**Invitation for Expression of Interest (IEOI) – Consultancy Firm**

**Invitation for Expression of Interest**

*Date 5 / April / 2023*

**Hiring a Consultancy Firm to** **Prepare the Feasibility Study of Small and Medium HPP**

**in the Kyrgyz Republic**

1. The Islamic Development Bank (IsDB) is hiring consultancy firm for preparation of the Feasibility Study of Small and Medium HPP in Kyrgyz Republic. The Terms of Reference (TOR) of the Services are attached and can be obtained from emailing EAnwar@isdb.org (cc: ArKenzhegulov@isdb.org, DAbylkhan@isdb.org, and idbroa@isdb.org. IsDB will select and engage the consultancy firm in accordance with the IsDB Corporate Procurement Policy.

2. IsDB now invites Expression of Interest (EOI) and proposal from potential consultancy firms for consideration by IsDB in selecting the consultant.

3. Consultancy firms who wish to submit an EOI with proposal should complete the EOI Form in Annex-III or obtain the template by writing to EAnwar@isdb.org (cc: ArKenzhegulov@isdb.org, DAbylkhan@isdb.org, and idbroa@isdb.org) and submit it to the IsDB by email to the following authorized representatives of IsDB by **20th of April 2023 before 15:00 hrs.**:

Edzwan Anwar

Operations Team Leader-EI

Regional Hub of Almaty

Islamic Development Bank

Email: EAnwar@isdb.org / DAbylkhan@isdb.org / arkenzhegulov@isdb.org / idbroa@isdb.org

Phone: +7 727 2727000

**Encl.:**

**Annex-I:** Terms of Reference

**Annex II –** Formats for the study of hydropower projects - hydropower study guideline based on installed capacity (Installed Capacity > 1 And ≤ 10 MW)

**Annex-III:** EOI Form

**Annex-I: Terms of Reference for Consultancy Firm (hereafter “Consultant”) to Prepare the Feasibility Study of Small and Medium HPP in the Kyrgyz Republic**

1. **Background**
	1. Kyrgyz Republic is facing the interrelated challenges of energy access, energy security and climate change mitigation and adaptation simultaneously. The chronic energy crisis hampers the social, economic and industrial development of the country. The need for modern, reliable and affordable energy services (electricity, motive power, modern fuels) is huge at all levels (productive sectors, social sectors, residential). The total installed capacity is 3,640 MW. Of this, hydropower capacity accounts for 2,950 MW and thermal capacity accounts for 690 MW. Almost 90% of the total hydropower capacity can be attributed to the Naryn hydroelectric cascade with a large Toktogul reservoir having substantial storage capacity (19 bcm). Hydropower plants (HPPs) and small HPPs account for 93.5% of power generated, followed by thermal power plants (TPPs) at 6.5%. Kyrgyz Republic’s HPPs generate 92% percent of domestically consumed electricity. While central heating plants (CHPs) account for ~1/5th of the installed capacity, TPPs usually do not use more than 30% of their capacity. The available hydropower resources are equivalent to potential capacity of 18,500 MW of which only around 15% (2950 MW) has been harnessed.
	2. Most of the Central Asian countries experienced a sharp decline in overall electricity demand owing to lack of industrial demand post dissociation of the Soviet Republic. However, the Kyrgyz Republic, which is hydropower dependent, experienced increased consumption of electricity as the tariff was low for hydropower compared to other fuels (such as coal, fuel oil, and natural gas which experienced price fluctuations due to global trends). Although the growth in demand is not very high during the year, there is a huge gap between inter seasonal demand, i.e. the summer and winter demand. The difference between demand of residential consumers between winter and summer season in 2020 is 2,450 GWh and winter demand consumption for residential consumers has shown an increase of 78% from 2009 to 2020. The unsustainable electricity generation and distribution system represents a high cost for the entire economy of the country, adversely impacting production costs and the population’s standard of living. At the same time, the power transmission and distribution system of Kyrgyz Republic remains under and continuous development. Therefore, only a small proportion of the population has access to reliable electricity services.
	3. Climate change could adversely affect the KGZ through impacts on social, cultural, economic, and natural resources. The Government of Kyrgyz Republic (GoK) has recognized the urgent need for climate change adaptation/mitigation measures. The planned Small and Medium Hydropower (SMHP) project, as part of Kyrgyz’s response to address the above challenges and advance the adaptation/mitigation planning process for meeting climate-sensitive energy sector. It is worth to mention that both leaders i.e. IsDB President and President Kyrgyz Republic, have discussed on IsDB intervention in RE projects specifically in small and medium hydropower in KGZ during the COP-26 (in Glasgow, Scotland) 2021. The proposed intervention to increase energy share of RE in the country and to contribute in meeting the world’s target of reducing the greenhouse gas emissions will be achieve tremendously by 2050. Following the meeting, RHA continues to discuss with Ministry of Energy and Industry (MoE) KGZ, Ministry of Finance (MoF), KGZ, and UNIDO, to streamline and develop several SMHPP as identified below:-

**Table 1- List of Proposed Sites for hydropower plant**

| **No.** | **Project Site** | **Output (MW)** | **Estimated Project Cost** |
| --- | --- | --- | --- |
| 1 | Ak-Su | 6.6 |  US$ 6.80 mil |
| 2 | Chandalash | 13.6 | US$ 14.00 mil |
| 3 | Talas | 5.4 | US$ 8.37 mil |
| **Total** | **25.6** | **US$ 29.17 mil** |

* 1. The IsDB is promoting investments in small to medium scale renewable energy technologies in the electricity sector follows-up on an official request of the Ministry of Energy of Kyrgyz Republic (MoE) to address the existing energy challenges in the country by promoting renewable energy (RE) investments in the electricity sector. The promotion of RE has been included as a key activity in the poverty reduction strategy and the country’s national energy policy, especially to satisfy the United Nation Framework Convention on Climate Change (UNFCCC).
	2. The IsDB project addresses the existing energy challenges of Kyrgyz Republic by promoting RE investments in the electricity sector. The combined and integrated interventions in the areas of technology demonstration, policy support and capacity building will create an enabling environment for the scaling-up of renewable energy investments. The scaling-up of both renewable energy and related technology transfer, is also an important climate change mitigation measure. The proposed projects in the IsDB project are fully in line with the GHG mitigation options proposed in the 2050 Net Zero Carbon. The feasibility study is proposed for development of above-mentioned hydropower projects are proposed.
1. **Objective**
	1. The main objective of the consulting services is to conduct the Feasibility Study of the listed in Table 1 above. The current consulting service seeks the attractiveness of the Project for development. The Consultant needs to evaluate the viability of the project in technical, financial, socio-economic, institutional, and environmental along with other relevant aspects of project development based on detailed field surveys, investigations analysis, design, cost estimate and economical & financial analysis. The Feasibility Study shall include collection of secondary data, literature review, reconnaissance of project area, relevant baseline investigations, assessments and plans, alternative layout, optimization and cost estimates regarding technical, economic/financial, environmental, and socio-economic aspects, preparation of drawings, carry out economic and financial analysis within the stipulated time.
	2. The output should be in the form of a bankable report that will analyze and document all important aspects required for the formal approval of the project by concerned government authorities of Kyrgyz Republic as well as potential financing partners. The Consultant shall follow National/International best practice during survey, design and report preparation in close coordination with Ministry of Energy (MoE).
2. **Scope**
	1. The Consultant shall collect and review all available, relevant reports, data and information. The Consultant shall then identify and recommend the extent of studies that will be necessary to complete the feasibility study of the project. The Consultant shall submit all the drawings, formats, engineering calculations and reports to MoE for review. If MoE requires any changes, they shall be incorporated accordingly. However, the Inception Report must be accepted by MoE before any further work is embarked upon. The plant capacity should be designed based on the optimization study. Topographic surveys and field investigations shall be described in the proposal and a program for this work shall be further detailed and updated in the Inception Report. The work plan prepared as part of the proposal shall be updated in light of the information collected and program for surveys and field investigations shall be updated. The work plan shall show all contemplated activities which will be performed during the course of the study work. The work shall be broken down into discrete elements and the duration, scheduling, and resources required for each element shall be displayed on Critical Path Method Scheduling.
	2. The Feasibility Study report shall contain, apart from other studies a short description of the Environmental Impact Assessment (EIA) component. The Feasibility Study shall be carried out in accordance with this TOR. For any other matters not covered in the TOR, the Consultant should refer the guidelines for study of hydropower projects or similar works, see Annnex-2.
	3. The scope of works and details of the work for the Feasibility Study shall include but not necessarily limited to the following sections:-
		1. Collect and review of previous study reports, manuals, standards, guidelines, legislations, policies & plans, maps, drawing etc.
		2. Conduct desk study and field reconnaissance survey, analyze the available data and identify data gap of previous study & recommend the further additional study needed with justification
		3. Prepare preliminary project layout for different alternatives in inception survey for further field survey and investigation
		4. Conduct engineering survey and field investigation for:
			1. Topographical surveys including L-section & X-section survey,
			2. Hydrological studies, sediment studies and hydro-metrological surveys,
			3. Geological survey, engineering geological mapping, geophysical & geotechnical investigations including drilling, seismicity/seismic study,
			4. Construction materials survey and testing,
			5. Communication surveys for transportation of equipment,
			6. Construction power survey,
			7. Power evacuation survey,
			8. Alignment survey of transmission line,
			9. Alignment survey of access road,
		5. Compile, analyze outcome of field survey & investigation tests
		6. Carry out optimum project scheme selection and alternative configuration studies (Run of River (RoR)/ Peaking RoR /Storage).
		7. Prepare and establish design criteria for the design of all major project components and associated structures as per recognized best practices and applicable standards.
		8. Prepare conceptual/preliminary layout & design considering alternative configuration of project component and conduct optimization of the components & associated structures of hydropower project.
		9. Conduct planning and design of switchyard, transmission line and associated substation.
		10. Carry out design of the access road, project road, bridges and cross drainage structures.
		11. Conduct planning of office complex, camp site and their required facilities such as water supply system, power supply.
		12. Conduct engineering design of each component of hydropower project including civil structures, hydromechanical components, electro-mechanical components and associated structures of optimized options, prepare quantity estimate, cost estimate, prepare drawings, maps and reports as per requirement of scope of work detailed in subsequent heading.
		13. Prepare construction plan/schedule and project implementation plan.
		14. Conduct economic and financial analysis including sensitivity and risk analysis.
		15. Incorporate the recommendation of EIA study report in feasibility study report.
		16. Analyze and propose appropriate contract/implementation module and institutional arrangement for project implementation.
		17. Prepare a complete feasibility study report of the hydropower project including associated structure.
3. **Deliverables**
4. This is a mixed office and site based consultancy assignment, whereby the Consultant is required to visit the project sites to inspect the current infrastructure and/or conditions for building new facility and/or its reconstruction/upgrade, including availability of land, utilities and other resources. The deliverables of this Consultancy assignment shall be:
5. Stage 1: An Inception Report
6. Stage 2: Draft Feasibility Study (FS) Report, see Annex-2 for proposed sections of the report.
7. Stage 3: Final Feasibility Study Report
8. All the documents shall be submitted in English and in 3 hard copies in addition to a soft copy in Microsoft Office Word and Adobe PDF. The draft versions of the documents, submitted as a soft copy in Microsoft Office Word only, will be validated by the MoE as they are produced by the consultant.
9. The Consultant shall formally present the deliverables to the MoE for comment, views and approval during the period of the assignment. Each deliverable shall be first submitted as a preliminary version to allow for comments. Any amendments to the draft documents will be normally communicated to the consultant within 2 weeks after submission. However, this will eventually depend on the quality of the draft report submitted. The Consultant shall therefore pay attention to the quality of deliverables. In the event the quality of deliverable is unacceptable, same will be returned and they will need to be re-submitted for approval after taking on board the comments of the MoE.
10. **Schedule**

The assignment is expected to span until the midst of 2023. The total estimated man-days of effort will be around 300 days. All deliverables will be approved by the client before being eligible for payment.

1. **Terms of Payment**

The contract will be lump sum basis and the Consultant will be entitled for payments, once the assignment outputs (deliverables) are provided as per the agreed schedule and upon acceptance by the client.

| **No.** | **Activities** | **%** | **Total (USD)** |
| --- | --- | --- | --- |
| **A** | **Contract**  |   |   |
| 1 | After contract signing | 10% |  10,000  |
| **B** | **Deliverables (Remuneration and Reimbursable)** |   |   |
| 1 | Stage 1: An Inception Report  | 15% |  15,000  |
| 2 | Stage 2: Draft Feasibility Study Report | 40% |  40,000  |
| 3 | Stage 3: Final Feasibility Study Report | 35% |  35,000  |
| Total | 100% |  100,000  |

1. **Consultant`s Evaluation Criteria**

The Consultant will be a firm or consortium/JV of firms including international and/or local consultants. The Consultant is expected to have the following qualification, with minimumscoring is 70 points.

* 1. **Qualifications (35 points)**

|  |  |  |  |
| --- | --- | --- | --- |
| No.  | Criteria  | Minimum Requirement | Points |
| 1. | Qualification of Key Experts | Minimum Bachelor's Degree in relevant subjects for Electrical Engineer, Mechanical Engineer, Senior Surveyor, Civil Engineer, Cost/Quantity Estimator. For all remaining experts: Minimum Master's Degree in relevant subject | 15 |
| 2. | Experience of Key Expert | For Team Leader : minimum 15 years of experience after graduation. For all other experts: minimum 10 years of experience after graduation | 20 |

* 1. **Experience (55 points)**

|  |  |  |  |
| --- | --- | --- | --- |
| No.  | Criteria  | Minimum Requirement | Points |
| 1. | General Experience of consulting firm | Minimum of 5 years of General Work Experience of the firm (Lead firm in case of JV) in Engineering Discipline | 20 |
| 2. | Specific experience of consulting firm within last 5 years. In case of person, specific experience of the person within last 3 years | 1. Work experience of the firm in Pre-feasibility/ Feasibility Study of Hydropower Projects in the last 5 Years. At least one project must be of more than 5 MW to obtain the marks under this sub-heading. Capacity of a project less than 5 MW will not be counted for calculating cumulative capacity.
2. Work experience of the firm in Detailed Engineering Design (studies)/ Detail Project Report (DPR)/ Construction Supervision of Hydropower Projects in the last 5 Years. At least one project must be of 5 MW to obtain the marks under this sub-heading. Capacity of a project less than 5 MW will not be counted for calculating cumulative capacity.
 | 35 |

* 1. **Capacity (10 points)**

|  |  |  |  |
| --- | --- | --- | --- |
| No.  | Criteria  | Minimum Requirement | Points |
| 1. | Financial Capacity | Minimum Average annual Turnover of more than US$ 50,000 for best 3 years of last 5 consecutive fiscal years | 10 |

**Annex-II: Formats for the study of hydropower projects - hydropower study guideline based on installed capacity (Installed Capacity > 1 And ≤ 10 MW)**

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
| **1** | **TOPOGRAPHICAL SURVEYS AND MAPPING** |
| 1.1 | Available Maps and Images | 1. Collect and make use of available contour maps of the project area published by the Department of Survey.
2. Enlarge the largest available scale Topo-map of the project area to 1:10,000 scale or larger.
3. Project the maps and images to match with the national coordinate system.
 | 1. Collect and review the available maps and images.
2. Additional maps and updated images recommended in the pre-feasibility level should be obtained.
 | 1. Additional maps and updated images should be obtained as required. |
|  |  |  | 1. Construct a safe foot trail to access the headworks, waterways and powerhouse of the project. | 1. The topographical survey carried out during the feasibility study should be augmented with additional coverage required for the detailed design. Where the feasibility maps are adequate and to acceptable standards, it will only be necessary to update them to reflect the changes.
2. Additional survey is required, if there are changes in alignment or any addition or change of location of project component(s).
3. The coordinates of control points established during the feasibility study should be verified and revised, if necessary.
4. Establish additional benchmarks at the selected headworks, waterways and powerhouse that can be used during project construction.
 |
|  |  |  | 2. Establish control points/benchmarks. The benchmarksshall be a permanent type, generally constructed with concrete or prominently marked in rocks/big boulders. |
| 1.2 | Topographical Survey | 1. Verify the coordinates of the key project components proposed in

desk/reconnaissance study with GPS survey.1. Carry out fly leveling, or use theodolite/total station to verify the gross topographic head.
 | 1. Determine the coordinates of at least two benchmarks by DGPS, triangulation or any appropriate methods to tie with triangulation points of the national grid established by the Department of Survey.
2. Complete the traverse survey by using coordinates of the two known benchmarks.
3. Carry out a detailed topographical survey of headworks, waterways (strip survey), forebay/surge tank/surge shaft, adit portal(s), powerhouse, tailrace and switchyard area and prepare map with 1 m contour

interval. |
|  |  |  | 6. The point density of detailed survey should be sufficient to cover all ground features. The survey should cover at least impounding area upstream of the dams/weir and adequate area downstream of the tailrace. The survey should cover at least 20 m in elevation above the maximum flood mark or full supply level on both banks. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 7. At least two of the most promising alternatives should be covered in the topographical survey. | 1. Conduct strip survey of access road(s) alignment with sufficed point density to produce map in 1:1000 scale. Take details to indicate all major and minor crossings.
2. In bridge/siphon crossings, conduct river cross section survey covering 500 m upstream and 500 m downstream from the bridge axis at 20 m intervals or closer and mark water levels. Take additional details at abutments.
3. For power canal/conduit, the width of strip survey should be decided considering the topography of the alignment, size of the conduit and access and safety requirements.
4. Locate and map river boulders larger than 2.0 m.
5. Conduct strip survey of transmission line route in 1:1000 scale. Also, take details at poles/tower locations.
6. Conduct cross section survey of critical slopes and landslide-prone zone in project area i.e. intake, forebay/surge tank, adit portal(s), waterway, penstock alignment and powerhouse, if not covered during the feasibility study.
 |
| 8. For inaccessible areas such as steep cliffs, generate contour and features using aerial images or any othersuitable methods. |
| 9. If there is a hydropower project upstream within the backwater reach, carry out river cross section survey upto the tailrace outlet of the upstream hydropower plant. |
| 10. The topographical survey should cover quarry sites; spoil tip areas, camp sites and access roads (stripsurvey) inside the project area including necessary river crossings. |
| 11. River cross section survey should be carried out at intake and tailrace sites covering at least 500 m upstream and downstream. The interval should be 20 to 50 m or closer depending upon the river morphology. The survey should be extended beyond high flood marks. The flood marks and existing water levels shouldbe indicated in the cross sections. |
| 12. If there are any tributaries/gullies that could affect the project components substantially, tributaries’ crosssection survey should cover the stretch within the project area. |
| 13. If there are major river confluences in the vicinity of the headworks and/or tailrace, the topographical survey should cover at least 500 m upstream and downstreamfrom the confluence point in the adjacent river(s) and the main river. |
| 14. Conduct walkover survey of transmission route(s) and construction route(s) using 1:25,000 or 1:50,000 scale topographic maps in order to verify the suitability of theroute(s). Mark the walkover points with GPS and plot these in the topographic map. |
| 15. For power canal/conduit, the width of strip survey should be decided considering the topography of the alignment, size of the conduit, access and safety requirements. |
| 1.3 | Topographic Mapping, Plotting,Reporting and Data | 1. Verify the key features shown in the available topographic maps including land use pattern. | 1. Prepare description cards of all benchmarks showing the points with a colour photograph and mention the nearby references, name of the surveyor, location and the coordinates. | 1. Use the topographic maps prepared during the feasibility study after updating when and where necessary. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  | Presentation | 2. Prepare a map in appropriate scale showing nearest road- head, construction power source, using collected information and data from the Department of Survey. | 1. Prepare topographical survey report and maps. If multiple surveys have been carried out, prepare a single report and include all findings.
2. Prepare access road(s) map in 1:1000 scale with 1 m contour intervals. Show cross sections along bridge/ culverts along the road alignment in appropriate scales. The general layout may be plotted in smaller scale.
3. For headworks, waterways, forebay/surge shaft/surge tank, adit portal(s), powerhouse, tailrace and switchyard areas, the contour intervals should be 1m and the scale of map may vary from 1:100 to 1:2000 depending upon the size of the area.
4. Prepare transmission route map in a scale of 1:25,000 or 1:50,000 showing key features such as agricultural land, forest area and settlements.
5. Prepare and verify the license boundary map showing project components and verify there is no conflict with other projects in the vicinity and ensure that backwater level is also within the license boundary.
 |  |
| 2. | **HYDROLOGICAL AND SEDIMENTATION STUDIES** |
| 2.1 | Hydrology | 1. Along with the guidelines mentioned herein, the Hydrological Manual for Infrastructure, Water and Energy Commission Secretariat can be followed for hydrologic analysis.
2. Collect long term historical rainfall data and climatological data pertinent to the study area (preferably more than 30 years) where available.
3. Collect long term historical flow data and sediment data of the river under study. If not available, collect the data from other rivers with similar

hydrological characteristics in | 1. All the information obtained from pre-feasibility study shall be reviewed, verified and updated. If gauge stations have been established previously, measurements shall be continued.
2. Data logger can also be added and used for online monitoring of hydrological data.
3. Install a cableway at the intake and powerhouse site wherever necessary for discharge measurement.
4. Update the flow data and assess accordingly the mean daily flows and develop an upgraded flow duration curve.
5. For ungauged river basin, hydrologic modelling for the estimate of water availability shall be carried out. Hydrologic models that consider snow/glacier melt schemes shall be used for the catchment that has snow/glacier fed rivers.
6. Water surface/level profile modelling shall be carried out.
 | 1. All the information obtained from the feasibility study shall be reviewed, verified and updated.
2. Data collection from previously established gauge stations in hydropower project shall be continued.
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | the vicinity (preferably for more than 30 years). | 1. Carry out cross section surveys at least 500m/1km upstream and downstream of the headworks site and the tailrace site covering the highest flood marks, preferably at the same locations as of the pre-feasibility study so that any change in the cross sections can be observed. If there are changes, check the magnitude of flood peaks with the previous ones.
2. Carry out discharge measurements/gauge readings intensively during the rainy season (June to September) to cover the peak floods at the intake and powerhouse sites, if the site is accessible during monsoon; if not, estimate the flood flows based on flood marks using appropriate hydrological models. In addition, take a reasonable number of measurements during the other months (October to May) at the control profile.
3. Check these measured data with the previous rating curve and upgrade these as necessary.
4. Update and upgrade the diversion floods computed during the pre-feasibility level study.
5. Update and upgrade the rating curves.
6. Update, validate and upgrade the design flow for power generation.
7. Carry out the water quality analysis to determine the corrosive effectiveness (hardness).
8. Collect the information on GLOF events in the past (if such events have occurred) and assess the magnitude of the potential GLOF.
9. Generate sequence of flow for the case of storage projects.
 |  |
| 4. Check the consistency of data. |
| 5. Assess mean daily flow (if available) and develop a flow duration curve using daily hydrograph. |
| 6. For the ungauged river, discharge (including flow duration curve) shall be estimated with empirical methods, rational method and catchment area ratio method selecting similar catchment, wherever applicable. Such discharge data shall be justified by checking rainfall runoff coefficient. |
| 7. Snow/glacier melt contribution shall be considered, if the catchment has snow/glacier fed rivers. |
| 8. Establish a gauging station as well as colour crest gauges at straight and stable control section for instantaneous flood recordings at the intake and powerhouse site. A data logger may also be used for automatic flow recordings. |
| 9. Carry out discharge measurements at the intake site. Develop a rating curve at headworks andtailrace/powerhouse area. |
| 10. Carry out three cross sectionsurveys at headworks site and three cross section surveys at |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | the tailrace site covering the highest flood marks.1. The river high flood data (instantaneous high flood) obtained from DHM needs to be analysed for flood frequency estimation, if available.
2. Estimate the design floods for return periods of 10, 50, 100 and 200 years.
3. Conduct flood frequency analysis for the period of October to May for ascertaining construction diversion flood. The frequency should be 1 in 20 years.
4. Assess possibility of GLOF in the catchment area, if any.
 |  |  |
| 2.2 | Sediment | 1. Identify in which zone of sedimentation the catchment lies (high, medium or low).
2. Estimate the sediment/bed load in the river using empirical methods.
3. Collect suspended sediment samples and perform necessary laboratory analysis to determine sediment concentration, particle size distribution and mineralogical content.
4. The sampling should cover at least one pre-monsoon, monsoon and post monsoon periods.
 | 1. Collect sediment samples daily during the rainy season (June to September) and at a reasonable frequency during other months (October to May) to develop a rating curve for the sediment concentration against the discharge.
2. Continue collection of data from the gauging station established during the pre-feasibility study level and update the sediment rating curve.
3. Determine the tentative value for median grain size, d50 of the river bed/banks’ materials.
4. Analyse the sediment samples to evaluate the volumes and characteristics of solid material transportation including suspended sediment concentration, particle size distribution and mineral content analysis.
5. Estimate the daily sediment load and assess the annual load in the river.
6. Carry out particle size distribution analysis for river bed materials at gauging station(s), headworks and powerhouse sites and their immediate vicinity.
 | 1. Review the findings of feasibility study and update, if necessary.
2. In case of substantial changes in the river morphology such as due to large landslides in the upstream catchment, carry out further suspended sediment sampling during the rainy season.
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 7. Analyse sediment impact due to construction activities on downstream projects. |  |
| **3** | **Geological/Geotechnical Investigation** |
| 3.1 | Regional Geology Study | 1. Collect and review available literature, topographical maps regional geological maps, geological sections, structural maps, available images and aerial photographs.
2. Prepare a brief report on regional geology with maps showing major structures

(fault, fold, window and thrust). | 1. Review pre-feasibility report.
2. Collect and review available literature, topographical maps, regional geological maps, geological sections, structural maps and available images.
3. Prepare a report on regional geology and structures.
4. Include existing regional geological maps with plan and section in available scale.
 | 1. Review the findings of feasibility study and update as necessary. |
| 3.2 | General Geology and Geomorphology of the Project Area | 1. Conduct a site visit to collect data for geological mapping, geomorphology survey and discontinuity survey.
2. Prepare geological maps with plan and section of the project area in 1:25,000-1:50,000 scale or on available larger scale maps.
3. Prepare a report on general geology and geomorphology of

the project area. | 1. Conduct detailed geological mapping of the project area and prepare a geological map with plan and section in 1:10,000 or larger scale.
2. Prepare a report on general geology and geomorphology of the project area.
 | 1. Review and update previous reports and geological maps, if necessary.
2. Conduct additional detailed geological mapping where necessary.
 |
| 3.3 | Geological, Conditions and Geomorphology of Major Project Components | 1. Describe geological and geomorphological conditions and potential geo-risks to major project components such as weir, intake, settling basin, waterways, forebay/surge tank/surge shaft/ penstock, powerhouse, tailrace and switchyard. | 1. Prepare detailed geology and geomorphology report of the project components.
2. Conduct detailed engineering geological mapping of major structures such as weir, intake, settling basin, waterways, surge tank/forebay, penstock, powerhouse and tailrace in 1:1000 to 10,000 scale.
3. Review and conduct a risk assessment of landslide damming inundation and Landslide Dam Outburst Flood (LDOF) risks etc. in the project vicinity covering both upstream and downstream reach.
 | 1. Review, and update maps and reports of previous studies. Conduct detailed mapping, if major components’ locations are changed.
2. Review mass wasting report and conduct detailed analysis and assessment of risks to major structures to consider protective measures.
3. Additional survey and geological mapping in appropriate scale (generally 1:1000 to 1:10,000) shall be required, if

there are any modifications in project |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 1. Assess landslides and rock fall risks for surface structures with special consideration for seismic events.
2. Refer to Section D – Additional requirements for hydropower projects with underground structures.
 | layout and/or location of major project components. |
| 4. Detailed chainage-wise geological andengineering geological description of the water conveyance. |
|  |  |  | 1. Conduct discontinuity survey to identify and locate bedding/foliation planes, lithological contacts, major and minor joints, faults, fold/thrusts, fissures, karst features and voids. | 1. Review and conduct additional joint survey and rock mass classification especially for underground structures for detailed design.
2. Conduct detailed slope stability analysis and rock support design/analysis.
3. Prepare cross section of the measured discontinuities.
 |
| 3.4 | Discontinuity and Rock Mass Classification Survey | 1. Conduct discontinuity analysis for slope stability, water stability and selection of stable orientation.
2. Collect rock mass properties and classify rock mass (Q system, RMR, GSI or any other international system). If other internationally accepted classifications are to be used, this should be correlated to equivalent Q and GSI system.
 |
|  |  | 4. Prepare Rock Mass classes distribution (along profile/ cross section) for each underground structure to determine rock support. |
|  |  | 5. Slope stability analysis and rock support analysis. |
|  |  |  | 1. Excavate representative test pits/trenches (not less than

1.5 m \*1.5 m where required and prepare log sheets with photographs. Collect samples for laboratory analysis to know the nature of soil at intake, settling basin, forebay, anchor blocks and powerhouse sites.1. Perform bearing capacity test and permeability tests in representative test pits to know the bearing capacity of soil and permeability of soil at surface structures such as weir, intake, settling basin, forebay, anchor block and powerhouse sites.
2. Perform laboratory analysis such as sieve and sedimentation, Atterberg limits, natural moisture content, plastic limit, friction angle and cohesion, specific gravity, shear box tests of collected samples for physical properties; and odometer consolidation/ swelling test for clay soil, if present.
3. Perform geophysical investigation such as seismic refraction or electrical resistivity or any other
 | 1. All geotechnical investigations including exploratory core drillings recommended in the feasibility study should be carried out. |
|  |  | 2. Conduct additional geophysical investigations, if required. |
| 3.5 | Geotechnical Investigation | 3. Exploratory core drilling could be necessary to verify geophysical investigation especially in powerhouse, founded in the soil for high head project. |
|  |  | 4. In case of underground structures, exploratory core drillings with in-situ tests such as Lugeon test, followed by laboratory tests such as point load test of lump sample, Uniaxial Compressive Strength (UCS) test and modulus test of the core sample, and odometer test for swelling clay should be carried out. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | appropriate geophysical methods to find out overburden thickness and nature of soil strata/bearing capacity at major project components.1. Carry out Multi-channel Analysis of Surface Waves (MASW) in boulder mixed heterogeneous soil, to determine the bearing capacity at foundations of major project components.
2. Survey and locate test pits/trenches, geophysical profile lines etc. on maps.
3. Perform exploratory core drillings at dam/weir, headrace tunnel, surge tank/forebay, surface powerhouse and underground caverns but not necessary, if exposed bedrock is very strong and massive with joint spacing > 1 m without faults. Perform tests on core sample as per requirement.
4. Refer to Section D – Additional requirements for

hydropower projects with underground structures. |  |
|  |  |  | 1. Prepare geological model (plan and sections, in appropriate scale of 1:1,000 to 1:10,000) for major surface structures such as weir, intake, settling basin, waterways, forebay, penstock, powerhouse and tailrace. | 1. Update or prepare new geological models of each structure by conducting additional engineering geological mapping and site investigations where necessary. |
| 3.6 | Geological Model | 2. Prepare geological model (plan and sections, in appropriate scale of 1:1,000 to 1:10,000) along waterway covering at least 50 – 100 m both uphill and downhill sides from the centre-line and extend in critical areas showing landslides, debris flow, gully erosion, steep slope etc. for stability and risks assessment for design considerations. |
|  |  | 3. Prepare geological model (plan and profiles) of underground structure in appropriate scale: 1:1,000 to 1:10,000. Prepare additional transverse/cross sections in low angle dipping beds for tunnel aligned parallel tothe foliation/bedding planes. |
| **4** | **Construction Materials Survey** |
|  |  | 1. Identify sources sites for the materials such | and quarry construction as sand, | 1. Take reference from pre-feasibility study.
2. Identify and investigate construction material sources and quarry sites for the construction materials such as
 | 1. Collect previous laboratory reports and results and verify the quality and quantity of construction materials. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | coarse aggregates, boulders, impervious soils, etc.2. Locate the quarry sites in the available topographic map (1:25,000 or 1:50,000) observed during the site visit. | impervious soils, stones, boulders, sand and gravel as required.1. Excavate test pits/trenches (not less than 1.5 m \*1.5 m) and log the nature of soil at borrow locations including photographs and collect samples for laboratory analysis.
2. Perform laboratory tests: gradation and classification, unconfined compression, absorption and specific gravity, uniaxial compressive strength, point load, Los Angeles abrasion test, sulphate soundness, slake durability test, compaction test, alkali aggregate reaction, swelling test (if necessary), aggregate crushing value, mica and clay content.
3. Estimate available quantities at each borrow area to meet the requirement of the construction.
4. Collect rock block/boulders samples from each quarry site for laboratory tests.
5. Prepare location map with source areas in appropriate scale.
 | 1. Carry out further investigations and laboratory tests, if required.
2. Prepare construction materials quarry site and burrow area location map.
 |
| **5** | **Seismic Study** |
| 5.1 | Tectonic Setting | 1. Briefly describe the regional tectonic (structural) setting related to the project area using available literature and regional maps. | 1. Describe tectonic settings related to the project area using available literature and regional maps. |  |
| 5.2 | Seismic Zoning | 1. Identify the seismic zone of the project area based on the National Building Code (NBC) 105. | 1. Review and update the previous study, if required | 1. Review and update the previous study, if required. |
| 5.3 | Earthquake Catalogue and Historical and Instrumentally Recorded Earthquakes |  | 1. Earthquake catalogue, especially for those historical and instrumentally recorded earthquakes, should be tabulated for earthquakes of magnitude 4.0 M and higher. For every significant earthquake event, the location, distance, magnitude and intensity should be shown in a map in a suitable scale. |  |
| 5.4 | Project Specific Seismic HazardAnalysis |  | 1. Empirical laws may be applied to deduce intensity or acceleration of the ground motion. The Peak GroundAcceleration (PGA) for Maximum Design Earthquake | 1. Review and update the previous study, if required. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | (MDE) and Operating Basis Earthquake (OBE) should be given in reference from other existing nearby hydropower project(s) or national/international standards or codes. |  |
| **6** | **Selection of Project Components and Project Layout** |
|  |  | 1. Assess and describe availability and condition of the access road(s) leading to the project site.
2. Identify and describe new access road(s)/ropeways/foot trails/tunnels or any other ways to be constructed for development of the project.
3. Identify the existing hydropower project(s) located at upstream and downstream of the project area and verify the project’s license boundary with existing hydropower project.
4. Conceptual layout of all possible schemes within the license boundary should be identified and studied.
5. Topographical, geological conditions of alternative layouts should be studied in order to select the location of project structures: weir, settling basin waterways, forebay, penstock, powerhouse, tailrace and switchyard.
6. While selecting the alternatives, socio-
 | 1. Review the pre-feasibility study report and update the site accessibility conditions to the project area.
2. Detailed topographic maps and preliminary geological maps should be prepared for designing the project configuration/layout.
3. Use updated hydrological data/analysis results for the design of project components. The design discharge should be based on prevailing practices in the context of Nepal (e.g. 40-45 percentile flow/flow mentioned in survey license).
4. While selecting the alternatives, socio-environmental variables should be considered and compared.
5. Select the shortest and most economical access road(s) alignment with minimum numbers of crossing structures.
6. Follow the relevant national and international guidelines, norms and codes to design the project components.
7. For the selection of the location of the diversion weir, alternative sites for settling basin, water conveyance, river crossings, forebay/surge tank/surge shaft, powerhouse, tailrace and switchyard should be studied/ investigated in detail.
8. Prepare preliminary design and drawings of all alternatives (at least two covering both banks) and project structures in appropriate scale.
9. Conduct an alternative study of transmission line routes (at least two) and identify the shortest and most economical route, sub-station and voltage level.
10. Based on the design and drawings, quantity and cost estimations should be carried out for each alternative.
11. Calculate revenue from the project using saleable energy and prevailing energy prices.
 | 1. Expert’s consultation is recommended to verify the project layout and components’ design.
2. Review the feasibility study incorporating expert’s recommendations, if any.
3. In case of significant changes to the layout, update the feasibility study.
4. Verify the updated project license boundary.
5. Carry out the detailed design of access roads within the project area, if required.
6. Carry out the detailed design of all components such as weir, intake, settling basin, water ways, forebay/surge tank/surge shaft, powerhouse, tailrace and switchyard.
7. Follow the relevant national and international guidelines, norms and codes to design the project components.
 |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | environmental variables should be considered and compared. | 1. Select the most optimum alternative scheme based on maximum benefit at minimum cost.
2. Prepare general layout drawings of the best alternative showing its components: headworks, waterway, forebay/surge tank/surge shaft, penstock, powerhouse, tailrace and switchyard using the detailed topographic map prepared during this stage of the study. Additionally, show transmission line route and access roads to all major project components
3. Expert consultation and verification of project layout and project structures should be carried out based on the complexity of the project.
 |  |
| 7. Assess the location and condition of immediate upstream and downstream projects, if any. List out issues related to the existing project(s) to be addressed while finalizing the project configuration. |
| 8. The locations and types of the structures of each scheme should be verified at site in terms of accessibility, topography, geology, river morphology, construction ease and technical, economic and socio-environmental considerations. |
| 9. Prepare conceptual layout (project configuration) of at least the two most promising schemes with their major structures in appropriate scale using available maps and conduct the preliminary cost- benefit analysis. |
| 10. Recommend area to be covered by topographical survey during the feasibility study phase as well as other site specific investigation. |
| **7** | **Optimization Study** |
|  |  | 1. Installed capacity should be tentatively fixed considering preliminary technical, socio- environmental and economic assessment. If due to lack ofdata (e.g., hydrology), it is not | 1. **General Approach**
	* For selection of parameters to be optimized, identify their ranges and establish a series of alternatives.
	* Carry out the conceptual design, drawings and cost estimate for each alternative.
 | 1. Re-optimization should be carried out based on changes in project capacity and/or design discharge and/or changes in market price for materials and labour. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | possible to fix the installed capacity, a range should be provided.2. The number of generating units should be determined considering the reliability of operation of the plant and maximum utilization of dry season river flow. Apart from that transportation aspects should also be considered. | * Estimation of benefits for each alternative.
* Comparison of cost and benefits.
1. **Assumptions**
	* Price of dry and wet energy, peak/off-peak as per the requirements of the off-taker.
	* Capacity benefit, if any.
2. **Selected Alternatives**
	* Determine the number of alternatives considering the range of installed capacities.
3. **Energy Production**
	* For ROR projects, calculate energy production for all alternatives with following considerations:
		+ At least five options, generally in the range of 65% to 25% flow exceedance and average daily flows to be used.
		+ Dry and wet energy, peak/off-peak energy as per the requirements of off-taker should be calculated.
4. **Project Layout**
	* Optimize project structures/components individually for the given installed capacity/discharge.
	* Size of settling basin to be adjusted as per optimized discharge.
	* Water conveyance system including tunnel, penstock and tailrace to be optimized considering the loss of revenue due to head loss and investment cost.
	* Forebay/Surge tank/Surge shaft dimension to be adjusted.
	* Powerhouse and unit sizes to be obtained from the empirical formula, past experiences and/or supplier(s)’ information.
5. **Cost Estimate**
	* Preliminary quantity and cost estimates should be developed for all the cases under consideration.
	* Only the major items should be computed in detail, while minor items may be estimated based on curves and data of similar structures in other projects.
 |  |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | * Unit rates should be estimated based on prevailing market rates in the area, project location and accessibility. Reference can be taken from under construction projects with similar features.
* Electro-Mechanical and switchyard equipment costs should be calculated using empirical relations, market price and/or based on budgetary quotations from the potential suppliers.
* The cost estimates should also consider the cost of access roads, infrastructure development and environmental costs.
* Technical contingencies should be taken into account to come up with the implementation cost of the alternatives.
1. **Financial Analysis**
	* Financial comparison of the different alternatives should be carried out considering the implementation and operation cost with accrued benefits due to energy production for each case.
	* The financial analysis should be carried out to determine the basic parameters such as Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit Cost Ratio (B/C).
	* The alternative with maximum B/C ratio and internal rate of return should be selected to fix optimum installed capacity.
2. **Number of Units**
	* Minimum possible number of units should be adopted

considering hydrology and transport capacity of road/bridge conditions. |  |
| **8** | **Project Description and Design** |
| 8.1 | General Layout and design: Civil Structures | 1. General layout of the selected alternative site of the project should be described.
2. Layout should be prepared using available larger scale topographic map.
3. Preliminary hydraulic design and sizing of the following civil
 | 1. General layout of the selected alternative of the project should be described.
2. Layout should be prepared using the survey maps.
3. Detailed hydraulic design and sizing of the all civil structures including the following should be carried out:
	* Weir, intake and undersluice
	* Upstream and downstream aprons
	* Stilling basin
 | 1. **General**:
	* The final project layout recommended in the feasibility study and the approved IEE/EIA report should be reviewed and verified by experts, if necessary.
	* Component-wise detailed design should be carried out for the final/updated project layout.
 |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | structures should be carried out:* Weir &intake
* Gravel trap
* Settling basin
* Headrace canal/pipe/tunnel
* Forebay or surge tank
* Penstock
* Powerhouse
* Tailrace
1. Preliminary design of switchyard and sub-station’s civil structures should be carried out.
2. A brief description of major project components should be given.
3. Typical drawings of major project components should be prepared in appropriate scale.
 | * Gravel trap
 | * Project definition report defining all project information, parameters and components should be prepared.
* Project parameters and design criteria should be included in a Design Basis Memorandum (DBM) referring to relevant national and international guidelines, norms and codes, and past experiences.
* Detailed hydraulic design and dimensioning of all components/structures carried out during the feasibility study should be reviewed and updated/refined/revised where necessary.
1. **Infrastructures**
	* Design of road components such as side drains, cross drainage structures, retaining walls, gabion and stone masonry structures should be carried out.
	* Plans, profiles and cross sections of access road including side drains, retaining structures, cross drainage structures should be prepared in appropriate scale.
	* Design of construction camps, temporary and permanent housings, water supply and sewerage system, bunker houses etc. should be prepared and presented in the drawings.
	* Necessary drainage system for surface runoff management should be designed.
	* Necessary design for construction power arrangement should be carried out.
2. **Temporary River Diversion**
	* Detailed hydraulic design and drawings of cofferdams, diversion channel and aprons should be carried out.
 |
| * Settling basin
 |
| * Headrace canal/pipe/tunnel
 |
| * Forebay/surge tank/surge shaft
 |
| * Penstock
 |
| * Powerhouse
 |
| * Tailrace
 |
| 4. Design of temporary and permanent infrastructures such as camp facilities, construction power, access roads (ropeways, bridges, tunnel), drinking water supply and sewerage etc. should be carried out. |
| 5. Design of switchyard and sub-station’s civil structures should be carried out. |
| 6. Design and location of spoil tips should be carried out. |
| 7. Design and drawing of temporary river diversion during construction should be prepared. The diversion channel should be designed to pass 1:20 years return period dry season flood. |
| 8. Necessary flood/debris/landslide protection works should be designed based on the river morphology, ground topography, possible debris flow area and the possibility of rock falls (rolling boulders) nearby powerhouse and switchyard area. |
| 9. All project components should be described in detail. |
| 10. Drawings of all project components should be prepared in appropriate scale. |
| **Headworks** |
| All headworks components should be designed following “Design Guidelines for Headworks of Hydropower Projects” published by DoED, Nepal, 2006. |
| 1. Weir/dam, intake, stilling basin, aprons and floodwalls should be designed to pass safely the maximum flood of 1 in 50 years return period. Stability analysis should be done for 1 in 100 years return period flood. |
| 2. Intake capacity should be about 130% of the design discharge in case of conventional gravel trap and settling basin flushing systems while the plant operates at full load during flushing. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 3. Clear spacing of the coarse trash rack in intake should be fixed considering the transport capacity of gravel flushing conduit. | * The diversion channel and cofferdams should be designed to pass 20 years dry season return period flood.
1. **Main Component Design**
	* Detailed design of all surface and underground structures should be carried out.
	* The safety of component should be checked by conducting stability and structural analysis.

5. **Seismic Design Criteria*** Pseudo-static analysis procedures (seismic coefficient method) can be used in the seismic design and analysis of structures where appropriate.
* The response of a structure to ground vibrations should be determined considering soil type, seismic zone, response reduction factor, importance factor, fundamental period of vibration and damping factor (ξ). These values can be referred from norms and codes such as NBC 105.
* For structures with minor importance, the seismic coefficient can be reduced appropriately.
* Both vertical and horizontal seismic components should be used in the design.
1. **Foundation Design**
	* The results from the geophysical investigation shall be used to design the foundations. In case of missing or unavailability of data, suitable values shall be assumed based on the local geology.
	* If foundation has to be placed in inferior soil type, a suitable foundation treatment method should be specified.
	* Detailed seepage analysis under the
 |
| 4. Settling basin should be designed for continuous supply of required design flow plus flushing discharge. The trapping efficiency should be 90% or higher for particle size greater than 0.2 mm depending on available head and mineral composition of sediments. Adequate justification should be provided, if smaller than 0.2 mm particle size is selected to be settled in the settling basin. It is suggested to divide the settling basin into 2 or more chambers. |
| 5. Sediment handling, controlling and flow regulation mechanism should be defined in the project description. |
| 6. An automatic/ungated spillway should be provided downstream of the settling basin at conveyance tank wherever possible. |
| 7. Sediment/gravel flushing outlet should be located at shooting flow of the stilling basin/river. |
| **Water Conveyance** |
| All water conveyance system should be designed following “Design Guidelines for Water Conveyance System of Hydropower Projects” published by DoED, Nepal, 2006. |
| 1. The power canal /headrace pipe/tunnel including all hydraulic and cross-drainage structures from intake to forebay/surge tank/surge shaft should be designed for 110% design discharge or higher. |
| 2. A number of saddle supports and anchor blocks should be designed and described in the report. |
| 3. Slope stability analysis in critical sections of waterways including forebay/surge tank/surge shaft should be carried out. |
| 4. Necessary drainage system for surface runoff management should be designed. |
| 5. Type and size of water conveyance should be determined considering the design discharge, silting/scouring velocity for the selected materials used (e.g., concrete grade, masonry) applied concrete grade and topography. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 6. Corrosion, scratching, pipe diameter and transportation limitation factors should be considered while fixing the headrace pipe thickness. | weir/dam foundation and other water retaining structures should be carried out. Uplift pressure and under piping mechanism for cutoff wall, apron and protection works should be analysed and proper measures should be proposed to prevent damage related to foundation undermining.* The allowable bearing capacity of the foundation may be increased in extreme loading conditions as provisioned in the design codes. Similarly, the allowable bearing capacity may need to be reduced when fully water saturation conditions occur and placing foundation on steep slopes or adjacent to them.
1. **Stability Analysis of Structures**
	* The following loadings should be considered for stability analysis of project components:
		+ Dead load
		+ Live load
		+ Water pressure
		+ Weight of water
		+ Hydro-dynamic load
		+ Active earth pressure
		+ At rest pressure
		+ Passive earth pressure
		+ Earthquake load
		+ In-situ stresses
		+ Impact load
		+ Vibration load
		+ Thermal
		+ Uplift (buoyancy and seepage)
		+ Surcharge/overburden loads
		+ Water hammer
		+ Wind
		+ Snow
		+ Construction and moving surface loads:
		+ Additional loads, if any.
 |
| **Surge Control Structure and Penstock Pipe** |
| 1. An emergency spillway at the forebay should be provided. The forebay should have the effective volume at least equal to the volume of water in the penstock pipe while filled or to supply design flow for at least 120 seconds, whichever is larger. |
| 2. For surge tank/surge shaft, various possible scenarios of transient analysis should be carried out to determine upsurge and down surge level. |
| 3. The thickness of the steel pipe should be able to withstand any variable load conditions encountered during operation of the plant. While deriving the effective thickness of the pipe, steel grade, corrosion factor, welding factor and rolling factor should be considered. |
| 4. Anchor blocks to hold penstock pipe should be designed at bends and also intermediately in long straight stretches. |
| **Powerhouse and Tailrace** |
| 1. The powerhouse should be dimensioned to accommodate electro-mechanical equipment and its ancillaries. |
| 2. The tailrace conduit should be designed considering turbine type, minimum power discharge available, minimum water depth requirement and the possible effect of river water level at the tailrace outlet. |
| 3. Switchyard area should be arranged nearby the powerhouse and civil design of switchyard should be prepared. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | * For the purpose of evaluating the stability and structural analysis, different load combinations that may occur during different phases of the project implementation and operation should be considered. Individual components/elements must be designed for the most unfavourable load combination. In general, the following conditions should be considered:
	+ Construction
	+ Normal operation
	+ Special/emergency/extreme cases
* The safety factor depends upon the codes and loading combination used.
1. **Detailed Structural Analysis and Design**
	* Appropriate codes (concrete, steel) should be referred for the detail design. All possible loading conditions should be considered.
	* The durability of the structure should be ensured in the design.
	* Material properties and allowable stresses for concrete, structural steel, reinforcement, etc. should be specified.
	* The structures should be analysed using acceptable methods manually or by using software.
	* All structures should be safe against internal and external forces/stresses and all kind of climatic conditions.
	* Reinforcement calculation should be done considering temperature and shrinkage effects.
	* The dynamic analysis should be carried out for the powerhouse and penstock

and ensure that natural frequency does not create resonance phenomenon. |
| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | * Ensure that the settlement/deformation and deflections are within permissible limits.
1. **Water Tightness**
	* Control of cracking in concrete should be as per the requirement specified in IS 456:1978 and 2000 or BS 8007:1987 or BS 8110 Part II, BS 2007 or equivalent codes.
	* The type and location of joints should be specified. Contraction/expansion joints should generally be located in 15 to 25 m spacing. Construction joints should be provided considering construction sequence.
	* The appropriate type of water stops should be provided at expansion/contraction/construction joints.
2. **Detailing and Drawings**
	* The reinforcement should be detailed considering the ductility of the structure.
	* Reinforcement arrangement should be shown in drawings in appropriate scale. Special attention should be given at joints.
	* Prepare construction drawings, reinforcement drawings and bar bending schedules.
3. **Field Verification of Design/Layout**
	* The arrangement of all project components should be verified at the site by laying setting out points. Any changes that may occur should be addressed in the design.
4. **Report Preparation**
	* After finalizing the design, a detailed design report should be prepared

showing all hydraulic, geotechnical, |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | stability and structural analyses calculations. Based on the detailed design report, a draft operation andmaintenance manual should be prepared. |
|  |  |  |  | 1. **General** |
| 8.2 | Hydro- Mechanical Components | 1. Preliminary selection/

estimation of hydro mechanical components such as gates, stoplogs, trashracks and penstock should be carried out.1. A brief description of hydro- mechanical components should be provided in the report.
 | The following hydro-mechanical components should be designed and described:1. Gates, stop logs, embedded parts, valves, trash racks, bell mouths, manholes, expansion joints, saddle/wear plates, sizing of headrace and penstock pipes, bends, reducers, branches, steel lining works etc.
2. The hoisting system for gates and stop-logs.
 | * This design is generally carried out by hydro-mechanical equipment manufacturers/suppliers, thus only preliminary design for preparing Terms of Reference of tender/contract documents shall be carried out in consultation with potential manufacturers/suppliers.
* Design and dimensioning of all components/structures carried out during the feasibility study should be reviewed and updated where necessary and presented in the project definition report.
* Component-wise design should be carried out for the final/updated project layout.
* Project parameters and design criteria should be included in a Design Basis Memorandum (DBM) referring to relevant national and international guidelines, norms and codes, and past experiences.
* While designing the hydro mechanical components, factors such as corrosion, welding defects, and plate inaccuracy/defects should be taken into account.
* Individual components/elements must be designed for the most unfavourable load combination. In general, loading conditions which may occur during the following phases/cases should be considered:
 |
|  |  |  |  | - Transportation |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | * Erection/Construction
* Testing in factory and site
* Normal operation
* Special/Emergency/Extreme cases
1. **Design of Gates and Stop-Logs**
	* The type of gate/stoplogs with embedded parts and its hoisting mechanism should be fixed.
	* The materials to be used for skin plates, stiffeners, girders, embedded parts and other components should be specified.
	* The gates/stoplogs with embedded parts shall be designed for the hydrostatic and hydrodynamic forces taking into consideration the forces arising from wave effects, water hammer, seismic loads, active soil load (sediment deposit), ice formation, friction, and thermal effect wherever applicable.
	* The internal stress should be ensured to be within the limit of allowable stress in normal and extreme operating conditions.
	* Sufficient corrosion allowance should be provided and corrosion prevention methods, if any, should be mentioned.
	* Types and material of seals should be mentioned.
	* Power-operated gates shall normally be capable of operation by alternate means in case of power supply failure.
	* If meant for regulation, it shall be capable of being held in partially open position without major damage to seal or deterioration due to cavitation and vibration.
	* Wherever necessary, model studies may be carried out for high head

regulating gates. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | * The deflection of the gate under various loading conditions should be within the permissible limits.
* Dogging devices and lifting beams should be designed for operation of gates, stop logs etc.
* Destructive and non-destructive testing procedures should be specified.
* All the gates shall be checked for the aeration requirement at its immediate downstream.
1. **Steel Pipes**
	* The steel plate used for the pipes shall comply with National/International Standards.
	* The pipes should be designed considering the following loading conditions:
		+ The normal condition includes static head, surge and water hammer pressure.
		+ Special conditions include those during filling and draining of penstocks and a maximum surge in combination with pressure rise during emergency operations/events and test pressures.
		+ The exceptional condition includes transportation and erection stresses, pressure rise due to the unforeseen operation of regulating equipment in the most adverse manner resulting in an odd situation of extreme loading, the stress developed due to resonance in penstock, seismic forces etc.
	* Adequate safety factors should be provided for safety against hoop stress due to internal and external pressure including surge pressure, longitudinal stress, beam action, temperature

variations. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | * Stress should be checked at bends, branches, transition and stiffeners
* Expansion joints should be provided just below the anchor block whenever possible.
* Special design provision shall be made to protect the penstock pipes/conduits against possible rupture due to denting/negative pressure.
1. **Other Structures**
	* Other HM components such as valves, trash racks, manholes, saddle plates, bulk head gates, bell mouths, steel lining etc. shall be designed to meet structural and hydraulic requirements.
2. **Report Preparation**
	* After finalizing the design, a report should be prepared showing all hydraulic, and structural calculations. Similarly, operating conditions, hoisting mechanisms, opening sizes, design pressures, and dimension of all major components/elements should be mentioned. Based on the detailed design report, a draft operation and maintenance

manual should be prepared. |
| 8.3 | Electro- Mechanical Equipment | 1. Preliminary design/selection of the electro-mechanical equipment should be carried out based on design discharge and net head and number of units (based on hydrology and transportation).
2. A brief description of selected electro-mechanical equipment should be given describing the type of turbine and accessories, generator and accessories, transformers and switchgears.
 | 1. The type and number of generating equipment with necessary equipment and power evacuation facilities should be designed and described.
2. Description of main mechanical equipment including the followings should be provided:
	* Hydraulic turbine
	* Inlet valve
	* Governor
	* Lubricating (hydraulic) system
	* Pressure oil system
	* Compressed air system
	* Cooling system
	* Control system
 | 1. **General**
	* This design is generally carried out by electro-mechanical equipment manufacturers/suppliers, thus only preliminary design for preparing Terms of Reference of tender/contract documents shall be carried out in consultation with potential manufacturers/suppliers.
	* Detailed design and dimensioning of all components/structures carried out during the feasibility study should be reviewed and updated/refined/revised where necessary and presented in the

project definition report. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 3. Description of the main electrical equipment including the followings should be provided: | * Project parameters and design criteria should be included in a Design Basis Memorandum (DBM) referring to relevant national and international guidelines, norms and codes, and past experiences.
* Individual components/elements must be designed for the most unfavourable load combination (mechanical and electrical). In general, loading conditions which may occur during the following phases/cases should be considered:
	+ Transportation
	+ Erection/construction
	+ Testing in factory and site
	+ Normal operation
	+ Special/emergency/extreme cases
1. **Mechanical Equipment**
	* Appropriate turbines and their components should be designed.
	* Suitable inlet valves shall be provided before each turbine.
	* Draft tubes, spiral casing, covers, seals should be designed appropriately
	* A suitable governor system should be provided for flow control to the turbine.
	* Proper auxiliary systems such as heat exchanger system, lubrication system, pressure system, compressed air system, hydraulic system, cooling system, EOT crane, lighting system, fire extinguishing system shall be designed.
	* Control system with local unit and remote (to control room) controlling capability should be provided.
2. **Electrical Equipment**
	* Single line diagram and control diagram for all powerhouse equipment and interconnection points shall be prepared following the latest NEA Grid Code and

other relevant standards. |
| * Generator
* Excitation system
* Switchgears
* Control panel
* Powerhouse earthing
* Power transformer
* Auxiliary transformer
* CT/PT for different voltages
* Earthing system for switchyard
* Hoisting mechanism/overhead crane
 |
| 4. A single line electrical diagram depicting the interconnection of all electrical equipment should be prepared. |
| 5. For the smooth operation of the power station, following auxiliaries should be provided and described: |
| * Grease lubricating system.
* Fire fighting system
* Station supply
* Lighting arrangement
* Heating Ventilation and Air Conditioning (HVAC)
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | * Generators shall be provided with all of their accessories including cooling and fire protection system, the hydraulic system including generator braking and heat exchanger system.
* Excitation system shall be provided with an automatic voltage regulator, excitation transformer and bridge rectifier.
* Power transformers to step up transmission voltage shall be provided with type of cooling, indoor/outdoor arrangement and other required accessories.
* HV switching equipment with bus bars, circuit breakers, disconnecting switches, instrument transformers, etc. shall be provided.
* Control equipment shall be provided consisting of governor monitoring, excitation monitoring, emergency shutting down, valve protection and other protection, etc.
* Station service transformer for redundant power supply to the plant shall be provided.
* Grounding including lightning protection shall be provided.
* Fire protection and ventilation system should be designed and described in detail.
* Emergency exit and safety plan should be described/provided as per available national/international guidelines.
* Diesel Generators shall be provided for backup power and black start/isolation

mode. |
| 8.4 | Power Evacuation and Transmission Line | 1. Assess the possibility of power evacuation through national grid/Integrated Nepal Power System (INPS). | 1. Design and describe the power transmission line and power evacuation system.
2. Prepare a single line diagram representing the major electrical equipment of the powerhouse, switchyard, and substation.
 | 1. The transmission line should be designed following the latest off-takers’/NEA grid code. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | 1. Carry out preliminary design to select voltage level, conductor type and the number of towers.
2. A brief description of the selected power evacuation system should be presented.
 | 1. Describe the details of interconnection equipment as per standards.
2. Design and describe poles/towers, circuit type, type of conductor, other components and safety measures.
 | 1. The route shall be finalized and described. Voltage level, number of circuits and length shall be confirmed.
2. Number and type of towers required shall be determined with location (coordinates) and their structure shall be designed. While designing the foundation of a transmission tower, geology and geotechnical conditions with socio- environmental assessment should be verified and additional investigation should be done, if required.
3. The size of conductors to be used shall be determined. The size of conductors must be selected so that the power loss doesn’t exceed the permissible limit as per latest off-taker’s/NEA Grid Code.
4. Sag, tension and loading in conductor shall be determined.
5. Auxiliary equipment in the transmission line such as insulators, clamps, guards, etc. shall be provided. Equipment to be installed in interconnection substation should be designed.
6. Power transformers shall be required, if the voltage level of a transmission line does not match the voltage level of interconnecting substation including HV switchgear (Circuit breaker, disconnecting switch, etc.), instrument transformers and control and protection equipment.
 |
| **9** | **Energy Computation and Benefit Assessment** |
| 9.1 | Energy Computation | 1. Energy computation should be carried out considering the average monthly flow (daily flow, if available), net head, design discharge and turbine, | 1. Energy computation should be carried out considering daily flow, net head, design discharge and turbine, generator and transformer efficiency. Furthermore, normal and forced outages should be consideredreferring to the off-taker/NEA Grid Code and/or norms | 1. Energy estimated in feasibility study should be updated/refined, if there are significant changes. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | generator and transformer efficiency. Furthermore, normal and forced outages should be considered referring to the off-taker/NEA Grid Code and/or norms and practices. If power output cannot be ascertained at this stage, then the range of annual energy generation should be provided. | and practices. Such energy estimation should be based on fixed installed capacity.1. During energy estimation, environmental and other necessary releases as recommended in EIA/IEE guidelines should be deducted from the available river flow.
2. Average daily, monthly energy and annual energy should be determined in Nepali and Georgian calendar months.
3. Estimated internal energy consumption within the power plant should be deducted from the total/monthly energy to derive saleable energy.
 |  |
|  | 5. Annual estimated average dry and wet energy should be determined considering the dry/wet periods defined by off-taker/NEA. Furthermore, dry energy should be divided into peak/off-peak energy in case of PRoR and reservoir type projects. |
| 9.2 | Benefit Estimation | 1. Average monthly/annual revenue throughout the license period should be calculated considering unit energy prices fixed by the NEA/off taking company/GoN for similar sized projects.
2. While calculating the annual revenue, base rates for dry, wet, peak, off-peak energy prices together with annual price escalation should be considered.
 | 1. Estimated average monthly/annual revenue throughout the license period should be calculated considering unit energy prices fixed by the NEA/off taking company/GoN for similar sized projects.
2. While calculating the annual revenue, base rates for dry, wet, peak, off-peak energy prices together with annual price escalation should be considered.
 | 1. Revenue estimated in feasibility study should be updated, if required.
2. If PPA has been concluded, the revenue estimates should be verified against the PPA.
 |
| **10** | **Cost Estimation** |
| 10.1 | Criteria and Assumptions | 1. Cost estimate during this stage should be based on thumb rules, cost per unit of installed capacity for similar sized projects, and prevailingbulk market prices for civil works, hydro mechanical, | 1. All the criteria and assumptions adopted for cost estimation should be mentioned including the following:* Consideration of the natural conditions prevailing at the site, construction scale, and levels of construction technology available in Nepal.
 | 1. The criteria and assumptions for feasibility level study should be applied but should be based on detailed design with inclusion of items not included in the feasibility level study. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | transmission line and electromechanical equipment. | * To the greatest extent possible, construction equipment available in Nepal should be considered.
 |  |
|  | * A brief description of the project with locations of components should be mentioned.
 |
|  | * Year and month of the cost estimate should be mentioned.
 |
|  | * The exchange rate applied to the calculation of NPR and USD adopted at the time of cost estimation should be mentioned.
 |
|  | * The criteria and assumptions for pre-feasibility level study should be updated based on feasibility level design with inclusion of items not included in the pre- feasibility level study.
 |
|  | * Identifiable Nepalese taxes, customs duties, royalties etc. for goods, materials and services, interest during construction etc. whether included in cost estimation or not, should be mentioned.
 |
|  | * Any source of references to rates or estimation should be mentioned with used escalation factors, if any.
 |
|  |  | 1. The cost estimate should be derived based on the criteria and assumptions discussed above considering the remoteness of the site, length of transmission line interconnection point and other technical features of the project including gross head, design discharge and length of waterways. | The following methodology should be applied for the estimation of the cost of each component of the project. |  |
|  |  | 1. **For Civil Works:** |  |
| 10.2 | Estimation Methodology | * The cost estimates should be based on unit rates developed from the prevailing labour rate, construction equipment rate and materials taking also into account the local situation and bill of quantities derived from design drawings.
* The cost estimate should be done by breaking down major structures into a number of distinct construction activities or measurable pay items.
* Due consideration should be given to local labour. The rates for locally available labour can be obtained either from District Rates of concerned districts or prevailing

market rates of the project area and can be used after appropriate adjustments. | 1. The methodology for feasibility level study should be applied but should be based on a detailed design with inclusion of items not included in the feasibility level study.
2. Carry out necessary updates such as revision of rate analysis.
 |
|  |  | * The rates of construction equipment can be taken from regularly updated cost data, a quotation from the suppliers/manufacturers.
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | * The construction materials to be used for construction work should be divided into;
	+ Materials locally available nearby project area.
	+ Materials available in the local market.
	+ Materials to be imported from neighbouring countries.
	+ Materials to be imported from overseas.
* The rates of construction materials should be derived as per their source of supply. While calculating the construction materials’ rate, sufficient attention should also be given to the mode of transportation and their corresponding costs. When access roads for the project are not built (generally for small hydropower projects) the cost of air transportation for transporting heavy equipment from the nearest town to the project area should also be included.
* From labour cost, material cost and equipment cost, the direct cost per unit of construction activity can be calculated.
* The estimate should be of contractor's type and, therefore, should also include all other indirect costs such as office overheads, contractor's financing cost, insurance bonds, profit and risk margin.
* A suitable percentage for contractor's expenses should be allocated. The total percentage should be used as a bid factor on direct cost. Thus calculated direct cost can be used to derive unit bid costs which in turn, be used to determine the total civil works cost.

2. **For Electro-Mechanical Equipment*** The cost estimate for generating equipment, transformer and switchyard equipment should either be based on quotations obtained from the supplier(s) or in-house estimate using established current international prices or price database from similar type and size projects. The cost should include the cost of control devices/system, auxiliary etc. transportation and erection.

3. **Hydraulic Steel Works*** The cost of hydraulic steel works should be based on a quotation of the supplier(s) or on market price, if they are

locally available. Transportation and installation cost should also be added. |  |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 4. **Transmission Line*** The cost of the transmission line can be calculated from per km rates of the transmission line. References of cost can be taken from current rates used by NEA/off-taker or constructed project of IPPs for same type/voltage of transmission lines taking into account different types of towers required, the conductors and types of terrains being crossed.

5. **Land Acquisition and Access Road*** Due attention should be given to the cost of land acquisition and construction of access roads.
* Cost of land acquisition should be determined considering detailed risk assessment, future development of the project area, accessibility and public demand.
* The length and type of access roads to be constructed or to be improved can be determined from preliminary design. Cost per km of different types of roads can be used to determine the cost of the access road.

6. **Camp and Other Facilities*** The costs of construction camps and permanent buildings required for operation and also of construction power facilities required should be included in cost estimation. A lump sum amount for this can be allocated depending upon the size of the project.

7. **Social Development:*** The cost of social development should be determined from reconnaissance field visits. Factors to determine the social development cost such as population density, available local resources and existing physical infrastructure in the project area should be considered. This cost can be derived as a lump sum taking a reasonable percentage of the project base cost.

8. **Resettlement/Rehabilitation*** Relocation and environment impact mitigation costs shall be as per existing Environmental Protection Act and Rules. At this stage, this cost can be derived as a lump sum taking a reasonable percentage of the project base

cost. |  |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 1. **Community Support Program (CSP)**
	* Include CSP cost as a fixed percentage of the total project cost as per the latest government policies.
 |  |
| 10.3 | Base Cost and Total Project Cost | 1. The total of all costs indicated above will constitute the base cost of the project. To that, the following costs are to be added as a certain percentage of the project cost for obtaining the total capital cost:
	* Engineering and Management
	* Owner's cost
	* Insurance cost
2. Contingencies added to account for unforeseen cost increases due to uncertainties in site conditions for:
	* Civil works
	* Generating equipment and transmission line
3. Interest during construction, cost/amount.
 | 1. The total of all costs indicated above will constitute the base cost of the project. To that, the following costs are to be added as a certain percentage of the project cost for obtaining the total capital cost:
	* Engineering and Management.
	* Owner's cost
	* Insurance cost.
2. Contingencies for civil works, hydro-mechanical, electromechanical, transmission line, price and physical contingencies etc. are to be updated/added to account for unforeseen cost increase due to various uncertainties during project construction.
3. Interest during construction should be calculated based on the prevailing interest rates and other parameters required for the calculation.
4. The exact percentage allocation for the above cost items should be based on prevailing market conditions and general practices.
 | 1. At the detailed design level, due to use of more detailed information collected and minor items included and designs concretized, level of uncertainties will decrease particularly in civil works/HM works/EM equipment and TL works component. Hence, project cost with higher accuracy and reduced contingencies can be calculated |
| 10.4 | Local and Foreign Currency Breakdown |  | 1. Local currency will be required for local labour, local materials, government cost tax, VAT, royalties and customs duties including land acquisition, resettlement, mitigation and management programs related to adverse socioeconomic environment impacts and bank interest.
2. Foreign currency will be required for imported materials and equipment and foreign experts.
 |  |
|  |  | 3. The cost estimation should include a breakdown of local and foreign currency components |
| 10.5 | Presentation of Cost Estimate Data | 1. The cost estimate derived at this stage should include the following:
	* Civil
	* Hydro-Mechanical
	* Electromechanical
 | 1. In the main volume of the report summary cost estimate data broken down into the above mentioned major sub- headings and into foreign and local currency should be presented; while the details of cost estimates including rate analysis and the unit rate could be presented in the Annex volume. | 1. The presentation should be done as in the feasibility level, but with the inclusion of more detailed items based on detailed design and other updated information. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | * Transmission line
* Engineering and construction supervision
* Others such as environment, owner’s management.
 |  |  |
| 10.6 | Cash Disbursement Schedule | 1. The costs incurred will spread over the whole construction period. Interest during construction will depend on how cash will be disbursed during the construction period. Hence cash disbursement schedule should be estimated with disbursement schedule based on experience with similar sized projects with similar criteria (e.g. access, geographical conditions, design parameters). | 1. Cash disbursement schedule should be based on an updated and realistic project implementation schedule.
2. Year-wise cash disbursement against each of the major activities is to be prepared and presented in the report. Cash disbursement can be presented as a certain percentage of capital cost per annum during the construction period.
 | 1. Cash disbursement schedule should be based on updated project implementation schedule, if required. |
| **11** | **Construction Planning and Schedule** |
|  |  | 1. Access, availability of construction materials, waste disposal and construction of camps at the site should be described.
2. River diversion sequences during construction should be tentatively considered.
3. A preliminary construction schedule should be prepared for the project showing the major construction activities. The total construction period should be determined.
 | 1. Review the construction schedule prepared during the pre-feasibility study and update as per the feasibility study’s findings and other prevailing conditions such as market conditions and available technology.
2. Plan contract/procurement/construction modality in coordination with client for pre-construction works, main civil works, hydro-mechanical, electro-mechanical and transmission line works.
3. Prepare a plan for pre-construction activities such as the construction of camps, the establishment of telecommunication facilities, construction/upgrading of the access road(s), arrangement of construction power, etc.
4. Prepare a plan for establishing necessary forest clearance, crusher plants, workshops, fuel depots, permanent camps for operators and site office(s). The

plan should also take into account time for necessary government approvals. | 1. Review the construction planning and schedule prepared during the feasibility study and update as necessary considering anticipated/planned Required Commercial Operation Date (RCOD).4. Plan and confirm the availability, quality and quantity of all construction materials. Special consideration should be given for materials required for high grade concrete, high grade steel etc. |
|  | 5. Land acquisition and environmental mitigation plan should be incorporated. |  |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 1. Prepare a plan for temporary diversion of the river during construction. This may consist of construction of cofferdam(s) and diversion channel at headworks and powerhouse/tailrace outlet.
2. Prepare a plan for construction of headworks, waterways, forebay/surge-tank/surge-shaft, powerhouse, tailrace, switchyard and transmission line including all civil, hydro-mechanical and electro- mechanical works in consultation with potential contractors/suppliers and based on past experience of constructing similar project(s).
3. Describe anticipated construction methodology for all major structures.
4. Update/prepare construction schedule considering above mentioned plans/factors and the following aspects:
	* Seasonal constraints for temporary river diversion
	* Local culture and national holidays
	* Climatic conditions
 |  |
| **12** | **Environmental Study** |
|  |  |  | 1. Guidelines, Acts, Regulations and Manuals to be followed during the environmental study are as follows:* National EIA Guideline, 1993
* Environment Protection Act, 1997
* Environment Protection Regulations, 1997
* DoED Manuals related to Environmental Study
* Working Procedure for Initial Environment Examination (IEE) and Environment Impact Assessment (EIA) of Hydropower and Transmission Line Projects, 2073
* Hydropower Environmental Impact Assessment Manual, July 2018.
 | 1. Guidelines, Acts, Regulations and Manuals to be followed during updating and supplementary environmental study are as follows: |
|  |  | 2. National EIA Guideline, 1993 |
|  |  | 3. Environment Protection Act, 1997 |
| 12.1 | Reference for Environmental Study | 1. Environment Protection Regulations, 1997
2. DoED Manuals related to Environmental Study
 |
|  |  | 6. Working Procedure for Initial Environment Examination (IEE) and Environment Impact Assessment (EIA) of Hydropower and Transmission Line Projects, 2073 |
|  |  | 7. Hydropower Environmental Impact Assessment Manual, July 2018. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
| 12.2 | Initial Environment Examination (IEE) | 1. Collect baseline data of the physical, biological and socio- cultural environment of project affected area to understand the socio-environmental situation.
2. Assess the impacts of major significance.
3. Develop mitigation and management programs to minimize the impacts.
 | 1. Prepare Terms of Reference (ToR) for IEE which includes:
	* Environmental issues of greater significance.
	* Baseline environmental data that supports the relevancy of identified environmental issues.
	* Approval of ToR for the IEE study from Ministry of Energy, Water Resources and Irrigation.
2. Continue the IEE study based on approved ToR.
3. Collect baseline data of the physical, biological and socio-cultural environment of project affected area as per approved ToR.
4. Prepare Initial Environmental Examination (IEE) report, which includes:
	* Baseline environment data
	* Impacts of environmental issues identified in ToR
	* Impact Mitigation and Enhancement Measures
5. Approve the IEE report from Ministry of Energy, Water Resources and Irrigation.
 | 1. Update IEE (if there are changes in project design). |
| 12.3 | Environment Impact Assessment (EIA) (if the project included in schedule 2 of Environment Protection Regulations such as project area lies within the conservation area/national park/wildlife reserves etc.) | 1. Collect baseline data of physical, biological and socio- cultural environment of project affected area to understand the socio-environmental situation.
2. Identify the major environmental issues in physical, biological, socio- economic and cultural environment.
3. Make environmental assessment by simple checklist
4. Assess impacts of major significance.
5. Assess the level of environmental assessment EIA as per the threshold of schedule 2 of EPR and its

amendments. | 1. Permission for conducting EIA from concerned ministry should be obtained, if the project lies within protected area (conservation area/national park/wildlife reserves).
2. Scoping document and Terms of Reference (ToR) for EIA should be prepared which should include the following:
	* Publication of 15 days’ public notice in a national daily newspaper for the scoping of the EIA study.
	* Collection of suggestion from the affected local government and other stake holders of the project area.
	* Record of environmental issues raised by stakeholders, concerned bodies, Government Authorities, local clubs and subject experts
	* Prioritized environmental issues.
	* Baseline environmental data that supports the relevancy of identified environmental issues.
	* Review of relevant national and International legislations.
 | 1. Carryout EMP updates in EIA, if there are minor changes in project design and get it approved from Ministry of Forests and Environment.
2. Carryout supplementary EIA, if there are major changes in project design and get it approved from Ministry of Forests and Environment such as:
	1. If there is change in the project area
	2. If the required forest area is increase by 10 %
	3. If the resettlement population is more than 100 people
	4. If there is significant impact in environmental and biological biodiversity.
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | * Describe basic procedures to conduct EIA
* Approval of Scoping Report and TOR
1. Continue the EIA study based on approved ToR
2. Prepare Environment Impact Assessment (EIA) which includes:
	* Environmental Impacts of the Environmental Issues prioritized in ToR plus additional environmental impacts identified during EIA.
	* Mitigation and Enhancement Measures for the environmental impacts and Environment Management Plan (including Monitoring and Auditing Plan).
	* Baseline on Physical, Biological and Socio-economic and cultural environment domain.
	* Review of relevant national and International legislations.
3. Prepare draft EIA Report
4. Conduct public hearing in the project area.
	* Publication of the notice for the public hearing
	* Muchulka of the public hearing in the project affected areas.
	* Collection of the recommendation letter from the affected local governments.
5. Finalize EIA report including the recommendations of concerned rural municipality and concerns of stakeholders raised during the public hearing.
6. The final EIA (after incorporating the issues raised in public hearing) has to be forwarded for approval to concerned ministry through Department of Electricity Development (DoED).
7. A Review Committee meeting will be held at DoED comprising related government agencies and independent environment experts.
8. Based on the recommendation of review committee, concerned ministry forwards the EIA for Approval.
9. A review committee meeting is organized to seek comments/suggestion on the final EIA report.
10. Further 30 days’ public notice is published in national daily newspaper to seek additional comments and
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | suggestions on the EIA. The draft EIA report along with the public notice has to be placed in public places/office such as TU library, district level office, affected local bodies and concerned government offices.13. Ministry of Forests and Environment approves the EIA based on the recommendations of review committee meeting and response to 30 days’ public notice. |  |
| 12.4 | Resettlement Study | 1. Conduct field survey for gathering the data/information on the population, household lying in the project area and their socio-economic status. Collect information about the number of cattle lying in the project affected areas.
2. Identify the potential land area for resettlement of the displaced people from the project area through map study.
 | 1. Conduct sampling survey over project area for verifying the data/information collected during the pre-feasibility study and collect additional data/information on population, household and their socio-economic status and number of cattle, lying in the project area.
2. Verify through a site visit the potential land area for resettlement identified during pre-feasibility study and identify the new sites, if any.
3. Collect the cost of lands proposed for resettlement.
4. Prepare the resettlement schedule and settlement area. Resettlement area shall be facilitated by all human requirements such as security, health and education facilities, economic resources availability, social and cultural viability etc.
 | 1. Review and update the data/information taken in previous studies.
2. Estimate the total resettlement cost including all requirements such as opportunity loss, educational and environmental effects, physiological, mental and physical health effect, security, social and economic impacts etc.

1. Update and finalize resettlement schedule and settlement area. |
| **13** | **Project Evaluation** |
| 13.1 | Economic Analysis (atleast forprojects under taken bygovernmental bodies) | 1. All significant intangible benefits should be identified and quantified in terms of monetary value to the maximum extent possible. For example, better access roads and bridges, communication facilities and schools could be established around the project area. The regional/national benefits due to these improved infrastructure should be quantified.
2. Employment benefits during construction phase of the project should be quantified. Economic benefits due to

increase in both regular and | 1. Update the economic analysis based on additional information and data available at this stage. | 1. Update the economic analysis based on additional information and data available at this stage. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | seasonal employment should be quantified.1. Economic cost of the project should also take into account opportunity cost (together with construction costs).
2. Economic cost should not include the taxes, duties and royalties. Similarly, it should not include interest during construction.
3. Economic value of project should be calculated in terms of NPV, EIRR and B/C.
 |  |  |
| 13.2 | Financial Analysis | 1. In performing financial analysis, the Financial Internal Rate of Return (FIRR) and the debt servicing parameters are examined based on financing conditions. The financial cost should include, construction cost, duties, taxes, periodic replacement cost, insurance and interest during construction. The benefits will comprise the revenue generation from the sale of electrical energy. As a result of the financial analysis, the financial cash flow showing operating expenses, debt service (loan repayment), royalty and tax payments should be presented.
2. NPV and FIRR could be used as financial indicators.
 | 1. In performing financial analysis, the Financial Internal Rate of Return (FIRR) and the loan repayment capacity are examined based on financing conditions.
2. The financial cost should include investment cost/base cost (study, preconstruction, civil, HM, EM, TL), O & M cost, duties, royalties, taxes, price escalation, periodic replacement cost, project environment and management cost, insurance and interest during construction.
3. To determine the project’s life from a financing perspective, the concession period should be considered.
4. The benefits will comprise the revenue generation from the sales of electrical energy. As a result of the financial analysis, the financial cash flow showing operating expenses, debt service (loan repayment), royalty and tax payments should be presented.
5. All assumptions including finalizing conditions made for the analysis should be clearly stated.
6. NPV and Financial Internal Rate of Return (FIRR) method should be adopted.
7. In the detailed financial analysis, Net Present Value (NPV), Benefit-Cost Ratio (B/C), Project IRR, Return on Equity (RoE), Equity NPV, Annual Debt Service Coverage Ratio (ADSR), discounted payback period and Levelized Cost of Energy (LCOE) etc. should be calculated.
 | 1. Review all previous analysis and update the financial parameters, assumptions and results based on updated market conditions and any updates on the government’s policy (e.g., tax, royalty etc.). The financial parameters such as NPV, IRR, B/C, Equity IRR and NPV, debt service coverage ratio etc. should be updated accordingly. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | 1. General expected financial parameters are as follows:
	* Internal Rate of Return on the project (IRR) - higher than the discount rate.
	* Net Present Value on the project (NPV) - positive.
	* Debt Service Cover Ratio (DSCR)—higher than 1.0.
	* Benefit Cost Ratio – higher than 1.0
 |  |
| 13.3 | Sensitivity Analysis |  | 1. Sensitivity analysis is required to be performed in general, for the following cases:
	* Varied discounted or interest rates based on prevailing market rates.
	* Varying capital cost for possible best and worst case scenarios.
	* Reduction in revenue generation taking into account hydrological risks.
	* Delay in commissioning of the project.
	* The cumulative effect of cost and time overruns.
 | 1. Update the sensitivity analysis carried out in the feasibility study based on current market conditions and new information/data available at this stage. |
| **14** | **Presentation Drawings, Maps, Charts and Tables** |
| 14.1 | General | 1. Prepare location Map in appropriate scale.
2. Prepare maps showing physiographic regions and geographical regions.
 | 1. Prepare location map in appropriate scale.
2. Map showing physiographic regions and geographical regions should be included.
3. Project general layout should be presented with the license boundary in topomap in scale 1:25,000 or 1:50,000 as available.
 | 1. Prepare location map in appropriate scale.
2. Map showing physiographic regions and geographical regions should be included.
3. Project general layout presented with license boundary in topomap in scale 1:25,000.
 |
| 14.2 | Topography/ Topographical Survey | 1. Generally, this level of study is considered to be carried out based on available maps. Survey works, if carried out during this study including verification of head, license boundaries etc. should be documented in appropriate scales. | 1. Control survey map showing benchmarks or travels stations and detailed features of the project area in appropriate scale should be presented.
2. Survey data and d-cards (with photographs) should be included in the appendix.
 | 1. Control survey benchmarks or traverse stations with their x, y, z coordinates (in a separate table) should be given in general arrangement drawings (with contours) for all components for reference and further use during construction and operation phases of the project.
2. Updated (if any) survey maps, data and d-cards with photographs should be documented and presented in the Appendix.
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
| 14.3 | Hydrology | 1. Drainage Basin Map showing area below 3000 amsl, 3000 to 5000 amsl and above 5000 amsl can be prepared.
2. Field measurement(s) should be presented in a tabular form with details, location, time and date.
3. Adopted monthly (daily, if available) flows and flood frequency table should be prepared.
4. Prepare Flow Duration Curve (FDC).
5. Prepare Reference Hydrograph and flood frequency charts.
 | 1. Drainage Basin Map showing the area below 3000 amsl, 3000 to 5000 amsl and above 5000 amsl can be prepared.
2. Field measurements should be presented in a tabular form with details, location, time and date.
3. Rating curves of headworks site and tailrace site should be presented.
4. Long term series data should be included.
5. Various methods of flow estimation, adopted daily flow and flood discharge in different return periods should be presented in tabular form.
6. Flow duration curve should be presented.
7. Prepare reference hydrograph and flood frequency charts.
8. A discharge-sediment relationship should be presented.
9. Sediment sample and laboratory analysis report should be included in the Appendix.
10. The result of sediment analysis and laboratory tests should be summarized in tabular form and charts.
 | 1. Updated hydrology report with recommended/adopted daily flow, FDC at headworks and tailrace outlet with tables, design floods and diversion flood during construction. |
| 14.4 | Geology and Seismicity | **Prepare drawings as follows:**1. Regional geological maps (plan and section in scale 1:250,000 or in available larger scale).
2. Geological Map of Project Area (plan and section in scale 1:25,000 or 1:50,000 or larger, if available).
3. Site specific geological maps as follows:
	* Headworks in scale 1:500
	* Water conveyance route in scale 1:5000 or larger
	* Powerhouse in scale 1:500
4. Map showing Seismic Refraction Lines, Electrical
 | 1. Prepare regional geological maps (plan and section in scale 1:250,000).

Prepare drawings as follows:1. Geological map of project area (plan, profile & section in scale 1:5,000).
2. Site specific geological maps (sections with drill whole logs, if any).
3. Headworks drawings in scale 1:500.
4. Water conveyance route in scale 1:2000.
5. Powerhouse in scale 1:500.
6. Map showing Seismic Refraction Lines, or Electrical Resistivity (if required) in scale 1:2000 or larger.
7. The result of geological investigation to be presented in a tabular format.
8. A Map showing Borrow Areas and Test Pits and Trenches in scale 1:2000 or larger.
 | 1. Prepare drawings for updated geology and seismicity report |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | Resistivity, if available in scale 1:5,000.5. Seismicity Map in available scale. | 10. Seismicity Map in scale 1:2,000,000 or 1:1,000,000. |  |
| The above mentioned scales are suggestive only. An appropriate scale should be used to make the information/ data presented in the drawings/report clear and readable/understandable. |
|  |  | 1. Location of alternative project components plans and alignments should be shown in appropriate scale. | 1. Location of alternative project components plans and alignments should be presented in appropriate scale.
2. Cost and energy comparison charts and tables should be prepared.
3. Financial evaluation charts and tables should be prepared.
 |  |
| 14.5 | Alternative Study | 2. Preliminary cost and energy comparison charts and tables should be prepared. |
|  |  | 3. Financial evaluation charts and tables should be prepared. |
| 14.6 | Optimization | 1. Not required. | 1. Optimization study charts and tables should be prepared. |  |
|  |  |  | 1. Following drawings in suitable scale should be prepared:
	* Alternatives considered
	* General arrangement of selected project
	* Headworks plan (general arrangement, elevations andsections)
	* Settling basin (plan and sections)
	* Headrace water conduit system (plan and profile)
	* Forebay/surge tank (plan, sections, profiles)
	* Penstock (plan, sections, profiles)
	* Powerhouse and tailrace (plan, sections and profiles)
	* Switchyard layout
 | 1. Following drawings should be prepared: | 1. Prepare civil general arrangement drawings of all components, showing benchmarks, setting out points with their coordinates and all necessary details.
2. Reinforcement drawings of all structures with bar bending schedules should be prepared.
3. Preliminary drawings of all hydro- mechanical components with necessary dimensions/schedules should be prepared.
4. Preliminary drawings of all electromechanical-mechanical components with necessary dimensions/schedules should be prepared.
5. Preliminary drawings of all switchyard components and accessories with necessary dimensions/schedules should be prepared.
6. Preliminary drawings of all transmission line components and accessories with
 |
|  |  |  | * Alternatives considered in scale 1:5000 or larger.
* General arrangement/layout of selected project in scale 1:5000 or larger.
 |
|  |  |  | * Headworks (general arrangement, elevations and sections) in scale 1:500 or larger
* Headworks components, weir, undersluice, intake,

gravel trap etc. plan, sections (L-section, cross sections) and elevations in appropriatescale. |
| 14.7 | Design Drawings | and | * Settling basin (plan and L-section in scale 1:500 and crosssections in scale 1:200 or larger).
* Headrace water conduit system (plan and L-section in scale 1:2000, sections in scale 1:100 or larger).
* Forebay/surge tank (plan and L-section in scale 1:200, cross sections in scale 1:100 or larger).
 |
|  |  |  | * Penstock (plans and L-sections in scale 1:200 or larger, cross sections in scale 1:100 or larger).
 |
|  |  |  | * Powerhouse (general arrangement in scale 1:500, plan and sections in scale 1:200 or larger).
 |
|  |  |  | * Powerhouse –switchyard layout in scale 1:500 or larger.
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  | * Single line diagram
* Protection structures (plan in scale 1:200 and sections in scale 1:100 or larger).

The above mentioned scales are suggestive only. An appropriate scale should be used to make the information/data presented in the drawings/report clear and readable/understandable. Distorted scales are notrecommended. | necessary dimensions/schedules should be prepared.7. Preliminary drawings of all interconnection point’s components (switchyard/substation) accessories with necessary dimensions/schedules should be prepared.**Drawings of Civil Structures** |
|  | The following civil drawings should be prepared: |
|  | 1. General arrangement/layout of selected project in scale 1:5000 or appropriate scale. |
|  | 2. Headworks (general arrangement, elevations and sections) in scale 1:500 or larger. |
|  | 3. Headworks components, weir, undersluice, intake, gravel trap etc. plan, sections (L-section, cross sections) and elevations in appropriate scale. |
|  | 4. Settling basin (plan and L-section in scale 1:500 and cross sections in scale 1:50 to 1:200 or larger). |
|  | 5. Headrace water conduit system (plan and L-section in scale 1:2000, sections in scale 1:100 or larger). |
|  | 6. Forebay/surge tank (plan and L-section in scale 1:200, cross sections in scale 1:100 or larger). |
|  | 7. Penstock (plans and L-sections in scale 1:200 or larger, cross sections in scale 1:100 or larger). |
|  | 8. Powerhouse (general arrangement in scale 1:500, plan and sections in scale 1:50 to 1:200 or larger). |
|  | 9. Powerhouse –switchyard layout in scale 1:500 or larger. |
|  | 10. Single line diagram. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | 11. Protection structures (plan in scale 1:200 and sections in scale 1:100 or larger).**Reinforcement Drawings**1. Reinforcement drawings should be prepared based on Civil General Arrangement drawings in scale 1:10 to 1:50 as appropriate.**Drawings of HM Components**1. Gates and accessories parts should be shown in appropriate scale.
2. Expansion joints, manhole covers, valves, gates driving system etc. should be shown in appropriate scale.
3. Other HM components should be prepared in appropriate scale.

**Drawings of E-M Components**1. General layout should be prepared in scale 1:500 or larger.
2. L-Sections should be prepared in scale 1:500 or larger, cross sections in scale 1:100 to 1:200 or larger.
3. Details should be prepared in scale 1:10 or larger.

**Drawings of Transmission Line (TL) Components**1. A general layout of TL alignment (plan in scale 1:5000 and profile in scale 1:500 to 1:2000 or larger).
2. Tower/pole in scale 1:100 to 1:200.
3. The support structure in scale 1:100 or appropriate scale depending on size of structures.
4. General arrangement of connection bay/switchyard in scale 1:500 or appropriate standard scale.
5. Steel structures and equipment foundation in scale 1:10 to 1:100.
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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | 6. Single line diagram.The above mentioned scales are indicative only. An appropriate scale should be used to make the information/data presented in the drawings clear and readable/understandable. Distorted scales are not recommended. |
| 14.8 | Energy and Revenue Calculation | 1. Prepare monthly energy (daily, if data available) and revenue calculation tables and charts. | 1. Prepare daily & monthly energy and revenue calculation tables and charts. | 1. Updated daily & monthly energy and revenue calculation tables and charts in comparative format with proposed or agreed power and energy table of PPA (if available) should be prepared. |
| 14.9 | Power Supply | 1. Present alternatives available for interconnection points in the INPS. | 1. Present a map of INPS (existing and planned) in appropriate scale.
2. Present a map showing transmission line alignment along with alternatives considered in appropriate scale.
 | 1. Update maps prepared during the feasibility study as necessary |
| 14.10 | Access Road | 1. Show access road drawings plan in suitable scale /best available map).
2. Show plan for alternative access (if any).
 | 1. Access road drawings plan should be shown in suitable scale or drawn based on best available maps.
2. Plan of alternative access (if any) should be shown.
 | 1. Access road map/drawings (plan in scale 1:5000, cross sections in scale 1:100 or larger and profile in scale 1:2000 or larger) should be prepared.
2. Drawings of ropeways and other alternative arrangements as required should be prepared in appropriate scale.
 |
| 14.11 | Construction Schedule and Planning | 1. Preliminary construction planning and implementation schedule showing major activities should be prepared. | 1. Detailed construction schedule should be prepared in standard format showing major project components including anticipated critical path. | 1. Detailed construction schedule in standard format should be prepared showing major project components. |
| 14.12 | Cost Estimation | 1. Prepare items rates for major works in tabular form.
2. Present project cost derived in tabular forms.
3. Rate analysis and quantity estimation tables should be attached in the Appendix.
 | 1. Items rate for major works should be presented in tabular form.
2. Project cost derived should be presented in tabular form.
3. Pie charts and graphs as necessary should be included.
4. Rate analysis and quantity estimation tables should be attached in the Appendix
 | 1. Item rates for major works prepared during the feasibility study should be updated.
2. Detailed project cost/engineer’s estimate derived should be presented in tabular form.
 |
| 14.13 | Project Evaluation | 1. Total project cost including financial cost derived in tabular form stating basis used and assumptions made while carrying out the financial evaluation should be included. | 1. Total project cost including financial cost derived in tabular form stating basis used and assumptions made while carrying out the financial evaluation should be presented. | 1. Updated total project cost including financial cost derived in tabular form stating basis used and assumptions made while carrying out the financial evaluation should be presented. |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  | 2. Results of financial analyses for the base case and most likely case should also be presented in tabular form. | 1. Results of financial analyses for the base case and most likely case should also be presented in tabular form.
2. Sensitivity results covering all possible scenarios studied/analysed should be presented in tabular form.
 | 1. Results of financial analyses for the base case and most likely case should also be presented in tabular form.
2. Sensitivity results of feasibility study should be updated based on market conditions and new data/information available at this stage.
 |
| 14.14 | Report | 1. Standard cover page, signature page, summary page, abbreviations, the body of report and conclusions and recommendations are required in standard report.
2. Generally accepted standard table of contents, list of figures, list of tables, heading’s font, size and style, paragraph arrangement, letter size, font and style, caption and cross reference, line spacing, etc. should be used in the report. The suggested report format given in Appendix, may be used.
3. The report should include:
	* Main report
	* Relevant annexes and appendices
	* Engineering drawings
 | 1. Standard cover page, signature page, summary page, abbreviations, the body of report and conclusions and recommendations are required in standard report.
2. Generally accepted standard table of contents, list of figures, list of tables, heading’s font, size and style, paragraph arrangement, letter size, font and style, caption and cross reference, line spacing, etc. should be used in the report. The suggested report format given in the Appendix may be used.
3. Separate volumes of report as necessary including investigation data (if any) calculations and drawings should be prepared as follows:
	* Main report
	* Relevant annexes and appendices.
	* Drawings
4. Periodically updated information in the form of progress report should be provided to owner/client/executives agency/regulating authorities with a cover letter as and when required.

In case of significant change(s) to the layout, design and or any other project parameters, such change(s) shall be reported in time to the client and regulating authorities with necessary supporting documents for timely approval. | 1. Standard formats/styles as suggested in the feasibility study report section should be followed while preparing all reports prepared as the outcome of detailed design. The following report should be prepared during the detailed design.
2. Project Definition Report: This is generally prepared at the beginning of detail design phase as guidelines for further design/development of the project. In the report, all base line data, up to date salient features of the project and project engineering parameters including relevant codes adopted, cost and revenue calculations financial indices, project implementation schedule, etc. should be briefly described.
3. When numerical and physical hydraulic model studies are carried out, separate reports should be prepared recommending further design refinements based on the outcomes of such studies.
4. Design Basis Memorandum (DBM): This document is prepared as project’s customized standards agreed for adoption in the detailed design of all components of project related to civil, hydro-mechanical, electro-mechanical and transmission line works. All relevant baseline information and other project

information given in the project definition |

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| **S.N.** | **Study Items** | **Details of Study Requirements** |
| **Pre-Feasibility Study** | **Feasibility Study** | **Detailed Design Study** |
|  |  |  |  | report, model study report, relevant codes and standards to be followed during detailed design should be documented in this report. DBM should be approved by the client before proceeding the detailed design further. Necessary amendments to the DBM should be made on need basis with timely approval from the client during the course of detailed design as and when required.1. Detailed Design Report: Main outcomes of the detailed design are reports, drawings (general arrangement and reinforcement), and specifications. The reports, drawings and specifications together with design calculation sheets can be structured in different volumes. An example of detailed design report volume is suggested below:
	* Volume-1: Detailed design main report
	* Volume-2: Detailed design annexes and appendices
	* Volume-3: Detailed design drawings:
		+ Volume-3A: Detailed design civil drawings
		+ Volume-3B: Reinforcement drawings
	* Volume-4: Technical specifications
2. The abovementioned report and documents will be the basis for the preparation of tender documents which are usually prepared during detailed design phase of a hydropower project.
3. In addition to the abovementioned report it is suggested to prepare a draft operation and maintenance manual for the power plant which should be further

refined/updated during construction/installation of the project. Such a manual should cover operation and maintenance guidelines for civil, H-M, E-M and TL components.8. Periodically, updated information in the form of progress reports should be provided to owner/client/executive agency/regulating authorities with a cover letter as and when required.In case of significant change(s) to the layout, design and or any other project parameters, such change(s) should be reported on time to the client and regulating authorities with necessary supporting documents for necessary approval. |

**Annex-III: Expression of Interest (EOI) by Applicant**

**[Hiring a Consultancy Firm to Prepare the Feasibility Study of Small and Medium HPP**

**in the Kyrgyz Republic]**

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Edzwan Anwar**

Operations Team Leader-EI

Regional Hub of Almaty

Islamic Development Bank

Email: EAnwar@isdb.org / DAbylkhan@isdb.org / ArKenzhegulov@isdb.org / idbroa@isdb.org

Phone: +7 727 2727000

(I/We) have read carefully your Invitation for Expression of Interest for the captioned assignment/project and find the Terms of References (TOR) and Scope of Work match the (my/company) skill mix and experiences for providing the services required in the TOR. (I/We) would like to express (my/company) interest being considered for the Shortlist. (I/We) understand that IsDB does not have an obligation that (I/we) must be shortlisted.

(I/We) have attached to this EOI supporting documents highlighting the relevant expertise and Experience for your consideration. Some of the key information is highlighted below:

1. **Company Profile** :

|  |
| --- |
| Specialization:Permanent Address: Phone No.:Email:  |

1. **Qualification of the Consultancy Firm:**

*Notes to consultancy firm: Please indicate all relevant qualifications and professional accreditations that make the company suitable for the assignment. Indicate relevant qualification, place from where the qualification was obtained, year etc]*

1. **Past Consultancy Assignment References**

*[Notes to consultancy firm: Please select most relevant consultancy assignments the company have recently completed to demonstrate its technical qualifications and experience. ]*

| Period | Client | Project | Country | Company’s role (As lead consultant or as sub-consultant?) | Value of theContract |
| --- | --- | --- | --- | --- | --- |
|   |   |   |   |  *Can elaboarate further below* |  |
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1. **Methodology and Work Program to Deliver the Assignment**

*[Notes to consultant: Please outline within a maximum of 2 pages on methodology the company will adopt to deliver the assignment, including key steps, processes, and activities that the company will undertake to achieve the consultancy assignment objectives. Also indicate any sub-consultants the company will engage to support engineering aspects of the assignment and their specialization and experience. Also provide a timeline/ work program for delivery of assignment objectives in line with the TOR requirements, indicating breakdown of key activities with milestones.}*

1. **Eligibility Declaration**

(I/We), the undersigned, certify to the best of my knowledge and belief:

(I/We) have read terms of reference (TOR) and Scope of Work (Appendix A), for this assignment.

(I/We) confirm that the project references submitted as part of this EOI accurately reflect the experience of myself.

(I/We) confirm that I have never been convicted of an integrity-related offense or crime related to theft, corruption and fraud.

(I/We) understand that any misrepresentations that knowingly or recklessly mislead, or attempt to mislead may lead to the automatic rejection of the proposal or cancellation of the contract, if awarded, and may result in further remedial action, in accordance with IsDB’s Integrity and Anti-corruption Policy.

(I/We) shall be available for the assignment as per the requirements

1. **Attach CV of the Lead consultant as well as any sub-consultants to be engaged**