Checklist of Documents required for examination/ vetting of various aspects of DPRs of Pumped Storage Projects (PSPs)

Stage 1: Checklist for Layout Finalization Chapters:

S.No.	Chapter	
1.	Power Potential Studies (HPA)	
2.	Geological aspects (GSI) Stage-I	
3.	General Layout Aspects	Hydel Civil Design aspects (HCD)
		Dam/Barrage Design aspects (CMDD/Embankment/BCD)
		E&M Design (HE&TD)

Stage 2 : Checklist for Pre-DPR Chapters:

S.No.	Chapter
1.	Hydrology (Hydrology Dte.)#
2.	Geological aspects (GSI) Stage-II
3.	Foundation Engineering and Seismic Aspects (FE&SA)
4.	Construction materials Aspects (CSMRS)
5.	Inter-State Aspects (ISM-Dte.) #
6.	Transmission System (PSPA)
7.	Dam/Barrage Design aspects (CMDD/Embankment/BCD)
8.	Gates / HM Design (Gates design Dte.)
9.	Instrumentation Aspects (Inst. Dte.)
10.	Hydel Civil Design Aspects (HCD)
11.	E&M Design (HE&TD)

Note: Clearance of Water Availability Series is not required for Off- stream closed loop type PSPs. However, clearance of design flood from CWC shall be obtained by the developer for the purpose of design of spillways.

Clearance of Inters-state Aspects is not required for Off- stream closed loop type PSPs and PSPs located in the states which don't have any downstream state.

Stage 3 : Checklist for DPR Chapters:

S. No.	Chapter
1.	Construction Power Aspects
2.	Bill of Quantities of Civil & HM works
3.	Construction Program and Plant Planning aspects
4.	Construction Schedule
5.	Cost of Civil &HM works
6.	Cost Estimates of Electro-mechanical works
7.	Financial and Commercial Aspects
8.	Legal Aspects

Stage 1: Checklist for Layout Finalization Chapters:

1. Power Potential Studies Chapter:

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	MoU/ MoA with State Government	
2	Letter of Confirmation of Levels (FRL & TWL) from state government for reservoirs located on rivers/ streams/ perennial nallah	
3	Operating levels (FRL & TWL) of Upstream & downstream projects to reservoirs on rivers/ streams/ perennial nallah, if any	
4	Terms of reference issued by MoEF&CC for preparation of EIA/ EMP report, if any	
5	Letter of allotment of water from State Government for first time filling of the reservoirs and recoupment of losses	
6	Area-elevation-capacity curve of both reservoirs	
7	Operating levels of existing reservoirs, if any	
8	Operating Rule Curve of the existing reservoir in case the reservoir is multipurpose reservoir	
9	Tentative efficiency of the Turbine-Generator set and Pump- Motor set	
10	Tentative head losses in water conductor system of the project in both generating and pumping modes	
11	Tentative cost at completion level and tentative levelized tariff	
12	Tentative salient features of the project	
13	Google Map / Earth – KMZ files and Digital Elevation Model (DEM) showing layout/ overview of the project	
14	Excel sheets for optimization of reservoir capacities and Power Potential Studies of the project	

2. Geological Chapter Stage-I:

Sl. No.	Geological inputs	Remarks (Yes/ No/ Not Applicable)
A.	**Map/Plan/layout and geological sections**	
1	Topographical Map/ Base Map of SOI (Scale 1:50,000) of area for reference of location along with layout of studied alternatives for project.	
2	River Basin Map showing locations of existing and all identified hydro projects including PSPs immediately upstream and downstream of the present proposed project.	
3	Regional Geological Map of GSI (Scale 1:50,000) of area with layout of studied alternatives for project.	
4	Seismotectonic Map of area prepared by GSI.	
5	Lineament Map and Geomorphological Map (Scale 1:50,000).	
6	Landslide Susceptibility Map (Scale 1:50,000) of area prepared by GSI, specially for Hilly regions if available.	
7	Detailed Geological map (Scale 1:10,000) with layout of alternatives studied.	
8	Tentative geological sections along proposed Dam/Barrage/Embankment axis, Water conductor system, longer axis of powerhouse cavern or surface powerhouse pit, construction adits, assess tunnels etc. on the basis of surface geology. The scale of geological sections will depends on scale of detailed mapping carried out for proposed structures at this stage.	
9	Geological exploration plan.	
10	Geological plan with locations of quarries identified for construction material and cross sections of quarries for construction material.	
Note	The maps and geological sections should be legible, have bar scale also and be produced at true scale.	
B.	**Text Part of Geological aspect/chapter**	
1	The geological aspect/chapter of report (to be discussed in 1st consultation meeting at CEA) may contain: Introduction,	
2.	Location & accessibility to the Project area,	
3.	Regional geological set up,	
4.	Seismicity of the area,	
5.	Alternatives considered or studied with table of comparison between alternatives including all aspects of study,	
6.	Previous work carried out at site, if any,	
7.	Project site Geology (in reference to the traverses taken and detailed mapping),	
8.	Subsurface exploration (if any at this stage),	
9.	Geological and geotechnical appraisal of all proposed project components (based on maps and data available, sections prepared at this stage and subsurface explorations, if any), including geological vulnerable features likely to be encountered at the project site, stereoplots in terms behaviour of discontinuities assessed and orientation of proposed structures.	

10.	Proposals or plan worked out for sub-surface explorations by way of boreholes to be drilled, drifts to be made etc., and to assess engineering properties of rock mass by way of in-situ and laboratory tests etc.	
11.	Availability of construction material (may be discussed adequately at this stage)	
12.	Conclusions and Recommendations. Note: The salient features of the project may be attached as annexure in last of the chapter.	

3. General Layout Aspects:

I. Hydel Civil Design aspects (HCD):

S. No.	Description	Hard copy	Soft copy	Remarks (Yes/ No/ Not Applicable)
1	Topographical survey of project area covering all components in each alternative in scale not exceeding 1:5000	A2 size	PDF	
2	Alternative Layout Studies should necessarily include : i. Brief discussion on various alternative layouts (including water conductor system / powerhouse complex) ii. Preliminary designs/analyses/discussions related to dimensioning/location of structural components (such as diversion structure, intake, desilting chambers, tunnels, pressure shafts / penstocks, surge arrangement and transient analysis, powerhouse complex, reservoir filling mechanism etc) in each of the alternative which is impactful in deciding a layout. iii. Techno-economic comparison of all the alternatives clearly indicating major differences in salient features, their pros and cons along with tentative cost and tariff shall be provided and included in the report. iv. Layout/s proposed for Phase-I investigations clearly mentioned in report with justification	A4 size	PDF and/or Excel	
3	Drawings related to Alternative Layout Studies: i. Surface geological mapping for all alternatives as per the scale indicated by GSI (geological L-section) ii. Layout with all alternatives marked on the contour plan (contour interval not exceeding 5 m) and L-section of all alternatives	A2 size	PDF	Information available at Sl no. 2.A.3, 2.A.7 & 2.A.8
4	Salient Features of the layouts proposed for Phase I investigations	A4 size	PDF	
5	Detailed Investigation plan for layouts proposed for Phase I investigations	A2 size	PDF	Information available at Sl no. 2.A.9
6	For Layouts proposed for Phase I investigations, discussion based on geological surface mapping with specific emphasize to location of various components	A4 size	PDF	Information available at Sl no. 2.A.8
7	For layouts proposed for Phase-I investigations, preliminary design calculations, analyses and discussions should necessarily include the following: i. Head loss calculations for both generation & pumping mode	A4 size	PDF & excel	

	ii. Hydraulic design (including submergence) of both intakes (upper and lower) and their trash rack iii. Economical diameter calculations for HRT, TRT & pressure shaft considering both mode of operations iv. Hydraulic transient studies for all modes of operations for complete water conductor system which clearly brings out the requirement and dimensioning of proposed surge arrangements (surge shaft, orifice, surge caverns etc.). In case of multiple surge tanks, surge studies should include the stability of the system v. Hydraulic design of approach channel & tail race channel for all modes of operation vi. Steel liner designs vii. Powerhouse dimensioning and orientation viii. Rock (vertical and lateral / minimum) cover requirements for HRT, TRT, pressure tunnels, surge shafts/caverns, UG powerhouse complex viii. Designs/discussions related to silt management/desilting mechanism (if required) ix. Discussions/designs related to first filling of reservoir, if applicable	A4 size	PDF and software file	
	viii. Layout specific 2D analyses for powerhouse caverns and tunnels for weak rockmass/shallow cover	A4 size	PDF and software file	
	x. Layout specific preliminary Wedge analysis for tunnels & caverns as per expected joint properties of rockmass	A4 size	PDF and software file	
	xi. Layout specific stability analyses for extensive slopes (intakes, surface powerhouse, outfalls) as per the expected rockmass	A4 size	PDF and software file	
8	For layouts proposed for Phase-I investigations, drawings (indicating NSL/rockline/chainages/ dimensions etc) should necessarily include the following: i. General project layout including adits ii. Plan and L-section of Intake and Trash Rack Structure (upper and lower) iii. L-section of water conductor system iv. Plan and L section of surge shaft/cavern v. Representative drawings of rock support systems in surge shaft/cavern, HRT, TRT vi. L-sections, plans at various levels and cross sections of Powerhouse/Transformer Caverns vii. Slope stabilization at backslopes of intake and surface powerhouse viii. Plan and L-section of TRT ix. Plan and L-section of Desilting Structures (if applicable) x. Plan and L-section of Approach Channel and Tail Race Channel xi. Layouts showing arrangements for first filling of reservoir as applicable	A2	PDF	

If developer preferred layout/s undergoes any change, developer shall revise and re-submit the calculations, drawings, salient features unless otherwise waived off by the appraising agency due to change being inconsequential.

All relevant provisions of IS codes/Guidelines/established practices may be followed at the time of preparation of PFR.

Above list may not be treated as exhaustive and appraisal agency may request the developer for additional details, if required.

II. Dam/Barrage Design aspects (CMDD/Embankment/ BCD):

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1.	Alternate studies on locations of upper and lower reservoirs	Information available at Sl no. 3.I.2
2.	Alternate studies on type of dams for both upper and lower reservoir	
3.	Fixation of various levels – FRL, MDDL, MWL and Top of the Dam along with Freeboard calculations.	
4.	Alternate plans/ Planning of Spilling arrangement , reservoir drawdown (Empty) etc.	
5.	Planning of Diversion Arrangement	
6.	Hydrological studies duly approved from HSO, CWC	
7.	Approval of GSI for layout clearance	
8.	Geological Mapping and Geological Plans & Cross sections of Dams based on Geological mapping.	
9.	Proposed Investigations Plan including Reservoir Rim Studies and water tightness.	
10.	i. Water allocation approval ii. Initial filling plan iii. Distance between existing reservoir to proposed reservoir on the same nala/ stream reach, river as per applicable Guidelines	

III. E&M Design (HE&TD):

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1.	General Layout Plan	
2.	Layout of all floors of Power House	
3.	Type of PSP (On-stream/Off stream)	
4.	Type of Machine (Fixed/Variable)	
5.	Head losses in water conductor system of the project both in Generation and Pumping Mode	Information available at Sl no. 3.I.7
6.	Operating water levels of Upstream & downstream reservoirs including Highest Flood Level (HFL) in case of Off stream (Open loop) / On-stream	
7.	Power House Dimensioning calculations as per relevant IS	
8.	Single Line Diagram.	
9.	Efficiency of the Turbine, Generator & Pump and Motor along with Cycle efficiency calculation	
10.	Write-up on all E&M Equipment and their ratings (including Electrical and Mechanical auxiliaries)	

Stage 2 : Checklist for Pre-DPR Chapters:

S.No.	Chapter
1.	Hydrology (Hydrology Dte.)
2.	Geological aspects (GSI) Stage-II
3.	Foundation Engineering and Seismic Aspects (FE&SA)
4.	Construction materials Aspects (CSMRS)
5.	Inter-State Aspects (ISM-Dte.)
6.	Transmission System (PSPA)
7.	Dam/Barrage Design aspects (CMDD/Embankment/BCD)
8.	Gates / HM Design (Gates design Dte.)
9.	Instrumentation Aspects (Inst. Dte.)
10.	Hydel Civil Design Aspects (HCD)
11.	E&M Design (HE&TD)

1. **Hydrology aspects:**

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Location coordinates of the storage structures	
2	Google Earth KMZ files or shapefiles showing layout/ overview of the project, catchment area and water spread area.	
3	Rainfall data of nearest rainfall station (preferably more than one, if available).	
4	Salient features such as gross capacity, live storage capacity, height of the dam, FRL, MDDL, river bed level, elevation area capacity curve, silt rate, etc.	
5	Detailed calculation (with source of data mentioned) for water availability used in the analysis.	
6	Detailed calculation (with source of data mentioned) for design flood study used in the analysis.	
7	Detailed calculation (with source of data mentioned) for evaporation study used in the analysis.	
8	Detailed calculation (with source of data mentioned) for diversion flood (if any) used in the analysis.	
9	Detailed calculation (with source of data mentioned) for sedimentation study used in the analysis.	
10	New zero elevation	

All the calculations may be submitted in hard copy and soft copy.

2. Geological Chapter Stage-II:

Sl. No.	Geological inputs	Remarks (Yes/ No/ Not Applicable)
A.	**Map/Plan/layout and geological sections**	
1	Topographical Map/ Base Map of SOI (Scale 1:50,000) of area for reference of location along with layout of studied alternatives for project.	
2	River Basin Map showing locations of existing and all identified PSPs and HEPs immediately upstream and downstream of the present proposed project.	
3	Regional Geological Map of GSI (Scale 1:50,000) of area with layout of finally selected alternative for project.	
4	Seismotectonic Map of area prepared by GSI.	
5	Lineament Map and Geomorphological Map (Scale 1:50,000).	
6	Landslide Susceptibility Map (Scale 1:50,000) of area prepared by GSI, specially for Hilly regions if available.	
7	Detailed Geological map (Scale 1:10,000) with layout of all alternatives.	
8	Detailed Geological map (Scale 1:2000/1:1000) of major project components of final selected layout i.e, Reservoirs, WCS, PH, Surge shaft/TRT/TRC and axillary tunnels etc.	
9	Geological sections along proposed Dam/Barrage/Embankment axis, Water conductor system, longer axis of powerhouse cavern or surface powerhouse pit, construction adits, assess tunnels etc. on the basis of surface and subsurface sub-surface investigations. The scale of geological sections will depend on scale of detailed mapping carried out for proposed structures.	
10	Geological exploration plan.	
11	Geological maps and sections of quarries identified for construction material.	
Note	The maps and geological sections should be legible, have bar scale also and be produced on true scale.	
B.	**Text Part of Geological aspect/chapter**	
	The geological aspect/chapter of report may contain:	
1	Introduction,	
2	Location & accessibility to the Project area,	
3	Regional geological set up,	
4	Seismicity of the area,	
5	Alternatives considered or studied with table of comparison between alternatives including all aspects of study,	
6	Previous work carried out at site, if any,	
7	Project site Geology (in reference to the traverses taken and detailed mapping),	
8	Subsurface exploration: It should incorporate geological logs of bore holes along with permeability data, logs of trenches and pits, 3-D geological logs of drifts, if any, geophysical survey etc	
9	Reservoir competency studies in case of natural slopes surrounding the reservoir along with maps and sections.	

10	Geological and geotechnical appraisal of all proposed project components (based on surface and sub-surface investigations carried out), including geological vulnerable features likely to be encountered at the project site, analysis of Geological Structural Data, stereoplots in terms behaviour of discontinuities assessed and orientation of proposed structures.	
11	Engineering properties of rock mass by way of in-situ and laboratory tests etc.	
12	Availability of construction material (to be discussed adequately),	
13	Conclusions and Recommendations. NOTE: 1. Any other study report carried out by the developer during the appraisal of S & I stage etc. 2. The salient features of the project may be attached as annexure in last of the chapter.	

3. Foundation Engineering and Seismic Aspects:

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Plan showing different alternatives of the project and rationale behind selecting a particular alternative.	Information available at Sl. no. 2.B.5
2	Salient features of the proposed project including the existing projects, if any.	Information available at Sl. no. 2.B.12
3	General geology of the project area along with geological maps as per the BIS codes.	Information available at Sl. no. 2.A.3
4	Proposed geological investigation plan during pre-DPR stage and complete investigation report in the DPR.	Information available at Sl. no. 2.A.10, 2.A.9 & 2.B.8
5	After finalization of the axis and layout of the project, the project authority may submit the site-specific seismic design parameters report as per the NCSDP guidelines to FE&SA directorate for its appraisal (in-house as well as from members of NCSDP) and further approval from NCSDP.	
6	Report on assessment of GLOF at the project location, if any. (For Himalayan region)	

4. Construction materials Aspects:

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Investigations for Concrete	
i	Coarse Aggregate	
ii	Fine Aggregate	
iii	Water (mixing and curing)	
2	Rock investigations	
i	Laboratory Tests	
ii	In-Situ Tests (in Drift or trench at foundation level)	
iii	Tests for underground structures	
3	Soil Investigations	
i	Foundation Investigations	
ii	Borrow Area Investigations	
iii	Filter Material Investigations	
4	Rockfill Investigations	

5. Inter-State Aspects:

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1.	Exact location like (latitude & longitude), Taluka, Districts, State of the reservoirs.	
2.	Name of the river and river basin (inter-State or intra-State) where proposed PSP/HEP is located.	
3.	State / countries traversed by the river.	
3A.	Legible copy of Index Map of the proposed PSP/HEP showing reservoirs, Power house location, name of the river and inter-State River basin and inter-State boundary (if it is nearby).	
4.	Distribution of catchment in States / countries and yields from the catchment of the State / country concerned.	
5.	Are there any International/ Inter-State issues involved'? If so, have these issues been identified and present status of agreement or tribunal decision indicated specially in respect of (a) Sharing of water (b) Sharing of cost (c) Sharing of benefits (irrigation, flood control, power etc.) (d) Acceptance of the submergence by the upstream state(s) (e) Acceptance by the upstream state(s) of compensation of land coming under submergence (f) Settlement of oustees (g) Any other NOTE:- If there is no agreement state the present position against each of the above item.	
6.	Effect of the following on project & of the project on the following: (a) Interstate/International agreement on sharing of waters, sharing the benefits and costs, acceptance of submergence in the upstream state(s)/ country(s) etc., if any. (b) Inter-State / International adjudication, if any. (c) Inter-State / International aspect of territory, property, etc. coming under submergence, project affected people, rehabilitation, compensation, etc. Prior concurrence of other country(ies) /other State(s) where territory/property is affected by the project should be obtained and appended in the DPR. (d) Existing and sanctioned projects (to the extent the information on existing & sanctioned projects can be obtained with reasonable efforts). (e) Any other aspect of the project involving Interstate/International problems.	
7.	Existing riparian use, quantum of water presently utilised, commitments for ongoing projects, plans for future development, balance share of the	

	State/country and proposed utilisation by this project. (Discuss relevant items both for upstream and downstream usages).	
8.	Whether operation and regulation of the project conform to the stipulation made in the Tribunal award/agreement and also the mechanism for such operation.	
9.	In case of addition/alterations for existing project involving submergence in other States and additional utilisation of water, concurrence of the concerned States is to be included.	
10.	Calculation details of consumptive utilization (annual evaporation loss and Seepage loss (with views of Geological Survey of India) from the reservoir) need to be included in the Chapter.	
11.	Source of water to meet the consumptive requirement (evaporation loss and seepage loss (if any)) of the project and for initial filling of reservoirs is to be clearly mentioned. If the source is an existing reservoir, then its complete details along with salient features, original planned utilization and approval status by TAC of DoWR, RD&GR of MoJS, GoI etc. need to be included.	
12.	Government Order (G.O.) of concerned State Government is required mentioning their permission to utilize the finalized quantity of water required towards annual consumptive use and initial filling of reservoirs from the specified source. The letter should clearly give break up of utilisation by the State (existing, ongoing and future) against the State's share allocated by any Tribunal / Agreement in that particular river basin. If project proponent proposes to make use of an existing reservoir of the concerned State, explicit permission of the State to project proponent for doing so should be included in the report. Further concerned State should also certify that existing / committed uses from the existing reservoir will not be affected if the reservoir is used for PSP purposes by the project proponent.	

Note: In certain cases, project developers are not sure whether a particular River is an inter-State River or not. For the purpose of above statement, any river basin is said to be an inter-State River basin, if its drainage area is located in more than one State and river finally outfalls in an ocean or a big water body. Any river basin which has drainage area in more than one State but outfalls into another river is considered as inter-State sub-basin of that inter-State River basin. In this regard, it may be noted that any project located in an Inter- State River basin, is deemed to have inter-State ramification and is required to be examined from inter-State angle. Any project which is located on a river or in its catchment / drainage area, which flows entirely in one State but is part of an Inter- State River basin / sub-basin shall also involve inter-State ramification and be required to be examined from Inter-State angle.

6. Transmission System:

Checklist		Remarks (Yes/ No/ Not Applicable)
Detail of Step-up transformer	Transformer rating	Information available at Stage-I, Sl. No. 3.III.10
	Transformer configuration and number of transformers	
	Adequacy of transformers in generating mode and Pumping mode	
	Spare transformer in case of single phase units	
Detail of Switchyard	Bus scheme	
	No. of bays and details	
	Bus coupler	
	Bus sectionalizer, if required	
	Rating of bus reactor (if required) /provision of space for future reactor bay	
	SLD of switchyard	
Details of Dedicated line	Voltage level of transmission line	
	Type of conductor and line configuration	
	Length of line	
	N-1 compliancy	
Connectivity with the Grid	Point of inter-connection	
	Status of connectivity (whether applied or not)	
	Correspondence with CTU/STU for connectivity (attach details)	
Other Information	Synchronous condenser mode operation	
	Peak power requirement in pumping mode and plan to meet the same	
	Phase-wise commissioning schedule	
	Other Details (if any)	

In addition to the above, following information should be included in the Final DPR Chapter related to transmission:

a. Coordinates of Switch yard
b. Type of switchyard (Indoor/outdoor/GIS/AIS)
c. Rating of Switchyard equipment
d. Details of Interconnection between Switchyard and pothead yard viz. GIL/Cable, size, current rating, length
e. Whether Transmission system under of scope of developer or STU/CTU, If system under the scope of developer - Details of the cost estimates along with Phasing
f. Phase wise Commissioning schedule

7. Dam/Barrage Design aspects:

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1.	General Layout Planning, including layout of Dam and reservoir	
2.	Finalization of Parameters FRL, MDDL, MWL and Top of the Dam	
3.	Flood routing and Free board calculation	
4.	Hydraulic design of spillway and energy dissipation arrangement,	
5.	Details of diversion arrangement and their design	
6.	Freezing of choice of Dam type	
7.	Views of GSI on dam type selection	
8.	Geo-technical investigation Results, Logs, Maps etc.	
9.	Stability Analysis for Earthen Dam, Concrete Dam (OF & NOF), Barrage etc.	
10.	Slope Stability wherever applicable such as hill slope (between upper and lower reservoir) etc.	
11.	Construction material survey and approval of CSMRS	
12.	i. Approval of FE&SA Directorate if applicable. ii. otherwise, seismic studies.	
13.	All relevant drawings such as plans, cross sections along with Geological details etc.	
14.	Emergency Action Plan (including Dam Break Analysis) for both upper and lower dam	

8. Gates / HM Design:

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
A	General description containing the following;	
1	Purpose/ Location of the gate	
2	Size and type of gate (such as radial gate, stoplog gate, vertical lift gate etc).	
3	Location of Skin plate for vertical gates (Upstream/ Downstream).	
4	Type of sealing arrangement (such as cladded or plain rubber).	
5	Operating Conditions for the gate (Balanced/ unbalanced).	
6	Type and capacity of hoisting arrangement (such as rope drum hoist, gantry crane, hydraulic hoist, EOT crane etc.).	
7	Provision for inspection & maintenance of hydro-mechanical equipment and its embedded parts.	
8	Provision of Air vent, if required	
9	Anchorage arrangement of the radial gate.	
10	preliminary sizing of gate components	
B	Bill of Quantity	
C	Relevant general arrangement drawings including the following but not limited to;	
1	Tentative pivot point of hoisting arrangement of hydraulic hoist for radial gate.	
2	Tentative Groove size for the gate	

9. Instrumentation Aspects:

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1.	Spillway gates and energy dissipation arrangements	
2.	Drawings of outlets – regulators, river sluices, intake structures, surge shafts, power house etc.	
3.	Details of Instrumentation provided in Dam (Type of instrumentation specification, numbers, etc.)	
4.	Details of Instrumentation provided for Powerhouse Complex, Cut Slopes and Underground Structures, etc	
5.	Provision for component wise cost of Instrumentation with justification	
6.	Instrumentation Drawings of all components of Project	

10. Hydel Civil Design Aspects:

S. No.	Description	Hard copy	Soft copy	remarks
A	Investigation/Test results/Borehole logs for various components	A4 / A2 size	PDF	
B	The updated design/analyses of all the components with tested Rock mass properties as follows: i. Detailed surge and transient studies for all modes of operations for complete water conductor system as per opening and closing time (to be later confirmed by the respective CEA of the developer) justifying the selected layout as per pressure rise in transient conditions ii. Rock support system for underground components (HRT, TRT, pressure shaft, surge shaft/caverns/pump house/adits/desilting mechanism) iii. Lining design of underground components (HRT, TRT, pressure shaft, surge shaft/caverns/pump house/adits) iv. Hydraulic Design of both intakes (upper and lower) and trash rack v. Hydraulic designs related to desilting mechanisms (if applicable) vi. Designs related to approach and tail race channels (hydraulics, lining design etc) vi. Analyses for finalization of orientation of powerhouse based on joint sets & in-situ stress results vii. Detailed Steel liner /penstock design viii. Power House structural design along with software files ix. 2D stress analysis for powerhouse, transformer, surge shaft/caverns x. 2D stress analysis for Tunnels in weak rock mass/Shallow cover xi. Wedge analysis for underground powerhouse caverns ix. Slope stability analysis of Intake, surface Powerhouse and outfall etc. as per the tested rock mass properties / strata x. Hydraulic designs/analyses related to approach and tail race channel x. Numerical study / CFD for flow at intakes	A4 size	PDF, excel & software files	
C	Updated civil and applicable geological drawings (indicating NSL/rockline/chainages/ detailed dimensions etc.) of all components should necessarily include the following: i. Layouts including adits - separate drawings for general project, upper and lower reservoirs ii. L-section of water conductor system	A2	PDF	

	ii. Plan and L-section of Intake (upper and lower) iii. Plan and L-section of Trash Rack Structure/Panel (upper and lower) iv. Plan and L section of surge shaft/cavern v. Drawings of rock support systems and lining details in underground components (HRT, TRT, pressure tunnels, surge shaft/cavern, powerhouse, transformer cavern, pump house) vi. Steel liner of penstocks/pressure shafts vi. L-sections, plans at various levels and cross sections of Powerhouse/Transformer Caverns vii. Slope stabilization at back-slopes of intake, surface powerhouse, outfall viii. Plan and L-section of HRT, Pressure tunnels, TRT ix. Plan and L-section of Desilting Structures x. Plan and L-section Approach Channel and Tail Race Channel xi. Layouts showing arrangements for first filling of reservoir as applicable			

11. E&M Design:

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1.	General Layout Plan	
2.	Layout of all floors of Power House inclusive of X- section and L-Section, Layout and sectional drawing of switchyard/pothead yard	
3.	Power Potential Study/ Installed Capacity duly vetted by concerned Division of CEA.	
4.	Type of PSP (On-stream/Off stream)	
5.	Type of Machine (Fixed/Variable) with detailed justification	
6.	Max. & Min. Head losses in water conductor system of the project both in Generation and Pumping Mode duly vetted by CWC	
7.	Operating water levels of Upstream & downstream reservoirs	
8.	Highest Flood Level (HFL) in case of Off stream (Open loop) / On-stream	
9.	Power House Dimensioning calculation as per relevant IS	
10.	Single Line Diagram of project and SLD of HT & LT System.	
11.	Reactive Power requirement with details of shunt reactor	
12.	Number of outgoing feeders/bays with power evacuation voltage level.	
13.	Efficiency of the Turbine, Generator & Pump and Motor along with cycle efficiency calculation	
14.	Power Factor of the Generator and Motor	
15.	Limits of Pressure rise and speed rise as per relevant IS	
16.	Provision of Synchronous Condenser Mode (if applicable)	
17.	Write-up on Operation Flexibility and Hydraulic Short Circuit	
18.	Write-up on all E&M Equipment and their ratings (including Electrical and Mechanical auxiliaries)	
19.	Salient feature related to E&M design	
20.	Transport Limitation to transport the Heaviest Equipment to the Project site	
21.	Escape Route/tunnel and Flood/Fire safety provisions, wherever applicable.	
22.	List of applicable IEC/IS/ IEEE/ANSI etc.	

An approved copy of E&M chapter is required for vetting of BoQ of E&M works of the Project

Stage 3 : Checklist for DPR Chapters

S. No.	Chapters
1.	Construction Power Aspects
2.	Bill of Quantities of Civil & HM works
3.	Construction Program and Plant Planning aspects
4.	Construction Schedule
5.	Cost of Civil &HM works
6.	Cost Estimates of Electro-mechanical works
7.	Financial and Commercial Aspects
8.	Legal Aspects

1. Construction Power Aspects in DPR of Pump Storage Projects (PSP) – HPA Division, CEA

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Location of nearest source point for construction power and its distance from the project	
2	Excel sheet showing calculation of maximum construction power demand (in MW) at the project site considering the deployment of machinery/ equipment to be used at project site	
3	Single Line Diagram of Construction power arrangement showing transmission of power from source point to various work sites of the project	
4	Estimates for capital cost of construction power arrangement along with supporting documents for cost of each item	
5	Ratio of electricity to be consumed from Grid to electricity to consumed from Diesel Generating (DG) sets depending upon reliability of power supply from grid	
6	Electricity Tariff from Grid along with supporting documents (Tariff order of State Electricity Regulatory Commission (SERC) or electricity bill of any nearby construction projects)	
7	Budgetary offers/ Quotation for Cost of Diesel and POL from project nearby areas	
8	Budgetary offer for cost of Diesel Generating (DG) Sets	
9	Excel sheets showing calculation of Electricity Tariff from DG sets	
10	Excel sheets showing calculation of tentative energy charges for non-works such as street lighting, office load etc.	

2. Bill of Quantities of Civil & HM works in DPR of Pump Storage Projects (PSP) – CD Division, CEA

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Certificate of correctness of quantities (in case of CPSUs/ SPSUs).	
2	Abstract of quantities of Civil and HM works.	
3	Detailed calculations of quantities of Civil & HM works in Excel sheet.	
4	Drawings on the basis of which quantities of Civil and HM works have been calculated (both in Pdf & AutoCAD).	
5	Letter of Clearances of Design/Drawings from respective Design Directorates.	

3. Construction Program and Plant Planning aspects in DPR of Pump Storage Projects (PSP) – CB&P&M Directorate, CWC

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Complete Project Layout	
2	Chapter on Construction Program and Plant Planning along with relevant calculations of various activities along with excel sheet of calculations.	
3	Drawings of all related civil works.	
4	Activity-Wise Construction Schedule highlighting the Critical activities.	
5	Finalized list of Equipment to be used in various civil works/ activities mentioned in the chapter of Construction Program and Plant Planning.	
6	List of Q-Special T&P required, if any.	

All the checklist items mentioned in 1 to 6 are required in hard copy as well as soft copy. Further, the chapter of Construction Program and Plant Planning will be finalized/ approved only after receiving the finalized Bill of Quantity (BOQ) of civil works after certification from Thermal Civil Design (TCD) Directorate of CEA.

4. Construction Schedule in DPR of Pump Storage Projects (PSP) – CD Division, CEA

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Approved chapter on Plant/Equipment Planning by CB& P&M Directorate, CWC	
2	Pre-Construction period, if any, to be incorporated in the main schedule	
3	Zero date of the Project is to be mentioned in the Construction Schedule	
4	Start and Finish date of the Project is to be incorporated in the Schedule	
5	Duration of activities	
6	Quantities of each activity is to be incorporated in the schedule	
7	Monsoon period of the project is to be shaded in separate color	
8	Critical path is to be shown clearly in the Construction Schedule incorporating Legends and Arrows	
9	Excel sheet of Construction Schedule	

5. Cost of Civil &HM works in DPR Pump Storage Projects (PSP) – CA(HWF) Directorate, CWC

General

1. Cost estimation chapter incorporating General Abstracts of cost & detailed subhead wise estimates as per extant guidelines (Guidelines For Preparation Of Project Estimates For River Valley Projects 1997, CWC) and in accordance with equipment planning.
2. Sub-head wise details of the expenditure incurred till date, if any.
3. A map showing the distance of the quarry site, muck dumping location, nearest railway head/ port etc. from the project site.
4. A map indicating all the major components of the project.
5. A note on sub-head wise variation of the cost with its reason, in case of Revised Cost Estimate.

I – WORKS

Estimated cost of various items under different sub-heads along with its supporting documents.

A-Preliminary

1. Expenditure incurred on previous investigations.
2. Detailed surveys for the final location
3. Arial Survey/Contour survey for reservoir basin (including the establishment of permanent benchmarks)
4. Geological surveys and geophysical surveys;
5. Hydrological and Meteorological surveys including the establishment of rain gauges/and river gauges and discharge, sedimentation stations and their running charges
6. Investigations for foundation and rock testing
7. Investigation for availability of construction materials
8. Construction of access roads to facilitate investigations
9. Model experiments
10. Computer & telecommunication facilities
11. Preparation and printing of project reports
12. Vehicles for inspecting officers for site investigations
13. Camp equipment
14. Preliminary soil tests, establishing soil testing laboratory
15. Consultants fees (including charges for preliminary design work or advice)
16. Training of engineers during investigation and preparation of project reports
17. Environmental and Ecological studies

18. Seismological equipment and measurements

B-Land

1. Acquisition for various types of land (Private, Government and Forest)
2. Compensation of land (Private and Government for works and that coming under submergence)
3. Compensation for other properties like houses, wells, trees etc.
4. Rent for use of land
5. Cost towards implementation of Rehabilitation & Resettlement plan.
6. If the submergence extends to other state(s), then details of provision under B-land be made in consultation with the concerned state(s).

C- Civil works and J- Power Plant civil works

1. Approval of design aspects including gates and equipment planning chapter from CWC. Approval of CEA in respect of quantity estimation for various item of works.
2. Basic material (cement, structural steel, reinforcement, admixture, drilling rod, blasting material, fuel and lubricants etc.) rates at nearest rail head, labour rates (skilled, semiskilled and unskilled) of the state wherein the project is located.
3. Construction power rates with the approval of CEA.
4. Detailed analysis of rates of machines and item of works as per CWC guidelines (1981)
5. Copy of the Schedule of Rates (SORs) applicable for the project, if required.
6. Awarded rates for the item of works in case of RCE.
7. Details of De-watering arrangements proposed.

K- Building

1. Proposed organizational structure (during and after construction)
2. Details of requirements of permanent and temporary buildings planned in this project.
3. Plinth area rates of the buildings.
4. Details of the estimated cost of the following:
    a) Land Development
    b) Colony Roads
    c) Fencing boundary walls, security/observation booths
    d) Service connections such as water supply, sanitation drainage and electrification.
    e) Lawns, gardens and plantation (other than plantation under the head M-Plantation and X-Environment & Ecology)
    f) Retaining walls, terracing etc.

M-Plantation

1. Details of plantation programme including gardens etc. required for beautification as considered necessary downstream of the dam, around powerhouse and other important structures and its estimated cost.
2. Estimate of maintenance/ protection of plantation for 2/3 years.

O- Miscellaneous

1. Capital Cost of Electrification, Water supply, purification and distribution, Sewage disposal and storm water drainage works, Firefighting equipment, Telephone, Telegraph, Post Office and Wireless, Medical equipment for hospital/dispensary(s) etc. and any other item such as fountains, recreation facilities, and special lighting arrangements for beautification of areas in the project.

2. Maintenance and service of Electrification, Water supply, purification and distribution, Sewage disposal and storm water drainage works, Recreation, Medical assistance, Post office, telephone and telegraph office, Security arrangements, Firefighting equipment, Inspection vehicles, Transport for labour and staff, School bus, School, Pay van and Ambulance

3. Other items such as Visits of dignitaries, Technical record, photographic record, completion report and history of the project, Inaugural ceremonies, Compensation to workmen. (for work-charge staff only), Boundary pillars and stones, distance marks and benchmarks, Power supply, Model and exhibits, Testing laboratory and exhibits, Publicity, information centres, Subsidy for school bus, Publications, Pamphlets, Running of transit camps/ rest sheds/ guest house/ rest house/ inspection bungalow, Training of Engineers, Canteen facilities, Co-operative Stores, Library facilities, Timekeeping cabin, Wireless communication system, Inflow forecasting and flood warning system, Retrenchment compensation (for work-charged staff only), Police Station, Community Centre, Photographic and Cinematographic equipment, establishment and R/M charges, Crèches, Maintenance of office equipment such as computer & reprographic facilities, fax, telex etc.

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Q-Special T&P

Cost of special T&P to be purchased in the project as per the approval of equipment planning by CWC.

R- Communication

1. Cost of Construction of the main approach road to the dam site, quarry roads, temporary roads in the work areas, temporary or permanent river crossings, Railway including sidings, bridges, connecting roads, waterways, air strips, helipads etc. as per estimates/ rates certified by local state PWD.

T- Water supply works

Cost of delivering water up to a point beyond which the supply system will be taken over by Public health department (if planned under this project)

X- Environment and Ecology

Provision of the following works as per the EIA report

1. Compensatory afforestation
2. Catchment area treatment
3. Establishment of fuel depots etc.
4. Measures to salvage/rehabilitate any rare or endangered species of flora and fauna found in the affected area and relocation of archaeological monuments.
5. Public health measures to control the spread of water and soil borne diseases
6. Restoration of land in construction areas by filling, grading etc. to prevent further erosion.

II – Establishment: As per the CEA guidelines

6. Cost Estimates of Electro-mechanical works in DPR of Pump Storage Projects (PSP) – HPA Division, CEA

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Bill of Quantities (BoQ) of Electro-Mechanical works approved by HE&TD division, CEA.	
2	Excel sheet for cost estimates of Electro-Mechanical Works as per the format mentioned in the guidelines for formulation of DPRs of HE Projects and PSPs.	
3	Budgetary offers/ supporting documents for cost of each item considered in the cost estimates of electro-mechanical works.	

7. Financial and Commercial Aspects in DPR of Pump Storage Projects (PSP) – F&CA Division, CEA

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Hard Cost of the project at completion along with start date and completion time.	
2	Phasing of hard cost every 6 months.	
3	Phasing of hard cost in equity and loan every 6 months.	
4	Government Grant against roads/bridges.	
5	IDC component in equity and loan every 6 months.	
6	Financing Charges and Equity Loan Ratio.	
7	Interest rate on loan along with source.	
8	Auxiliary consumption and transformation loss.	
9	Operation & Maintenance Charges along with rate of increase of O&M charges.	
10	Loan repayment period.	
11	Maintenance spares (% of O&M cost)	
12	Depreciation rate	
13	Rate of return on equity	
14	Rate of interest on working capital.	
15	Cost of land & cost of R&R	
16	Discount rate	
17	Economic life of the project	
18	Tax rate	
19	Storage hours	
20	Cycles/day	
21	Round trip efficiency (Cost of conversion losses)	
22	Transmission losses if applicable	
23	Energy cost for pumping	
24	Energy Equivalent Natural Flows (Not required for offstream closed loop PSPs)	
25	Plant availability	
26	Installed capacity	

8. Legal Aspects in DPR of Pump Storage Projects (PSP) – Legal Division, CEA

Sl. No.	Description	Remarks (Yes/ No/ Not Applicable)
1	Letter from the Registrar of Companies indicating that the company has been registered as a Generating Company under the Companies Act, 2013.	
2	Article of Association indicating that generation is one of the objectives of the Company.	
3	Letter from Competent Government authorizing the company to establish, own and operate generating power plant.	
4	Land availability certificate	
5	Water availability certificate	