concrete dam :

5.1.1. While the excavation of abutments at higher level can proceed simultaneously with river diversion works, excavation of riverbed area and lower reaches on the valley sides is programmed after the diversion of river. While excavation of these areas is not complete, it is generally not reasonable to commence concreting as the critical path for a dam, usually corresponds to the blocks in these areas.

5.1.2. Excavation of several rubble-loading levels should be carried out simultaneously wherever possible, without compromising safety.

5.1.3. When stability problems are foreseen that may affect considerable areas of the valley side, it is essential to program excavation & concreting of the first list lifts of the corresponding blocks simultaneously.

5.2. Concreting: Apart from attempts to apply continuous concreting method, concrete dams are usually executed in blocks divided by transversal joints and sometimes longitudinal joints, when the dimension of resulting blocks would otherwise produce cracks due to heat caused by setting, shrinkage and temperature variations. Further, in order to eliminate the heat produced by setting, in layers upto 1.5m thick, 72hrs (3 days) are usually

left before pouring the next layer of the same block. Bearing these factors in mind, following main conditioning factors should be specified while scheduling the concreting of dam :

- Admissible thickness of layer. (usually = 1.5m)
- Interval between concreting successive layers of same block. (72 hrs, i.e. 3 days)
- Maximum acceptable difference in elevation between adjacent blocks during construction in order to avoid possible risk of instability and unforeseen deformations (usually 9m).
- Seasonal climatic conditions.

The optimum thickness obtained by one day production is set by taking all of these factors into account. This thickness is normally the same for all blocks except for special cases.

Concreting Installation capacity: To determine the size of the concrete mixing plant required for a dam, the capacity of any given installation is used to make up initial concreting schedule. On the basis of the number of blocks, layers of thickness, frequency of concreting successive layers, it is then determined whether or not the given capacity is sufficient. If necessary, the rate of concreting is accelerated until it adequately meets the commissioning schedule requirements and the schedule is recalculated on the basis of a larger capacity installation. This is repeated till most suitable solution is reached.

For these calculations, it is necessary to establish the output or capacity for the different possible project conditions or phases. The basic datum required is the real production rate obtainable in peak months, that is, under optimum dam conditions when foundations for most of the blocks have been completed, when concreting in an area with a sufficient number of large surfaced blocks and without the threat of rain, flood or frost. To calculate this basic information required for the concreting schedule, it is necessary to have figures for peak hourly yield in order to obtain the daily yields.

In general the most economical solution is to concrete as rapidly as possible, this criterion can be adopted, when scheduling for Dam-toe projects, where dam is the most critical component. However, when optimum concreting conditions as mentioned before only exist for a very short time (for example when dam is small and is not a critical component in the project), it is not advisable to set up an installation for the maximum yield but rather choose a smaller one which would work at maximum capacity over a longer period of time so that completion of dam is planned simultaneously with the critical component (most likely the Head race tunnel).

6. **Embankment Dam :**

6.1. <u>Excavation program :</u>

6.1.1. Main excavation is involved in the riverbed & lower parts of the sides, plus excavation of the cutoff. These activities are planned after the river diversion.

6.1.2. For typical cases (mild side slopes), the sides are usually excavated simultaneously with dam body construction, with a reasonable time as required for excavating and concreting the perimetric inspection gallery or cutoff moduli.

6.1.3. On other hand, for a non-typical case (steep sides), the excavation is generally carried out in advance with respect to commencement of dam body construction.

6.2. Factors affecting schedule for embankment dams :

6.2.1. Admissible thickness of the layer, both for rockfill and impervious core or earthfill. In this case, this does not necessarily have to correspond to a daily work season, but simply to that which can be adequately compacted.

6.2.2. Number of passes required by compacting equipment for each type of material.

6.2.3. Seasonal climatic conditions.

6.2.4. River Diversion plan

6.2.5. Execution of cutoff which connects the dams impervious material with the bedrock or overburden.

6.2.6. Finishing of the faces as dam goes up, especially when upstream side is to be covered with an impervious blanket.

6.2.7. Spillway construction

6.2.8. Output of aggregate plant: The output is the capacity of the extraction, transport, placing spreading and compaction equipment used for different types of materials forming the dam.

7. Erection Methodology of E&M works: After completion of excavation of the Powerhouse lower floor and erection & commissioning of the Powerhouse EOT Crane. The First Stage of Embedment comprising of Earthing Mat, Drainage pipes etc. shall be placed and handed over to Civil Works for Concreting.

7.1. Erection of Main Plant Equipment: (Pelton): The Turbine Pit Liner and Service Platform for Runner Inspection / Removal shall be assembled and placed. Civil Works for concreting shall commence thereafter on completion of this phase.

After Concreting of runner platform and distributor pedestals, Distributor Erection shall be carried out by Site Welding and shall be Radio Graphically and ultrasonically tested. Distributor shall be pressure tested at site as per relevant standards; Distributor Pipe Concreting shall be done with pressurized Distributor Pipe after alignment of the Inlet Flange of the Distributor and Nozzle flanges.

After successful erection of the distributor, the site shall be handed over for concreting upto the Generator Barrel in different stages.

The Turbine Guide Bearing and Housing shall be aligned prior to Turbine Shaft Alignment. Nozzles shall be assembled with Distributor Pipe and aligned as per Runner Centerline.

Turbine Shaft shall be lowered and aligned with the Unit Centerline.

Generator Lower Bracket shall be assembled at Service Bay and placed in the Generator Barrel Pit. At this stage Brake Dust Collector Assembly and Lower Fire Fighting Piping shall be erected. Generator Guide Bearing Assembly and Alignment shall also be done after placing the lower bracket.

Generator Stator Segments and windings shall be assembled at Service Bay and lowered in the Generator Pit after alignment with the machine centerline for secondary concreting of the Generator Foundation. HV Testing shall be carried out after completion of assembly of windings and Stator Erection in Generator Barrel.

Rotor Assembly shall be done at the Service Bay which would include building of the Rotor Punchings with the Hub and Assembly of the Rotor Poles with the assembled Rotor. After Alignment of the Generator Shaft with the Turbine Shaft, coupling of the shafts shall be done. HV Testing shall be carried out after completion of assembly. Special tools to check and maintain maximum possible circularity shall be done as per relevant standards.

Assembly of the Upper Bracket shall be carried out in the Service Bay and lowered in the Generator Barrel. Erection of the Thrust Collar and Thrust Bearing Assembly shall be done thereafter.

Erection and Commissioning of the Governors and Excitation Systems, Electrical Braking Panels and other Balance of Plant Equipment and Cable laying shall be done parallelly with the unit erection and commissioning works. (Refer to the Erection Schedule attached)

The Upstream Piece of the MIV shall be welded with the Penstock and for Erection of MIV; MIV shall be assembled at Main Plant Equipment Manufacturers' Works and installed at site after alignment with the Penstock and Distributor Pipe.

Erection of Unit Control & Protection Panels, dry commissioning tests shall be initiated. Wet Commissioning shall be done as per water availability and completion of all Balance of Plant Equipment Erection, Commissioning and Testing. Thereafter Commercial Operation Date shall be achieved as per Water Availability at the Powerhouse.

7.2. Erection of Main Plant Equipment: (Francis and Kaplan)

Draft tube erection will be carried out by installation and welding of various segments.

After Concreting of Draft Tube and Spiral pedestals, Spiral casing and stay-ring erection shall be carried out by Site Welding and shall be Radio Graphically and ultrasonically tested. Spiral casing shall be pressure tested at site as per relevant standards; Spiral casing concreting shall be done with pressurized Spiral casing.

After successful erection of the Spiral casing and stay-ring and assembly of pit liner, the site shall be handed over for concreting up to the Generator Barrel in different stages.

Subsequently erection of guide apparatus including Turbine Cover, Turbine Guide Bearing, Shaft and Runner shall carry out.

Turbine Shaft shall be lowered and aligned with the Unit Centerline.

Generator Lower Bracket shall be assembled at Service Bay and placed in the Generator Barrel Pit. At this stage Brake Dust Collector Assembly and Lower Fire Fighting Piping shall be erected. Generator Guide Bearing Assembly and Alignment shall also be done after placing the lower bracket.

Generator Stator Segments and windings shall be assembled at Service Bay and lowered in the Generator Pit after alignment with the machine centerline for secondary concreting of the Generator Foundation. HV Testing shall be carried out after completion of assembly of windings and Stator Erection in Generator Barrel.

Rotor Assembly shall be done at the Service Bay which would include building of the Rotor Punchings with the Hub and Assembly of the Rotor Poles with the assembled Rotor. After Alignment of the Generator Shaft with the Turbine Shaft, coupling of the shafts shall be done. HV Testing shall be carried out after completion of assembly. Special tools to check

and maintain maximum possible circularity shall be done as per relevant standards.

Assembly of the Upper Bracket shall be carried out in the Service Bay and lowered in the Generator Barrel. Erection of the Thrust Collar and Thrust Bearing Assembly shall be done thereafter.

Erection and Commissioning of the Governors and Excitation Systems, Electrical Braking Panels and other Balance of Plant Equipment and Cable laying shall be done parallelly with the unit erection and commissioning works. (Refer to the Erection Schedule attached)

The Upstream Piece of the MIV shall be welded with the Penstock and for Erection of MIV; MIV shall be assembled at Main Plant Equipment Manufacturers' Works and installed at site after alignment with the Penstock and Spiral casing.

Erection of Unit Control & Protection Panels, dry commissioning tests shall be initiated. Wet Commissioning shall be done as per water availability and completion of all Balance of Plant Equipment Erection, Commissioning and Testing. Thereafter Commercial Operation Date shall be achieved as per Water Availability at the Powerhouse.

7.3. Erection of Balance of Plant Equipment: The Erection and pre-commissioning of balance plant equipment shall be carried out parallel main plant erection.

Annexure - 6

Grading	**Total marks/rating as per RMR system**	**Rate of Tunneling***			
		<4 m dia	**4 - 8 m dia**	**8-12 m dia**	**> 12 m dia**
Class - I	100 - 81	100-80	100-120	80 - 100	60-80
Class - II	61 – 80	80 - 60	80 - 120	70 - 100	50-60
Class - III	41 – 60	40 - 60	50 - 80	40 - 70	30-50
Class – IV	21 – 40	20 – 40	20 – 50	25 – 40	15-30
Class - V	<=20	10 – 20	10 – 20	8 – 25	5-15

* Rate of progress and cost of equipment deployed will have to be weighed economically.

CHECKLIST

CHECKLIST – 1 (TO BE EXAMINED IN THE OFFICE OF SECRETARY, CERC)

S.no	Item	Check		Remarks
		Yes	No	
2*	Whether generating company has entered into or otherwise have a composite scheme for generation and sale of electricity in more than one State;			
3*	Whether the Generating Company is Registered with the Registrar of the Company.			
4*	Whether Article of Association has Generation as one of the objectives of the Company.			
5	Whether authorization of the Competent Government in favour of the company to establish, operate and maintain specific Power Station available			
6	Complete address for correspondence, along with pin code/ e-mail, FAX, Telephone number, of the generating company available?			
7*	Whether project site has been allotted to the developer by the concerned State Government after following a transparent two stage process as defined in the Tariff Policy			
8	Whether Concurrence of CEA available(if required under Section 8 of the Act),			
9	Whether Long term PPA with at least 60% of the total saleable design Energy is available or the Generating Company has given the Undertaking under Clause 5.1.1			
10	Award of contracts for supply of equipment and construction of the project, either through a turnkey or through well defined packages, are done on the basis of international competitive bidding			
11*				
12*				
13*	Whether the application made has been			

	supported by affidavit of the person acquainted with the facts stated in the application			
14*	Commissioning schedule submitted as per the clause 4.1.2			
15*	Detailed Justification note as per the requirement of clause 4.1.3 available			

*: Must for admitting the commissioning schedule for scrutiny and approval.

SCHEDULE

[To be published in pursuance of Clause 5.2.7]

Name of the Generating Company (in bold letters)

(Registered Office Address ……)

1. The aforementioned Generating Company has made an application before the Central Electricity Regulatory Commission, New Delhi, for scrutiny & approval of Commissioning Schedule for [Give name of the generating station transmission system].
2. Effective Start date for construction activities at project site
3. Scheduled date of commercial operation or COD
4. Type of the project
5. Location of the project area
6. Salient Features of the project
    a. Type & Height of Dam
    b. Length of Water conductor System
    c. Type & capacity of Power House
    d. ……..
    e. ……
7. Land requirement for the project construction
    a. Forest Land
    b. Private Land
    c. Government Land (other than Forest Land)

8. Releief & Rehabilitation aspects :

   a. No of Persons displaced :

   b. No of families affected :

9. A copy of the application made for scrutiny & approval of the Commissioning Schedule is posted on the website of the Commission .

10. The suggestions and objections, if any, on the proposed commissioning schedule contained in the application be filed by any person, before the Secretary, Central Electricity Regulatory Commission, 7th Floor, Core-3, Scope Complex, Lodi Road, New Delhi - 110 003 (or other address where the office of the Commission is situate), with a copy to the Generating Company within 2 weeks of publication of this notice.

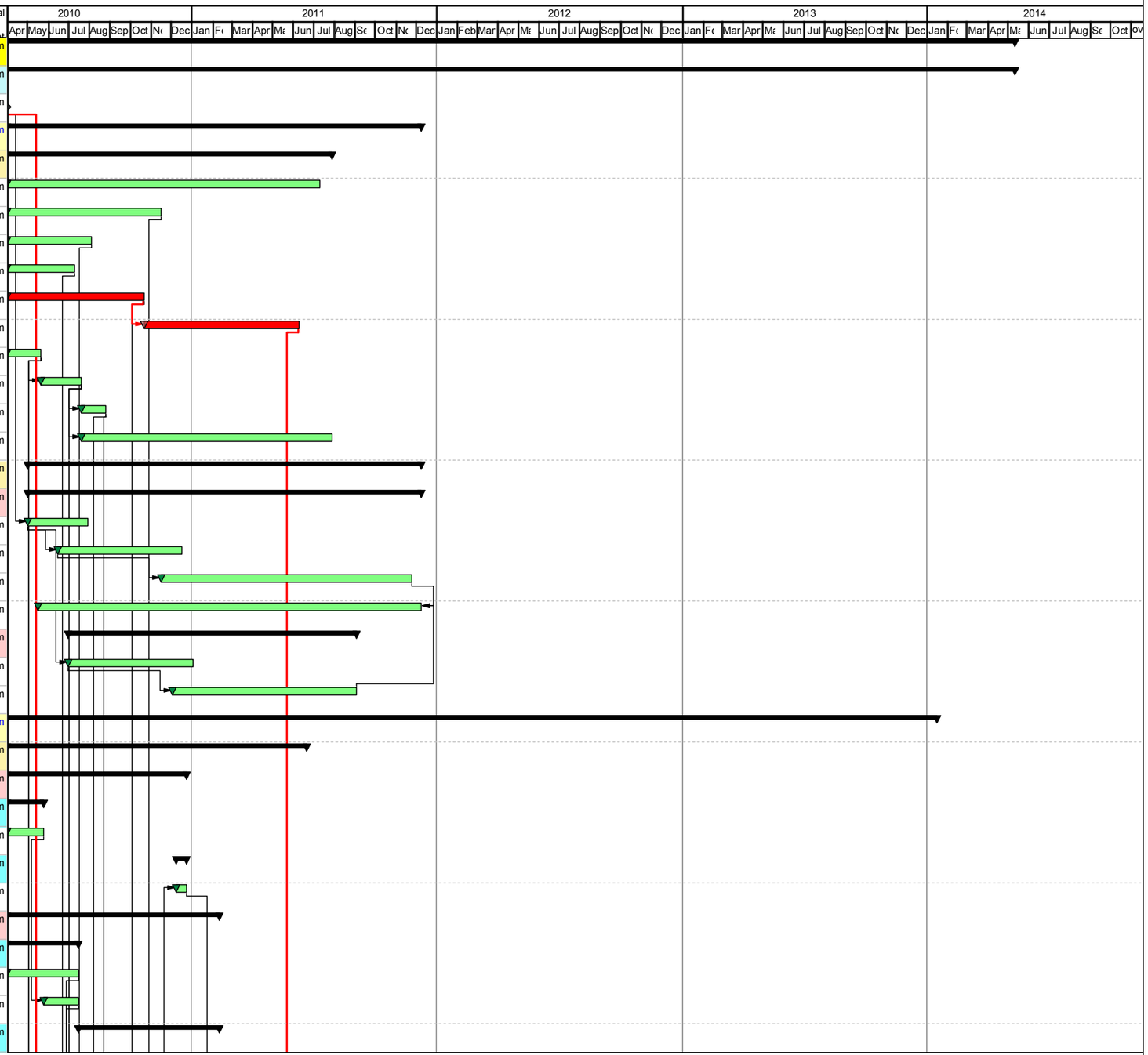
Place _____ Name and Designation of the Authorised Signatory

Date _____

FORMAT FOR PREPARATION & SUBMISSION OF SCHEDULE

ANNEXURE - 1
(CLAUSE 4.1.2)

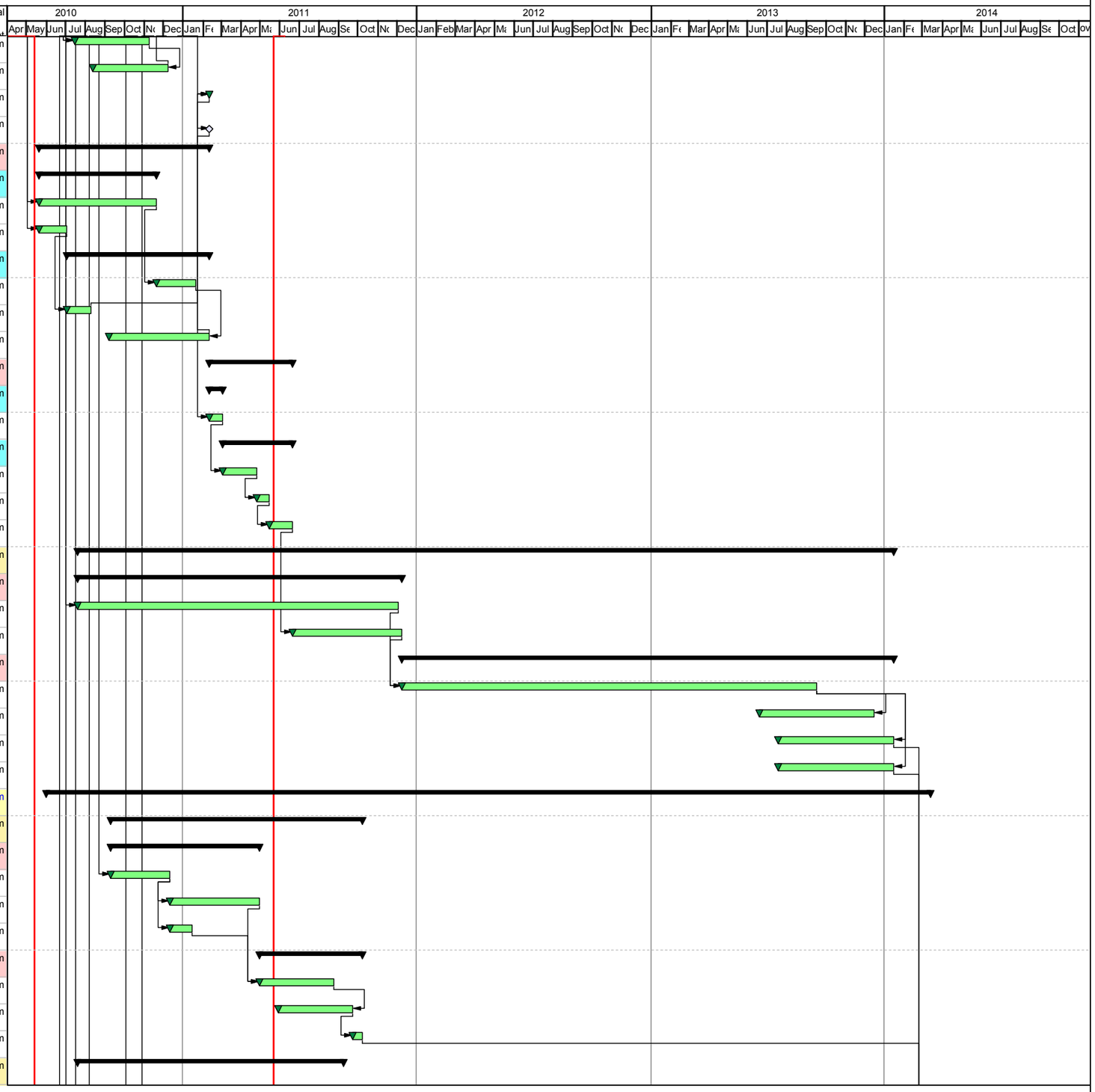
Activity ID	Activity Name	Start	Finish	Total Qty	Duration (Month)	Predecessors	Total float
TYPICAL SCHEDULE FOR H.E. PROJECT		01-Apr-10	12-May-14		50m		0m
CONSTRUCTION STAGE		01-Apr-10	12-May-14		50m		0m
A2220	START DATE OF CONSTRUCTION ACTIVITY	01-Apr-10			0m		0m
Infrastructure Development		01-Apr-10	10-Dec-11		20m		29m
Roads & Bridges		01-Apr-10	30-Jul-11		16m		34m
A2350	Strengthening of Existing Roads	01-Apr-10	11-Jul-11		15m		34m
A2380	C/o approach road to Surge shaft Top	01-Apr-10	16-Nov-10	4.5Km	8m	A2220	12m
A2390	C/o Approach road to Adit-5	01-Apr-10	05-Aug-10	2.50 km	4m	A2220	1m
A2400	C/o of Approach road to Adit-4	01-Apr-10	11-Jul-10	2 km	3m	A2220	1m
A2410	C/o Approach road to Adit-3	01-Apr-10	22-Oct-10	4 km	7m	A2220	0m
A2420	C/o of Approach road to Adit-2	22-Oct-10	10-Jun-11	4.50	8m	A2410	0m
A2430	C/o Approach road to Dam Site	01-Apr-10	22-May-10	1 km	2m	A2220	2m
A2440	C/o of Temporary bridge at Dam site	22-May-10	21-Jul-10	8 km	2m	A2430	2m
A2450	C/o approach road to Adit-1	21-Jul-10	26-Aug-10	700m	1m	A2440	20m
A2460	C/o of Permanent Bridge	21-Jul-10	30-Jul-11	1 no (50m span)	12m	A2440	34m
Buildings		02-May-10	10-Dec-11		19m		29m
Residential Buildings		02-May-10	10-Dec-11		19m		29m
A2290	Land development for colony	02-May-10	31-Jul-10	2 ha	3m	A2220	29m
A2320	C/o of Temporary Residential buildings	16-Jun-10	18-Dec-10	20 unit	6m	A2290	29m
A2330	C/o of Permanent Residential Buildings	16-Nov-10	25-Nov-11	10 unit	12m	A2320	29m
A2340	Other MIscellaneou works like colony roads/fencings/retainig walls etc for colony development	17-May-10	10-Dec-11		19m	A2330, A2310	29m
Non Resedential Building		01-Jul-10	04-Sep-11		14m		32m
A2300	C/o of Temporary Non-Residential buildings	01-Jul-10	03-Jan-11	5 unit	6m	A2290	32m
A2310	C/o of Permanent Non Residential Buildings	03-Dec-10	04-Sep-11	3 unit	9m	A2300	32m
River Diversion & Dam		01-Apr-10	15-Jan-14		46m		4m
River Diversion & Coffer Dam		01-Apr-10	22-Jun-11		15m		2m
Adit to Diversion Tunnel		01-Apr-10	24-Dec-10		9m		3m
Excavation		01-Apr-10	24-May-10		2m		3m
A2530	Excavation of Adit to Diversion Tunel	01-Apr-10	24-May-10	150m	2m	A2220	3m
Concreting		09-Dec-10	24-Dec-10		1m		3m
A2540	Plugging of Construction Adit	09-Dec-10	24-Dec-10	500 cum	1m	A1110	3m
DIVERSION TUNNEL		01-Apr-10	11-Feb-11		10m		2m
Excvation		01-Apr-10	16-Jul-10		4m		3m
A1070	Excavation of DT from Inlet & outlet end	01-Apr-10	16-Jul-10	600m	4m	A2220	3m
A1075	Excavation of DT from (U/s & D/s of Adit Junction)	24-May-10	16-Jul-10	300m	2m	A2530	3m
Lining in DiversionTunnel		16-Jul-10	11-Feb-11		7m		2m



FORMAT FOR PREPARATION & SUBMISSION OF SCHEDULE

ANNEXURE - 1
(CLAUSE 4.1.2)

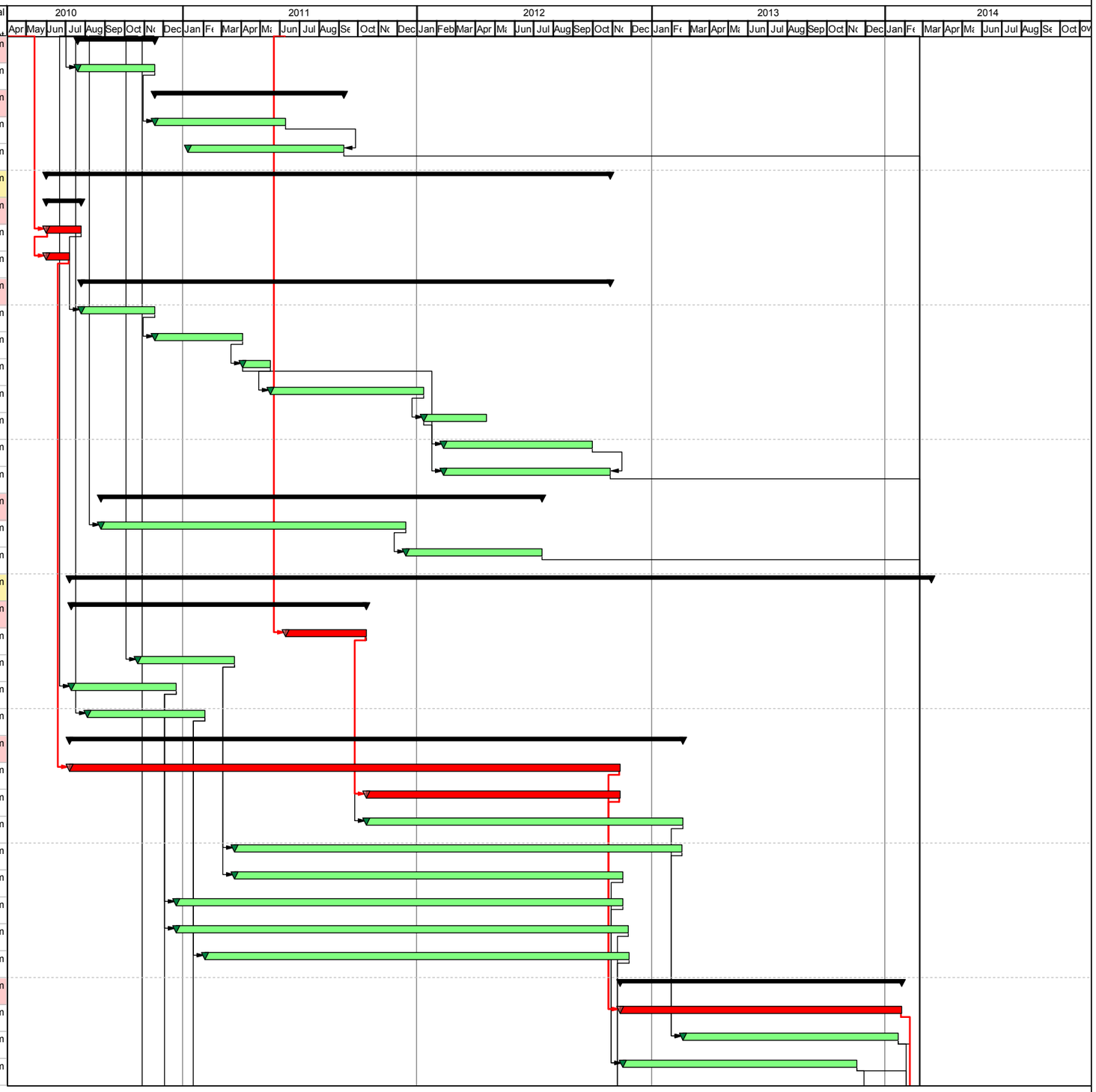
Activity ID	Activity Name	Start	Finish	Total Qty	Duration (Month)	Predecessors	Total float
A1100	Concreting in DT	16-Jul-10	09-Nov-10	900m	4m	A1070, A1075	3m
A1110	Contact /Consolidation grouting in DT	13-Aug-10	09-Dec-10	900m	4m	A1100	3m
A1111	Construction of Closure Dyke	10-Feb-11	11-Feb-11		0m	A1130, A1140, A2540	2m
A1112	River Diversion		11-Feb-11		0m	A1111	2m
DIVERSION TUNNEL - INLET & OUTLET STRUCTU...		22-May-10	10-Feb-11		9m		2m
Excavation		22-May-10	21-Nov-10		6m		3m
A1040	Open Excavation in for DT inlet Structure	22-May-10	21-Nov-10	27000 cum	6m	A2430	2m
A1050	Open Excavation in for DT Outlet Structure	22-May-10	03-Jul-10	6500 cum	1m	A2430	8m
Concreting & HM works		03-Jul-10	10-Feb-11		7m		2m
A1080	Concreting in DT Inlet Structure	21-Nov-10	20-Jan-11	4500 cum	2m	A1040	2m
A1130	Concreting in DT outlet structure	03-Jul-10	11-Aug-10	2700 cum	1m	A1050	8m
A1140	HM works in DT inlet structure (incl fabrication at shop)	07-Sep-10	10-Feb-11		5m	A1080	2m
U/S COFFER DAM		11-Feb-11	22-Jun-11		4m		2m
Excavation		11-Feb-11	04-Mar-11		1m		2m
A1000	Excavation & Stripping in all types of Soil including excavtion in river bed	11-Feb-11	04-Mar-11	10000 cum	1m	A1112	2m
Concreting/ Rockfill in dam body		04-Mar-11	22-Jun-11		4m		2m
A1010	Dumped Rock fill in Coffer Dam	04-Mar-11	27-Apr-11	125000 cum	2m	A1000	2m
A1020	Concreting in Coffer Dam	27-Apr-11	16-May-11	2500 cum	1m	A1010	2m
A1030	Jet Grouting in Coffer Dam	16-May-11	22-Jun-11	7000 cum	1m	A1020	2m
DAM		21-Jul-10	15-Jan-14		42m		4m
Excavation		21-Jul-10	09-Dec-11		16m		2m
A1160	Excavation in Dam (Abutment stripping above river level)	21-Jul-10	03-Dec-11	350000 cum	16m	A2440	2m
A2550	Excavation in Dam in river bed & incl found treatment	22-Jun-11	09-Dec-11	120000 cum	6m	A1030	2m
Concreting		09-Dec-11	15-Jan-14		26m		4m
A1170	Concreting in dam	09-Dec-11	17-Sep-13	32000 cum	22m	A1160, A2550	2m
A1180	Curtain Grouting in Dam	19-Jun-13	16-Dec-13		6m	A1170	5m
A1185	Other Misc/Archite works in Dam incl rim protect etc	19-Jul-13	15-Jan-14		6m	A1170	2m
A1190	HM works in DAM	19-Jul-13	15-Jan-14		6m	A1170	2m
Water Condctor System		01-Jun-10	13-Mar-14		46m		0m
Feeder tunnels		10-Sep-10	08-Oct-11		13m		30m
Excavation		10-Sep-10	30-Apr-11		8m		30m
A1225	Excavation of Adit -1 to "Feeeder Tunnle"	10-Sep-10	12-Dec-10	250m	3m	A2450	30m
A1230	Excavation of Feeder Tunnel U/s of Adit	12-Dec-10	30-Apr-11	370m	5m	A1225	30m
A1240	Excavation of Feeder Tunnel D/s of Adit	12-Dec-10	15-Jan-11	90m	1m	A1225	33m
Concreting		30-Apr-11	08-Oct-11		5m		30m
A1260	Concrete lining in Feeder Tunnel	30-Apr-11	24-Aug-11	460m	4m	A1230, A1240	30m
A1270	Contact / Consolidation grouting in Feedsr Tunnels	29-May-11	22-Sep-11	460m	4m	A1260	30m
A1280	Plugging of Adit to feeder Tunnels	22-Sep-11	08-Oct-11		1m	A1270	30m
Power Intake Structure		21-Jul-10	09-Sep-11		14m		30m



FORMAT FOR PREPARATION & SUBMISSION OF SCHEDULE

ANNEXURE - 1
(CLAUSE 4.1.2)

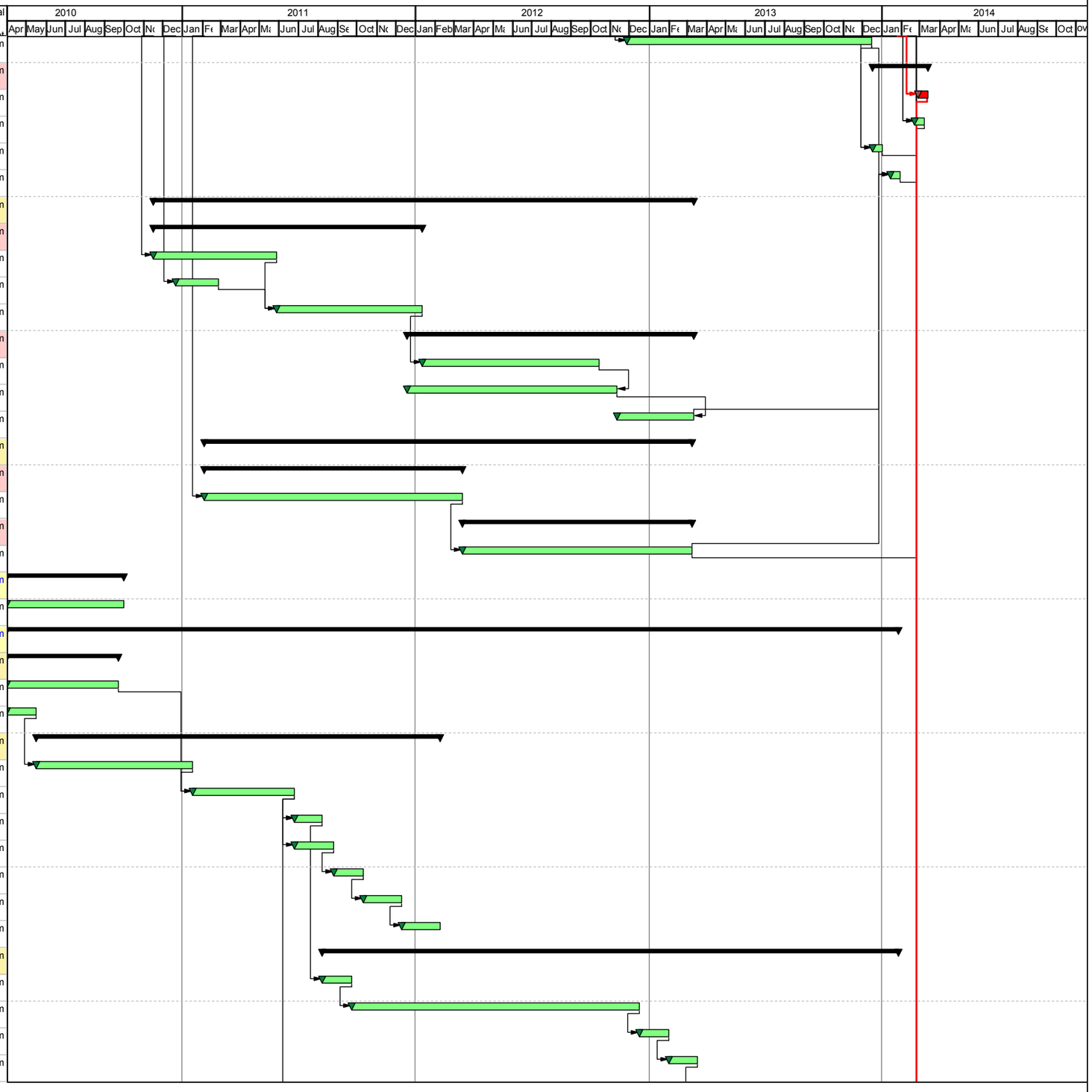
Activity ID	Activity Name	Start	Finish	Total Qty	Duration (Month)	Predecessors	Total float
Excavation		21-Jul-10	18-Nov-10		4m		30m
A1200	Open Excavation in Power Intake structure	21-Jul-10	18-Nov-10	15600 cum	4m	A2440	30m
Concreting		18-Nov-10	09-Sep-11		10m		30m
A1210	Concreting in power Intake Structure	18-Nov-10	10-Jun-11	4760cum	7m	A1200	30m
A1220	HM works in Power Intake structure (including Fabrication at shop)	08-Jan-11	09-Sep-11		8m	A1210	30m
Desilting Chamber Complex		01-Jun-10	29-Oct-12		29m		17m
Construction Adits in DC		01-Jun-10	26-Jul-10		2m		0m
A1310	Excavation of Adit -1 upto DEsilting Chamber	01-Jun-10	26-Jul-10	150m	2m	A2220	0m
A1370	Excavation of Adit to D/s of DC upto Jn with HRT	01-Jun-10	08-Jul-10	100 m	1m	A1310	0m
Excavation & Concreting of DC		26-Jul-10	29-Oct-12		27m		17m
A1410	Excavation of DC-1 (central pilot -including Transtions)	26-Jul-10	18-Nov-10	8500 cum	4m	A1310	17m
A1420	Widening of central pilot of DC-1 (including transition portion)	18-Nov-10	04-Apr-11	17000 cum	4m	A1410	17m
A1430	Concreting in Crown portion of DC-1	04-Apr-11	17-May-11	1200 cum	1m	A1420	17m
A1440	Benching of DC-1 upto Hopper	17-May-11	12-Jan-12	46500 cum	8m	A1430	17m
A1450	Excavation of DC-1 beolw hopper (Flushing conduit)	12-Jan-12	19-Apr-12	3600 cum	3m	A1440	17m
A1460	Concreting in DC -1 (Hopper & Side walls & Flushing conduit)	11-Feb-12	01-Oct-12	7000 cum	8m	A1450	17m
A1540	Drilling & grouting in DC-1	11-Feb-12	29-Oct-12		9m	A1430, A1460	17m
Excavation & Concreting of Silt Flushing Tunnel		26-Aug-10	14-Jul-12		23m		20m
A1560	Excavation of SFT from outlet upto DC	26-Aug-10	15-Dec-11	465m	16m	A2450	20m
A1580	Concrete lining in SFT	15-Dec-11	14-Jul-12	465m	7m	A1560	20m
HRT		08-Jul-10	13-Mar-14		44m		0m
Adits to HRT		11-Jul-10	14-Oct-11		15m		0m
A1620	Excavation of Adit-2 to HRT	10-Jun-11	14-Oct-11	350m	4m	A2420	0m
A1630	Excavation of Adit-3 to HRT	22-Oct-10	23-Mar-11	420m	5m	A2410	0m
A1640	Excavation of Adit-4 to HRT	11-Jul-10	21-Dec-10	450m	5m	A2400	1m
A2480	Excavation of Adit-5 to HRT	05-Aug-10	04-Feb-11	500m	6m	A2390	1m
HRT- Excavation		08-Jul-10	19-Feb-13		32m		0m
A1650	Excavation of HRT (D/s of DC)	08-Jul-10	13-Nov-12	2400m	28m	A1370	0m
A1660	Excavation of HRT (U/s of Adit-2)	14-Oct-11	13-Nov-12	1120m	13m	A1620	0m
A1670	Excavation of HRT (D/s of Adit-2)	14-Oct-11	19-Feb-13	1400m	16m	A1620	0m
A1680	Excavation of HRT (U/s of Adit-3)	23-Mar-11	18-Feb-13	1965m	23m	A1630	0m
A1690	Excavation of HRT (D/s of Adit-3)	23-Mar-11	17-Nov-12	1700m	20m	A1630	2m
A1700	Excavation of HRT (U/s of Adit-4)	21-Dec-10	17-Nov-12	1950m	23m	A1640	2m
A2490	Excavation of HRT (D/s of Adit-4)	21-Dec-10	26-Nov-12	1980m	23m	A1640	1m
A2500	Excavation of HRT (U/s of Adit-5)	04-Feb-11	26-Nov-12	1860m	22m	A2480	1m
HRT - Lining		13-Nov-12	27-Jan-14		15m		0m
A1710	Conc in HRT between Adit-2 & DC	13-Nov-12	27-Jan-14	3500	15m	A1650, A1660	0m
A1720	Conc in HRT between Adit-2 & Adit-3 (1 shutter from each adit)	19-Feb-13	22-Jan-14	2265m	11m	A1670, A1680	0m
A1730	Conc in HRT between Adit-3 & Adit-4 (1 shutter from each adit)	17-Nov-12	17-Nov-13	3650m	12m	A1690, A1700	2m



FORMAT FOR PREPARATION & SUBMISSION OF SCHEDULE

ANNEXURE - 1
(CLAUSE 4.1.2)

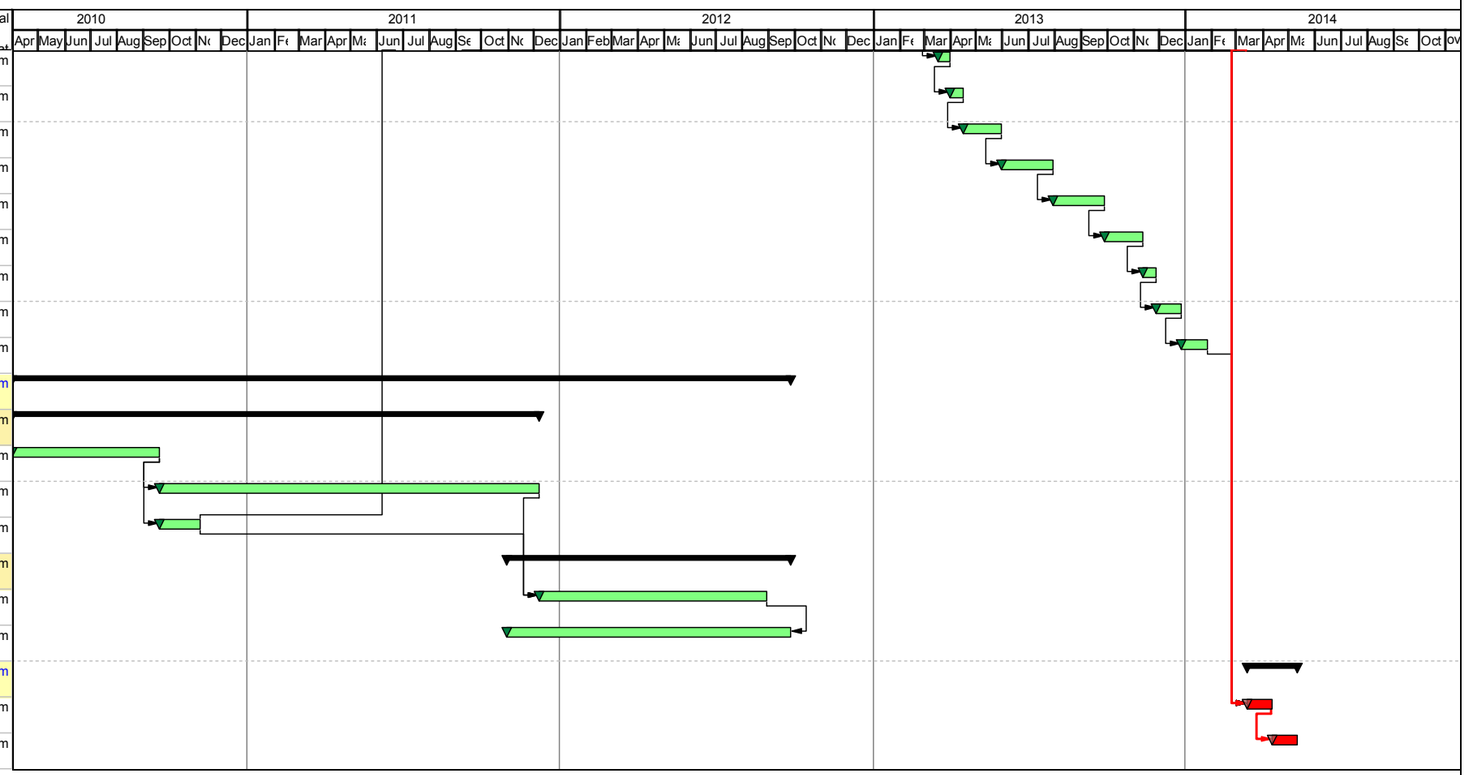
Activity ID	Activity Name	Start	Finish	Total Qty	Duration (Month)	Predecessors	Total float
A2510	Conc in HRT between Adit-4 & Adit-5 (1 shutter from each adit)	26-Nov-12	15-Dec-13	3840m	13m	A2490, A2500	1m
Plugging of Adits		17-Dec-13	13-Mar-14		3m		0m
A1770	Plugging of Adit-2	26-Feb-14	13-Mar-14	600 cum	1m	A1710, A1720	0m
A1780	Plugging of Adit-3	21-Feb-14	08-Mar-14	600 cum	1m	A1720, A1730	0m
A1790	Plugging of Adit-4	17-Dec-13	01-Jan-14	600 cum	1m	A1730, A2510	2m
A2140	Plugging of Adit -5	14-Jan-14	29-Jan-14	600 cum	1m	A1910, A1860, A2510	1m
Surge Shaft		16-Nov-10	12-Mar-13		28m		12m
Excavation		16-Nov-10	11-Jan-12		14m		12m
A1810	Open Excavation in Surge Shaft	16-Nov-10	28-May-11	2500cum	6m	A2380	12m
A1820	Excvation of Pilot Hole in Surge Shaft	21-Dec-10	26-Feb-11	150m\	2m	A1640	15m
A1830	Full face Slashing in surge shaft	28-May-11	11-Jan-12	150m	8m	A1820, A1810	12m
Lining & HM works		18-Dec-11	12-Mar-13		15m		12m
A1840	Concreting in surge shaft	11-Jan-12	15-Oct-12	150m	9m	A1830	12m
A1850	Contact/ Consolidation grouting in SS	18-Dec-11	12-Nov-12	150m	11m	A1840	12m
A1860	HM works in surge shaft (including fabrication in shop)	12-Nov-12	12-Mar-13		4m	A1850	12m
Pressure Shaft		04-Feb-11	10-Mar-13		25m		12m
Excavation		04-Feb-11	15-Mar-12		13m		12m
A1870	Under ground excavation in Pressure shaft & valve house	04-Feb-11	15-Mar-12	800m	13m	A2480	12m
Lining		15-Mar-12	10-Mar-13		12m		12m
A1910	Erection of Steeliners in PS& B/Fly Valve	15-Mar-12	10-Mar-13	800m	12m	A1870	12m
Switchyard		01-Apr-10	01-Oct-10		6m		44m
A2130	Civil works for Switch yard	01-Apr-10	01-Oct-10		6m		44m
Power House		01-Apr-10	26-Jan-14		46m		4m
Acess Tunnels in PH complex		01-Apr-10	23-Sep-10		6m		5m
A1920	Excavation of Main Acess tunnel to PH s/bay level	01-Apr-10	23-Sep-10	460m	6m	A2220	5m
A1940	Excavation of Acess tunnell to Power House cavern	01-Apr-10	16-May-10	120m	1m		2m
Power House Cavern		16-May-10	08-Feb-12		21m		27m
A2060	Excavation of PH cavern upto S/bay level	16-May-10	17-Jan-11	60000 cum	8m	A1940	2m
A2070	Excavation of Power House below S/Bay level upto barrel portion incl Bus ducts etc	17-Jan-11	25-Jun-11	40000 cum'	5m	A2060, A1920	2m
A2080	Excavation of Power House upto foundation level	25-Jun-11	07-Aug-11	10000 cum	1m	A2070, A1990	2m
A2090	Laying of Earth Mat on S/bay & Conc in col & beam in S/bay area	25-Jun-11	25-Aug-11	500 cum	2m	A2070	27m
A2100	Erection/ Testing & commissioning of EOT crane in S/bay	25-Aug-11	11-Oct-11		2m	A2090	27m
A2110	Assembly of Stator in S/BAy	11-Oct-11	10-Dec-11		2m	A2100	27m
A2120	Assembly of Rotor in S/bay	10-Dec-11	08-Feb-12		2m	A2110	27m
Erection of Units (Pelto for Illustration)		07-Aug-11	26-Jan-14		30m		2m
A2560	First stage concreting in unit area	07-Aug-11	23-Sep-11	1000 cum	2m	A2080	2m
A2570	Wheel pit liner, assembling, welding	23-Sep-11	17-Dec-12		15m	A2560	2m
A2580	Concreting for Distributor (spiral case)	17-Dec-12	31-Jan-13	1500 cum	2m	A2570	2m
A2590	Spiral distributor, assembling, welding and pressure testing	31-Jan-13	17-Mar-13		2m	A2580	2m

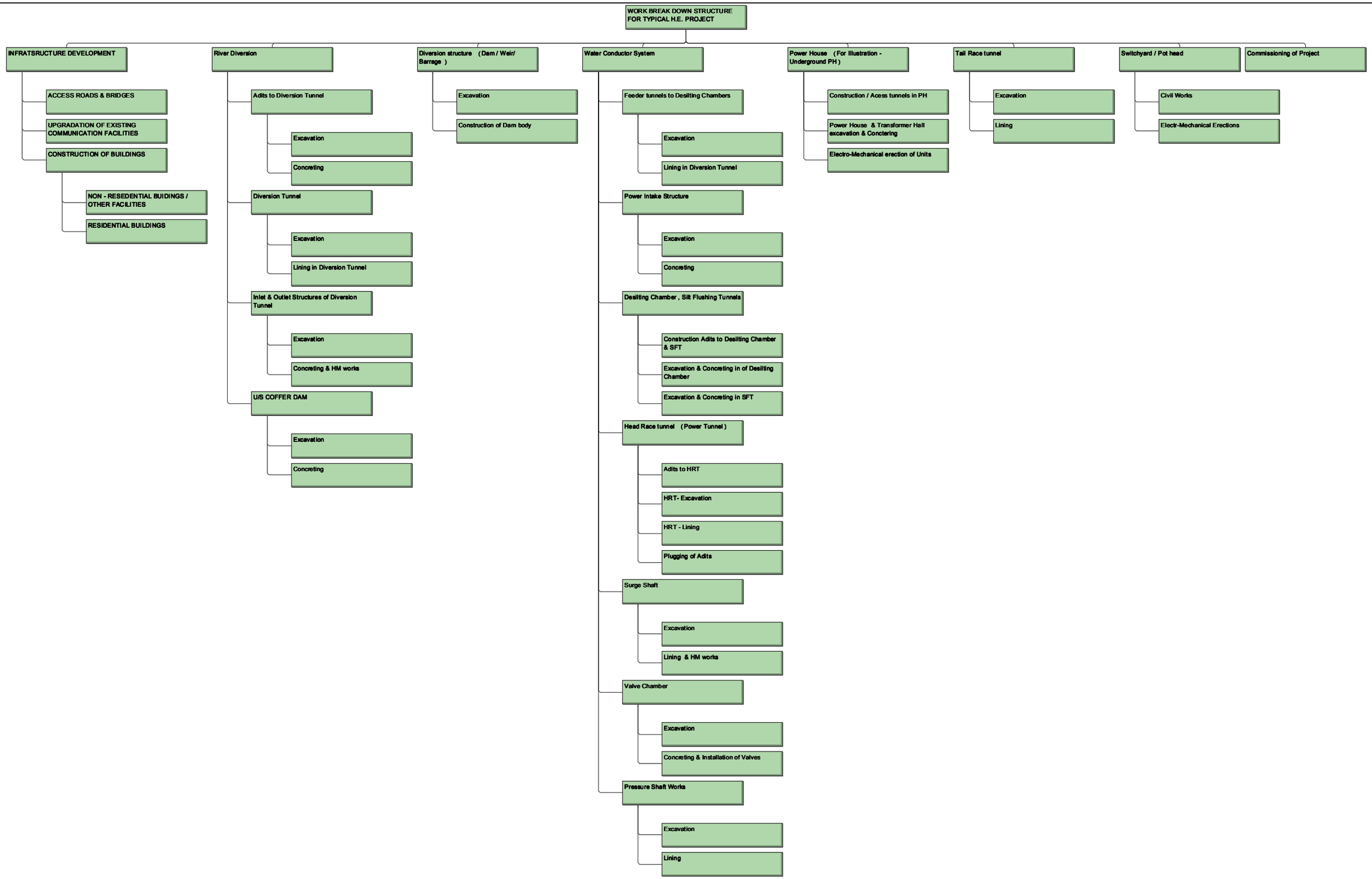


FORMAT FOR PREPARATION & SUBMISSION OF SCHEDULE

ANNEXURE - 1
(CLAUSE 4.1.2)

Activity ID	Activity Name	Start	Finish	Total Qty	Duration (Month)	Predecessors	Total float
A2600	Aeration Piping & 2 nd stage embed ments	17-Mar-13	01-Apr-13		1m	A2590	2m
A2610	Housing cover	01-Apr-13	16-Apr-13		1m	A2600	2m
A2620	Generator & Guide bearing support	16-Apr-13	31-May-13		2m	A2610	2m
A2630	Concreting Barrel / Pit liner	31-May-13	30-Jul-13	1500 cum	2m	A2620	2m
A2660	winding & lowering of Stator	30-Jul-13	28-Sep-13		2m	A2630	2m
A2670	Lowering of Rotor & assembly	28-Sep-13	12-Nov-13		2m	A2660	2m
A2680	Coupling with Generator	12-Nov-13	27-Nov-13		1m	A2670	2m
A2690	Run out test and alignment	27-Nov-13	27-Dec-13		1m	A2680	2m
A2700	Boxingup of Unit & precommissioning tests	27-Dec-13	26-Jan-14		1m	A2690	2m
Tail RAce tunnel		01-Apr-10	27-Sep-12		30m		20m
Excavation		01-Apr-10	08-Dec-11		20m		20m
A1970	Excavation of Adit to TRT	01-Apr-10	20-Sep-10	480m	6m	A1920	9m
A1980	Excavation of TRT (D/s of Adit)	20-Sep-10	08-Dec-11	1200m	14m	A1970	20m
A1990	Excavation of TRT (U/s of Adit to the Power house M/hall)	20-Sep-10	06-Nov-10	130m	2m	A1970	9m
Lining		31-Oct-11	27-Sep-12		11m		20m
A2030	Concreting in TRT	08-Dec-11	30-Aug-12	1330m	9m	A1980, A1990	20m
A2040	Contact/ Consolidation grouting in TRT	31-Oct-11	27-Sep-12	1330m	11m	A2030	20m
Commisioning		13-Mar-14	12-May-14		2m		0m
A2200	Charging of Water Conductor System	13-Mar-14	12-Apr-14		1m	A1910, A1770,	0m
A2210	Commissioning of Project	12-Apr-14	12-May-14		1m	A2200	0m




WORK BREAK DOWN STRUCTURE FOR TYPICAL H.E. PROJECT
INFRATSRUCTURE DEVELOPMENT
ACCESS ROADS & BRIDGES
UPGRADATION OF EXISTING COMMUNICATION FACILITIES
CONSTRUCTION OF BUILDINGS
NON - RESEDENTIAL BUIDINGS / OTHER FACILITIES
RESIDENTIAL BUILDINGS
River Diversion
Adits to Diversion Tunnel
Excavation
Concreting
Diversion Tunnel
Excavation
Lining in Diversion Tunnel
Inlet & Outlet Structures of Diversion Tunnel
Excavation
Concreting & HM works
U/S COFFER DAM
Excavation
Concreting
Diversion structure (Dam / Weir/ Barrage)
Excavation
Construction of Dam body
Water Conductor System
Feeder tunnels to Desilting Chambers
Excavation
Lining in Diversion Tunnel
Power Intake Structure
Excavation
Concreting
Desilting Chamber , Silt Flushing Tunnels
Construction Adits to Desilting Chamber & SFT
Excavation & Concreting in of Desilting Chamber
Excavation & Concreting in SFT
Head Race tunnel (Power Tunnel)
Adits to HRT
HRT- Excavation
HRT - Lining
Plugging of Adits
Surge Shaft
Excavation
Lining & HM works
Valve Chamber
Excavation
Concreting & Installation of Valves
Pressure Shaft Works
Excavation
Lining
Power House (For Illustration - Underground PH)
Construction / Acess tunnels in PH
Power House & Transformer Hall excavation & Conctering
Electro-Mechanical erection of Units
Tail Race tunnel
Excavation
Lining
Switchyard / Pot head
Civil Works
Electr-Mechanical Erections
Commissioning of Project