

**Suri Khola Hydropower (P.) Ltd**  
Kathmandu



**Desk Study Report**  
of  
**33 kV Double Circuit Transmission Line Project**  
Of  
**Suri Khola Hydropower Project**  
Dolakha District, Janakpur Zone, Nepal

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### **Annexure**

- i Breakdown of cost for feasibility and environmental study of Transmission line
- ii Work Schedule for feasibility and environmental study of Transmission line
- iii. Topo Map of the showing project layout with alternatives

# **1 Desk Study Report and ToR for Feasibility Study of TL**

## **1.1 General**

Suri Hydropower Pvt. Ltd. has applied for survey license of 33 kV double circuit transmission line to conduct feasibility and environmental study. In this regard, Feasibility Report of the project through Technical Consultant has to be framed. Suri Khola hydropower project is located at Chankhu and Suri VDCs of Dolakha district. The installed capacity of the project is 7 MW. The electricity generated is proposed to connect to INPS through 33 kV double circuit transmission line to 132/33 kV Singati Substation. This Desk Study Report with Terms of Reference is prepared for conducting feasibility studies and preparing a Detailed Project report/Feasibility Report (the "Feasibility Report" or "FR") for construction of 33kV double circuit transmission Line from Suri Khola Hydropower Project Powerhouse to Singati Substation.

## **1.2 Description of Transmission Line Route**

Suri Khola Hydropower Project area is located in Dolakha district of Central Development Region of Nepal. The Transmission line route starts from the powerhouse of Suri Khola Hydropower Project that lies at Gurumphi village of Suri VDC and finally ends at Singati Substation owned by Nepal Electricity Authority. In this stage of study two alternatives has been proposed. The other possible alternatives shall be explored at site during feasibility study of the project. However, it will be tried to align the route along the existing road from the point of view of easiness and less time consuming in fault identification process. Physiographically the transmission line route area belongs to the middle mountains. Geographically the project area is located between longitudes 86° 14' 00"E to 86° 09' 40"E and latitudes 27° 46'00" N to 27° 43'30" N.

### **Alternative I:**

The 33 kV double circuit transmission line starts from the powerhouse of the project located at Gurumphi village of Suri VDC and passes through Sumna, Suri Dovan, Olitar of Laduk VDC and finally to Singati Substation at Singati Bazaar of Lamidada VDC.

### **Alternative II:**

The 33 kV double circuit transmission line starts from the powerhouse of the project located at Gurumphi village of Suri VDC and passes through Sumna and crosses Tamakoshi River at Suri Dovan and follows road of Upper Tamakoshi HEP until Bhorle then goes uphill of Laduk Village towards Moldun, follows the trail of Ladhuk, and finally joins to Singati Substation at Singati Bazaar of Lamidada VDC.

The layout of these alternatives has been shown in topo maps in annex.

### **1.3 Accessibility of Suri Khola Project Area**

Charikot is 133 km away from Kathmandu in the North-East direction. Nearest market is Charikot, (i.e. headquarter of Dolakha district) which is about 42 km away from the power house site. The project is connected by earthen road from Bhorle at Tamakoshi access road. There is RCC Bridge under construction over Tamakoshi River near Bhorle bazaar. The earthen road starts after crossing Tamakoshi River Bridge near Bhorle. This road connects proposed alignment and powerhouse. Alternatively access from Bardibas can also be used if the road is ready by the time the project construction starts. This road starts from Bardibas following B.P. Highway up to Khurkot and follows Manthali, Khimti power house and finally to Charikot. From Charikot, the same route as indicated above can be followed. For the transportation of materials coming from the south, use of this route will curtail the distance as compares with transportation via Kathmandu. This access route will be used after completion of bridge under construction over Sunkoshi River at Khurkot. This route will not be useful for the transportation of equipments and materials from Kathmandu.

### **1.4 Objectives of Study**

- 1.4.1 The objective of study is to prepare a Detailed Project Report/Feasibility Report (FR) for Construction of 33kV Transmission Line from Suri Powerhouse to 132 kV national Grid Sub-Station at Singati, Dolakha.
- 1.4.2 The Feasibility Report would be expected to provide, on the basis of available information and the information to be collected as required, a detailed, and verifiable survey description of the route alignment. The primary objectives of the FR would be to achieve the following;

### **1.5 Methodology of study**

The complete procedures for the execution of different tasks are explained herewith in details.

#### **SURVEY (detail survey, estimating of quantities & spotting of towers/ poles).**

- (I) Walk over survey: Total Station survey, profile survey (if required) shall have to be carried out to establish the route alignment by the consultant for new 33 KV lines. If the line is passing by any Municipal/ town areas, permission from local bodies, concerned authority has to be indicated prior to execution of work.
- (II) Details of land, the 33kV Tr. Line passing through, like the portion of Tr, Line passing in Forest Land, Paddy Land, Orchard land Barren land. The survey shall give the details of Trees to be felled during execution. The details of Departments involved for assessing the cost of trees and land wherever required.
- (III) Detailed cost Estimation of items in section (II) above shall be framed on assessed rates the concern departments involved.
- (IV) Detailed marking of pole, Double pole, Four Pole, Tower Structure and Underground cables all along the route as per the route profile shall be carried

out. The marking shall be clear and visible at the time of check survey and execution.

(V) All the concerned parties along the route alignment. i.e departments involved and public shall be taken into confidence while carrying out detailed survey of the route alignment, so that ROW( Right Of Way) problem is solved instantaneously. Wherever such problem arises documental evidence shall be created between the parties so that at the time of execution no ROW problem is entertained. However, incase of unavoidable constraints the matter shall be discussed with the concerned authorities. Involvement of forest land should be restricted as far as possible.

(VI)While carrying detail survey of the route alignment following points shall be taken care:

(a)The line is as near as possible to the available roads in the area and the route is straight and short as far as possible.

(b) Good farming areas, religious places, forest, civil and defense installations, aerodromes, public and private premises, ponds, tanks, lakes, gardens, and plantations are avoided as far as practicable.

(c) The line should be far away from telecommunication lines as reasonably possible. Parallelism with these lines shall be avoided as far as practicable.

(d) Crossing with permanent objects are minimum but where unavoidable preferably at right angles.

(e) Difficult and unsafe approaches are avoided.

(f) For river crossing/ Crossing of drains : Taking levels at 25 meter interval on bank of river and at 50 meter interval at bed of river so far as to show the true profile of the ground and river bed railway/road bridge, road. The levels shall be taken at least 100 m. on either side of the crossing alignment. Both longitudinal and cross sectional shall be drawn preferably to a scale of 1:2000 at horizontal and 1:200 vertical.

(g) Route of Cable shall be surveyed thoroughly and marked in the drawing for laying of cable in HDD method. After completing the detailed survey, the consultant shall submit the final profile and tower schedule (with no. of stay or structure) and Cable layout for final approval. To facilitate checking of the alignment, suitable reference marks shall be provided. For this purpose, concrete pillars of suitable sizes shall be planted at all angle locations and suitable wooden/iron pegs shall be driven firmly at the intermediate points.

#### **PROFILE PLOTTING AND TOWER/POLL SPOTTING:**

With the help of sag template, final tower location shall be marked on the profiles and while locating the tower on survey chart, the following shall be kept in mind:

SPAN should be as near as possible to the basic design span so that the minimum ground clearance should not less than 7.0 mts in cross country at maximum sag condition.

## **SUB-SOIL INVESTIGATION**

(In case of river crossing locations/other locations where PILLING may be required) an adequate ground clearance, sub-soil investigation through reputed soil consultant shall be carried out.

## **LABORATORY TEST S OF SOIL SAMPLES**

Adequate volume of test samples shall be collected from site and transported carefully to laboratory for carrying out necessary laboratory tests to find out the following parameters of every samples. Data and time of taking of the sample shall be recorded in the test report.

- a) Natural moisture content, Liquid limit, Plastic limit and Plasticity index.
- b) Bulk, dry and buoyant density of soil.
- c) Void ratio (e-long P curve shall be submitted)
- d) Specific gravity.
- e) Grain size distribution (Sieve analysis and hydrometer analysis)
- f) Tri-axial and consolidation tests (consolidation undrained and consolidated drained as and when application in table, graph and drawing.
- g) Permeability tests
- h) Chemical tests for both water and soil samples at different layers.
- i) Evaluation of safe bearing capacity at different strata for square footings shall be done for a maximum value of 25-mm. settlements.
- j) At depths from 3M to 25 different strata.
- k) Factor of safety shall be considered as 3 for evaluation of safe bearing capacity of soil.
- l) Unconfined compression test for cohesive soil if encountered.

## **REPORT ON SUB- SOIL INVESTIGATION**

Comprehensive report shall have to be prepared, finally incorporating all the data collected in proper tabular forms or otherwise along with the analysis.

- a) Geological information of the region.
- b) Past observations and historical data, if available, for the area or for other areas with similar profile or for similar structures in the nearby area.
- c) Procedure of investigations employed at field as well as laboratory test results.
- d) Net safe bearing capacity and settlement computation for different types of foundations for various widths and depths of tower and building.
- e) Recommendations regarding stability of slopes, during excavations etc.
- f) Selection of foundation types for towers, cable duct construction wherever required etc.
- g) Bore hole and trial pit logs on standard proforma showing the depths, extent of various soil strata etc.
- h) A set of longitudinal and transverse profiles connecting various boreholes shall be presented in order to give a clear picture of the site, how the soil/rock strata are varying vertically and horizontally.
- i) Modulus of sub grade reaction from plate load test for pressure ranging up to 6 kg/cm<sup>2</sup>.

The recommended values shall include the effect of size, shape and depth of foundations.

- j) Deformation modulus from plate load test in various test depth/stratification.

- k) Coefficient of earth pressure at rest.
- l) Depth of ground water table and its effect on foundation design parameters.
- m) Recommendations regarding stability of slopes, during shallow excavation etc.
- n) Whether piles are necessary or not. If piles are necessary, recommendation of depth diameter and types of piles to be used.
- o) Recommendations for the type of cement to be used and any treatment to the underground concrete structure based on the chemical composition of soil and sub-soil water.

## **1.6 Content of Feasibility Report**

The Detailed Project Report shall contain all descriptions, Technical details; Preliminary data required for design and cost estimation of the 33kV Transmission Line detailed as below.

- a) The Preliminary Tower designs data for design purpose and all the BOQ to be prepared.
- b) The required data for foundation designs to be done for different soil classifications like normal, submerged, hard rock, fissured rock etc and provisional quantities to be indicated in the BOQ.
- c) The detailed data required for designing/selection with IS specifications of following items.
  - Construction of foundation (Civil Work) for the towers, 4 poles structure and DPs.
  - 33 kV Isolator with earth switches, required if any.
  - DP structure and 4-Pole structure with required Insulators and H/W fittings.
  - 33 kV Lightning Arrestors.
  - HG Fuse unit.
  - 33KV XLPE UG Cable with spares and accessories, wherever required as per route profile.
  - all other material items required for construction of 33kV double circuit Transmission Line, which are not defined above.
- d) Defining Technical specifications for all materials as per IS and Technical Guaranteed Particulars for each material item:
- e) Provisional quantities/numbers of different types of tower structures/poles, Length of cables, Conductors etc, has to be estimated and indicated in the BOQ Schedule. However final quantities for work shall be determined on the basis of detailed survey carried out by the consultant in the Feasibility Report above.
- f) Cost estimation as per BOQ prepared of whole 33kV line.

## **1.7 Scope of Services**

- 1.7.1 The scope of services shall comprise collection of the necessary data and information relating to technical feasibility and financial viability of the Project and to carry out the required assessments, analyses, evaluations and studies, and to prepare the required preliminary designs, preliminary specifications, estimated bill of quantities, cost estimation and other necessary information for preparation of the Feasibility Report to facilitate tendering out the project through a competitive bidding process.
- 1.7.2 The scope of services is briefly explained below:
- 1.7.3 Assessment of possible technical, social and commercial risks together with suggested mitigation options.
- 1.7.4 Listing of all the relevant regulations, codes, standards, rules, statutory requirements, provisions of law and other such relevant references that would provide a ready reference to the prospective bidders for obtaining necessary clearances and for undertaking the operation and maintenance of the Project.
- 1.7.5 Environmental and social impact assessment in compliance with the applicable laws, policies, regulations and guidelines of the government and suggest a strategy to address the underlying issues, including measures to mitigate the negative impacts so as to facilitate the development of the Project.
- 1.7.6 Techno-economic justification: The Feasibility Report shall include evaluation and assessment of the technical feasibility and economic justification and financial viability of the Project, including identification of the possible technical and commercial risks together with suggested mitigation options.
- 1.7.7 System operation requirements: The Study shall assess the technical standards applicable for the transmission line system under Code of Nepal Electricity. It is assumed that a project of this scope would normally follow international standards. ISO recommendations shall govern the quality of project components, including design, engineering, and equipment fabrication, testing and commissioning. It will be necessary to take into account the need for compatibility with the transmission system.
- 1.7.8 The Consultant shall address the following aspects while defining the Project:
- (a) preventive and restorative maintenance of 33kV Transmission lines;
  - (b) requirement of spares;
  - (c) emergency restoration system for the 33kV level System;
  - (d) ancillary services requirements;
- 1.7.9 Operation and Maintenance Plan: The study shall suggest the principal elements of an Operation and Maintenance (the "O&M") plan for the Project. This may include facilities such as protection, communication, measurement, telemetry and interface equipment.
- 1.7.10 Design, Technical Specifications and Construction standards. The consultant will be responsible for preparing the preliminary design data, technical specifications



and construction standards of the Project, sufficient for awarding the Project contract.

- 1.7.11 Based on the extant specifications and standards, the Consultant shall prepare the main characteristics and guaranteed technical particulars of the new equipment, including a description of the basic components of the Project—general layout, single line diagrams etc.
- 1.7.12 Cost Estimates. It will be required to prepare preliminary civil and electrical layout plans in sufficient detail to form the basis for the cost estimate(s). The study team shall prepare the cost estimates for the Project, including identification of the costs of the various system elements (such as cables, conductors, transformers, switchgears, capacitors, lightning arrestors and insulators, the control and communication system, engineering and project management, supervision and contingencies). The Project costs comprising the construction costs. To the total construction cost so arrived at, the Consultant may add 25% (twenty five per cent) thereof as a lump sum provision for physical and price contingencies, interest during construction and other financing costs, pre-construction expenses etc.
- 1.7.13 Project Implementation. The study team shall propose an overall implementation plan and schedule for the Project taking into account, system constraints and other relevant factors.

## **1.8 Deliverables**

- 1.8.1 The Consultant shall deliver the feasibility report (the “Deliverables”) during the course of this Consultancy. The Deliverables shall be so detailed that they could be given to the prospective bidders for guidance in preparation of their bids.
- 1.8.2 The Feasibility Report of the Project shall include, inter alia, all needed details collected, analyzed, estimated, and compiled in respect of the scope of work specified above, including the following:
  - (a) Investigation Reports: Reports on the site survey of route survey of transmission lines.
  - (b) Technical design: Preliminary data for design, key drawings and preliminary engineering, if required.
  - (c) Technical and commercial risks: Report on technical, social, commercial and law & order risks together with suggested mitigation options.
  - (d) Relevant statutes: Report on all the relevant regulations, codes, standards, rules, statutory requirements, provisions of law and other such relevant references.
  - (e) Preliminary costing: Report on preliminary costing of the Project including investment and its phasing for provision of electricity 24X7, including estimated BOQs;

- (f) Open access: Phasing of open access for all consumers domestic and commercial consumers.
- (g) System operation requirements and O&M Plan: Report on the system operation requirements and O&M plan.
- (h) Implementation plan and schedule including likely delays, if any, on account of land acquisition and/or other factors.

## **1.9 Time and Cost Schedule**

- 1.9.1 The total duration for preparation of the Feasibility Report and Preparation of Detailed Project Report shall be 6(six) months, excluding the time taken by the Authority in providing the requisite documents or in conveying its comments on the Detailed Feasibility Report. The Consultant shall deploy its Key Personnel as per the Deployment of Personnel proposed. The detail work schedule is prepared and presented in annex.
- 1.9.2 Similarly the work wise detail cost breakdown is also presented in annex.

## **2 Terms of Reference for Environmental Impact Assessment (EIA)**

### **2.1 Objectives of the study**

The principle objectives of the present study are:

- To establish physical, biological and socio-economical and cultural baseline conditions of the project area.
- To assess the positive and negative environmental impacts of the project
- To analyze the critical impacts
- To propose necessary mitigation measures against adverse environmental impacts
- To prepare environmental management plans and monitoring and auditing plan

### **2.2 Scope of the Work**

The current study to achieve the aforesaid objectives entailed the following activities.

- To collect and review secondary information/data.
- To conduct a field study for the collection of baseline information, assessment of positive and negative environmental impacts
- To analyze critical impacts
- To propose cost- effective mitigation measures for adverse impacts
- To prepare management plans and monitoring and auditing plans.

### **2.3 Approaches and methodology**

The approach will follow the Manual on EIA Report Preparation prepared for private sector hydropower development project by DoED, GoN in collaboration with US Agency for International Development and International Resources Group.

#### **2.3.1 Identification of data requirement**

The following data are required for physical, biological and socio-economic and cultural environments.

##### **Physical environment**

- Meteorological data of the project area
- Land uses and land uses pattern
- Hydrological data and discharge record at intervening locations
- Discharge of downstream tributaries between transmission line from powerhouse to substation
- Geological data of the project area

##### **Biological Environment**

- Floral and faunal data of the project area
- Biomass data
- Ecological data
- Fish and fisheries

- Rare/endanger/protected flora and fauna of the area
- Estimation of the plants and vegetation type likely to be affected by the project

### **Socio-economic and cultural environment**

- Socio-economic features of the project in general
- Population ethnicity and employment status
- Agriculture, income and expenditure and occupation
- Education and public health and sanitation condition in the area
- Waterborne diseases
- Land parcels and owners of the land to be affected by the project
- Seriously Project Affected Families (SAFs) and Project Affected Families (PAFs)
- Tribal of vulnerable ethnic groups
- Infrastructure and land development activities in the project area
- Land acquisition and compensation
- Economic status of local inhabitants
- Occupational health and safety
- Historical and cultural monuments of the area
- Future development potential of the area/resources

#### **2.3.2 Data collection procedure**

- Literature review and field study
- Questionnaire survey
- Checklist survey/ in-depth interviews/focused group discussions
- Matrix method
- Public hearing program

#### **2.4 Review of policies, acts, rules, regulations and guidelines and manuals**

The proposed EIA study shall review and comply with the relevant national legislation of Nepal.

#### **2.5 Mitigation measures**

All identified impacts shall be taken in to consideration and evaluated in the report. Applying pragmatic approach from technical, economical, and practical points of views will be applied in developing mitigation measures for the adverse impacts. The cost needed for each measures shall be estimated and incorporated in the report. The mitigation measures are to be implemented in association/consultation with responsible agency/ agencies during pre-construction, construction and operational stages. In general the following areas shall be covered while developing mitigation plan.

- Protective Measures
- Design Measures and
- Compensatory Measures

#### **2.6 Monitoring Plan**

Using the results from the study a monitoring plan will be formulated describing indicators of potential parameter to be monitored together with probable roles and responsibilities of the concerned agencies. Monitoring method, time schedule, cost and manpower will be worked out for conducting monitoring the impacts of the proposed project on biodiversity. Baseline, compliance and Impact monitoring and indicators to be measured will be included. Monitoring plan will be developed for pre-construction, construction and operation phases.

## 2.7 Management Plan

The Management plan includes activities, impacts, prescribed mitigation measures, responsibility for the implementation of mitigation measures and monitoring activities, cost and mode of coordination with line agencies, VDCs and local people will be developed for pre construction, construction and operation stages. It also identifies the manpower requirement for mitigation works and provides an action plan for all identified measures.

## 2.8 Auditing Plan

An auditing plan will be prepared to audit the effectiveness of the mitigation measures and the effect of unforeseen impacts. It will include types of audit, auditing parameters, cost, manpower, location, timing and the responsibility of the auditor. The auditing will be concentrated on baseline audit, impact audit and compliance audit.

## 2.9 Proposed work plan

The proposed work plan for EIA study is as following:

<b>Activities</b>	<b>Time in months</b>
1. Scoping and TOR preparation	3.5 months
2. Approval from concerned authorities	2 months
3. Field investigation for EIA	1 month
4. Data encoding and analysis	1.5 months
5. Report preparation	0.5 month
6. Public hearing and compilation of report	1 month
7. Final report preparation and submission	0.5 months
8. Approval process from concerned authorities	2 months
<b>Total</b>	<b>12 months</b>

Note: Figure showing in months not in man months.

## 2.10 Expected Human Resources

The following professionals will be required to undertake the study. Additional professionals may be involved as deemed necessary.

- Team leader
- Environmental Engineer
- Forester/ Botanist
- Socio-economist
- Aqua culturist
- Surveyor/Enumerator
- Wildlife Biologist

- Computer operator

### **2.11 Report Preparation**

A separate report of Environmental Impact Assessment shall be prepared as per the EIA Report format given in schedule 6 of EPR 1997 and National EIA Guidelines 1993.

# **Annexure**

**Workwise Detailed Cost Breakdown for feasibility and EIA study of Suri HPP 33 kV Transmission line**

S.N.	Description of work	Man months	Rate	Total (Rs)
<b>A Topographical survey</b>				
2	Senior surveyor	2	90,000.00	180,000.00
3	Junior Surveyor	1	80,000.00	80,000.00
3	field staff	2	18,000.00	36,000.00
4	Map production	Lump sum		100,000.00
5	Travelling and other miscellaneous expenses	Lump sum		200,000.00
<b>Sub Total</b>				<b>596,000.00</b>
<b>B Geology and Geological investigation</b>				
1	Geologist	1.5	90,000.00	135,000.00
3	Geological investigation and lab testing	Lump sum		50,000.00
4	Field assistant	1	18,000.00	18,000.00
5	Geological Map Production	Lump sum		50,000.00
<b>Sub Total</b>				<b>253,000.00</b>
<b>C Design of Transmission line</b>				
1	Electrical Engineer	1	90,000.00	90,000.00
2	Structural Engineer	1	90,000.00	90,000.00
3	Quantity and cost estimation	1	70,000.00	70,000.00
4	Construction planning and scheduling	1	70,000.00	70,000.00
5	Financial Analysis	1	70,000.00	70,000.00
6	Production of drawing (Autocad expert)	1	60,000.00	60,000.00
7	Site visit (transportation and other expenses)	Lump sum		200,000.00
8	Printing, photocopy and binding of reports	Lump sum		100,000.00
<b>Sub Total</b>				<b>750,000.00</b>
<b>D Environmental study</b>				
1	Team Leader/Environmentalist	3	90,000.00	270,000.00
2	Sociologist	2	80,000.00	160,000.00
3	Forestry and Biologist	1.5	50,000.00	75,000.00
4	Environmental Engineer	1.5		



			50,000.00	75,000.00
5	Field Assistant	3	18,000.00	54,000.00
6	Computer Operator	3	15,000.00	45,000.00
7	Site visit (transportation and other expenses)	Lump sum		200,000.00
8	Printing, photocopy and binding of reports	Lump sum		200,000.00
9	Expenses on public consultation and workshops	Lump sum		300,000.00
10	Publication of notices etc	Lump sum		100,000.00
			<b>Sub Total</b>	<b>1,209,000.00</b>
			<b>Grand</b>	
			<b>Total</b>	<b>2,808,000.00</b>

### Work schedule for Environmental Impact Assessment (EIA) study of Suri Khola HP Transmission line

S.N.	Activities	Time in months																							
		1		2		3		4		5		6		7		8		9		10		11		12	
		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
<b>2</b>	<b>Environmental Impact Assessment Study</b>																								
2.1	Initial study (Scoping & TOR preparation and Approval)																								
2.1.1	Familiarization and review																								
2.1.2	Preliminary site evaluation																								
2.1.3	Publication of notice for Scoping and TOR of EIA																								
2.1.4	Collection of comments suggestions from concerned authorities																								
2.1.5	Preparation of Scoping and TOR document																								
2.1.4	Approval process of Scoping and ToR																								
2.2	EIA Preparation and Approval																								
2.2.1	Baseline field data collection																								
	* Physical environmental parameters																								
	* Biological environmental parameters																								
	* Socio-cultural environmental parameters																								
2.2.2	Identification and prediction of impacts																								
2.2.3	Alternative analysis																								
2.2.3	Mitigation measures																								
2.2.4	Environmental management and monitoring plan																								
2.2.5	Estimate and Costing																								
2.2.6	Preparaton of draft EIA report & submission																								
2.2.7	Approval process of EIA																								
2.2.8	Final EIA report preparation and submission																								

