Oil India Limited
(A Govt. of India Enterprise)

Notice Inviting "Expression of Interest" (EOI) for Hiring of Services for Seismic Data Acquisition, Processing & Interpretation in Brahmaputra River Bed (BRB) in the state of Assam-Arunachal Pradesh

Oil India Limited (OIL), a premier National Oil Company, is engaged in the business of exploration, production and transportation of crude oil and natural gas. OIL intends to hire services for carrying out 2D Seismic Data Acquisition, Processing and Interpretation (API) of around 1000 GLKM in parts of the Brahmaputra River Bed in Upper Assam/Arunachal Pradesh by an internationally reputed and competent service provider having required infrastructure and relevant experience in similar areas in different parts of the world. The 2D seismic profiles are shown in Annexure-I. The end points co-ordinates of the 2D Seismic profiles are also enclosed as Annexure-II. Seismic data acquisition is planned to complete in one (1) field season (December-April). Additionally, the job of processing and interpretation are planned to be accomplished within six (6) months.

1.0 Objective of the Survey:

The main objective of the survey is to assess the prospectivity in the BRB area as the adjoining areas of BRB is a petroliferous basin with proved hydrocarbons reserves. With the help of proposed 2D seismic survey, the BRB area which is un-appraised so far is to be appraised.

2.0 Basic Information of the Area & Logistics

2.1 The Salient points about the area to be surveyed are given below:

i) Location of the Area

The area proposed to be surveyed lies approximately in North-Eastern parts of India within longitudes 94º05' 15" to 95º55' 15" and latitudes 26º54' 45" to 28º15' 30".

(ii) Type of Area:

The area to be surveyed consists of the Brahmaputra riverbed and its adjoining marshy and swampy lands, forest & partly boulder covered near surface areas on both sides of the river.

2.2 Logistics

2.2.1 In the upper Assam valley, the Brahmaputra River rolls down from north-east to west for distance of about 780 Km with meandering and shifting channels, permanent/semi permanent/temporary islands, marshy/swampy areas, horse –shoe lakes etc. The swift water currents are observed at many places. The operational area is bounded by Himalayas in north, by the Naga-Patkai hill ranges in south southeast, by Manabhum hill ranges in east and is open to west. The area under study is a part of upper Assam valley, extended about 80-85 kms in North –South direction. The Brahmaputra has the width of about 10-15 kms at many places. The water depth varies from 4-5 mtrs in shallow portion to more than 20 mtrs in deeper part of the river. The river Brahmaputra has two distinct sets of tributaries; those on the north bank have larger catchment and heavier precipitation and are bigger than those of the south bank. The north bank frontaries have very steep slope, shallow braided shifting channels and have coarse sandy beds. The tributaries in south bank, on the contrary, have low gradient, deep meanders, roughly east-west channels and have comparatively low silt charge. Brahmaputra River bed is embedded with diversified River Bed Eco-system and the operational area is very close to Dibru-Saikhowa National Park, Daying Ering Wild Life Sanctuary etc.

2.2.2 Approximate length of the Brahmaputra River within the area under reference is about 250 km. Around the meandering channels, a number of islands have been formed of which many are temporary in nature. This river is lifeline for people in Assam (India) and Bangladesh and has been extensively used for domestic and irrigation purposes. The forest and marshy/swampy areas around the river host a variety of vegetation with thick undergrowth and swarm wildlife of National/Environmental importance. Most of these forests are unapproachable throughout the year due to lack of motorable roads.

2.2.3 In most of the river islands the height of elephant grass varies from 3 to 5 mtrs. Some of the islands of permanent/ semi-permanent nature are thinly inhabited.

2.2.4 The Brahmaputra river catchment plain receives rainfall ranging 5100-6400 mm annually and the flood period is generally from Mid-May to Mid-September.

3.0 Brief Scope of Work/Technical Specifications:

A. Seismic Data Acquisition

(i) The service provider shall plan and execute high quality 2D seismic data acquisition in transition zone of BRB by using appropriate methodology, equipments, along with necessary energy sources like explosives, shallow water airgun, marine vibroseis etc. by deploying experienced personnel with professional competence and to provide industry standards output to OIL.

(ii) The tentative acquisition parameter for the survey is stipulated in Annexure-III.

(iii) The service provider shall conduct geodetic survey including fixation of reference points and pillars, GPS networking and staking of the source-receiver locations required for seismic recording operation.

(iv) Service provider shall carry out experimental work prior to the commencement of regular production to optimize the acquisition parameters.

(v) Service provider shall carry out Up-hole/Shallow Refraction survey for near surface modelling to decide optimum depth (OD) of shot holes during the survey work. Up-hole survey and Shallow Refraction survey (LVL) requires to be done at approximately 2 Km intervals.

(vi) Service provider shall deploy adequate shot hole drilling technology (heli-portable rigs, air compressor drilling, mechanized rigs, pneumatic drilling, mechanized water rotary drilling rigs and ancillary equipment) in sufficient numbers to meet the project timelines and terrain conditions which is characterised by sandy/boulder/marshy area.

(vii) Service provider shall make arrangements for procurement, storage, transportation and all statutory clearances pertaining to explosive magazine licenses and usage.

(viii) Service provider shall deploy latest state-of-art 24-bit telemetry system with Delta-Sigma technology and compatible accessories/ground electronics suitable to acquire the required quality data in the logistics and the terrain condition prevailing in the areas mentioned above.

(ix) Planning and Quality Control of the seismic data acquisition is primarily the responsibility of the service provider. However, OIL's personnel shall be associated for real time QC of seismic data and quality assurance through analysis of raw as well as processed data in

field. Personnel from OIL shall do overall co-ordination throughout the contract period to ensure quality of data. However, if any error related to acquisition occurs, service provider shall take corrective measures before the submission of final data.

(x) Service provider shall obtain permissions from Government authorities, Custom clearance, licenses for storage, transportation and use of explosives and any other license/clearance. However, necessary recommendatory letters based on appropriateness shall be provided by OIL. Service provider shall adhere to prescribed rules and regulations pertaining to explosive uses.

(xi) Service provider shall fulfil all the mandatory requirement of HSE specifications and appropriate safe work practices.

B. Seismic Data Processing

(i) The acquired data shall be processed by deploying experienced and professional experts using state of the art processing hardware/software and adopting most optimal processing. The processing flows includes advanced statics solutions, reliable Velocity analysis and Pre-stack Time Migration (Pre-STM) to obtain geologically conformable subsurface images amenable for meaningful interpretation. Pre-stack Depth Migration (Pre-SDM) along with velocity model building is optional as per OIL's requirement.

(ii) The service provider shall plan and execute high quality seismic data processing by using appropriate state of art methodology, equipment and software by deploying experienced personnel with professional competence and to provide the industry standards output.

(iii) Planning and Quality Control of the seismic data processing is primarily the responsibility of the service provider. However, OIL's personnel shall be associated for monitoring and quality assurance through analysis of raw as well as processed data. Personnel from OIL shall do overall co-ordination throughout the contract period to ensure security and quality of data.

(iv) Service provider shall obtain permission(s) from Government authorities, Custom Clearance, licenses etc. However, necessary recommendatory letters based on appropriateness shall be provided by OIL.

(v) Service provider shall fulfil all the mandatory requirement of HSE specifications and appropriate safe work practice.

(vi) The tentative processing sequence is attached as annexure-IV.

C. Seismic Data Interpretation

(i) The service provider shall carry out detailed interpretation work using the processed 2D seismic data, well data (if available), GM data and other relevant geo-scientific data if available in and around the study area as detailed below:

- Integration of processed 2D seismic data with other geo-scientific data of the area under study.
- Integration of processed 2D seismic data with information of drilled wells (if available) in and around the areas of study.
- Well to seismic correlation using synthetic seismograms.
- Mapping of at least five (5) co-relatable horizons from Near Top Basement to Shallow Sub Surface both in time and depth domain incorporating the surface geology, drilled well information and wire line log data available in the area of study and nearby areas (if & as available).
- Preparation of Two-way Time Contour (TWT) and Average Velocity Maps on different interpreted horizons.
- Preparation of Depth Contour Maps on different interpreted horizons
- Preparation of Isopach Maps between different interpreted horizons.
- Well Log Evaluation and Analysis (if & as available).
- Integrate the interpretation results of Gravity-Magnetic data available for the areas under study.
- Fault Mapping & Fault-Seal Analysis is required to be carried out.
- Lead/Prospect generation, analysis and ranking.

(ii) **Structural Geology and Structural Reconstruction:** A detailed palinspastic reconstruction and both forward and backward modeling to be carried out to understand the structural evolution in the area, both in geological time and space and its bearing in hydrocarbon generation, migration and accumulation. The structural modeling needs to be carried out by engaging a structural geologist. Preparation of regional balanced cross section and restoration of geological section in inferred direction of tectonic transport to validate the interpretation/depth modeling and petroleum entrapment risking needs to be carried out.

(iii) **Pressure Regime:** The service provider will study the sub-surface formation pressure information and its relation with hydrocarbon generation/migration and trapping mechanism. This study will be required to be carried out at the service provider's interpretation centre.

(iv) **Recommendations for Exploration:** Based on the above-mentioned studies and the available data, the service provider will generate structural and exploration model of the area under study, identify the hydrocarbon prospects, its prospectivity from generation, migration and entrapment point of view.

4.0 Requirement(s) for service providers:

The broad requirements for a service provider are as follows:

(i) Service provider should be an Indian/International company/firm/ joint venture/consortium/technical collaborator having expertise and should have experience of seismic data acquisition, processing & interpretation in transition zone/swampy area or similar areas.

(ii) Service provider should have fully trained personnel capable to undertake the seismic data acquisition, processing and interpretation jobs in prescribed areas very efficiently and complete the job as per time schedule.

(iii) Service provider should be capable to deploy appropriate equipments like line telemetry (cable)/cable less/cable free system, ground electronics, adequate energy sources for the terrain as mentioned above.

(iv) Service provider should complete mobilization and commence work within 3 months (90days) from issue of Letter of Award.

(v) The major equipments including surveying equipment, recording unit along with accessories, processing system should not be more than three (3) years old on bid opening/closing date. The geophones should not be more than one (1) years old on bid opening/closing date.

(vi) Service provider should adhere to various applicable rules and regulations in India related to safety, security, confidentiality and other activities of related to seismic data acquisition and processing.

5.0 Submission of EoI:

Interested service providers (Indian/international company/firm/joint venture/ consortium/technical collaborators) having expertise and experience in seismic data acquisition and processing in similar areas are invited to submit their EOI. EOI response should accompany the following information/documents:

(i) Experience details of seismic data acquisition in last 7 years (as per Performa-A).
(ii) Experience details of seismic data processing in last 7 years (as per Performa-B).
(iii) Experience details of seismic data interpretation in last 7 years (as per Performa-C).

(iv) Holistic mobilization plan (expected) including vintage (age) & numbers of key equipment viz. Surveying Equipment, Recording Equipment (cable/cableless), Geophones, Hydrophones, Energy source, Shot Hole Drilling equipment/types, Field Processing System etc.
(v) Expected type(s) and deployment pattern of shot hole drilling equipment (heliportable rigs, air compressor drilling, mechanized rigs, pneumatic drilling, mechanized, water rotary drilling rigs and ancillary equipment) for accomplishing the acquisition within stipulated time frame.
(vi) Holistic execution plan for the entire project.
(vii) Details of the experience of key personnel likely to be deployed during seismic data acquisition.

(viii) Details of processing software and experience of key personnel likely to be deployed during data processing.

(ix) Details of interpretation software and experience of key personnel likely to be deployed during data interpretation.

(x) Details of the Annual Turnover (specify currency) As per Audited balance.

(xi) Budgetary quote as per format given at Performa-D.

(xii) Any other information that will demonstrate the service provider's competence/capability.

Note: Prior to submitting response to EoI, the prospective service providers are advised to have a through reconnaissance of the terrain and get fully acquainted with details not limited to surface topographic features, fair

weather window, working culture in the area, socio-political conditions, security aspects and law of the land etc. The thorough reconnaissance of the area is desired for realistic budgetary estimate and it will also help to judiciously plan inputs for successful execution of the project.

Interested service providers, who fulfil the specifics above, should submit their response by post/courier/email before 31.10.2017 The hard copy in a sealed cover with the superscription “Expression of Interest (EOI) for Hiring of Services for Seismic Data Acquisition, Processing & Interpretation in Brahmaputra River Bed (BRB) in the state of Assam-Arunachal Pradesh” along with supporting documents may be sent within the stipulated period at following address:

CHIEF GENERAL MANAGER (GEOPHYSICS)
GEOPHYSICS DEPARTMENT
OIL INDIA LIMITED
REGISTERED HEAD QUARTER
DULIAJAN, DIST: DIBRUGARH
ASSAM 786602
FAX NO: 91 374 2804754
PHONE NO: 91 374 2808439
E MAIL ADDRESS: oilunapprised@gmail.com

Annexure-I

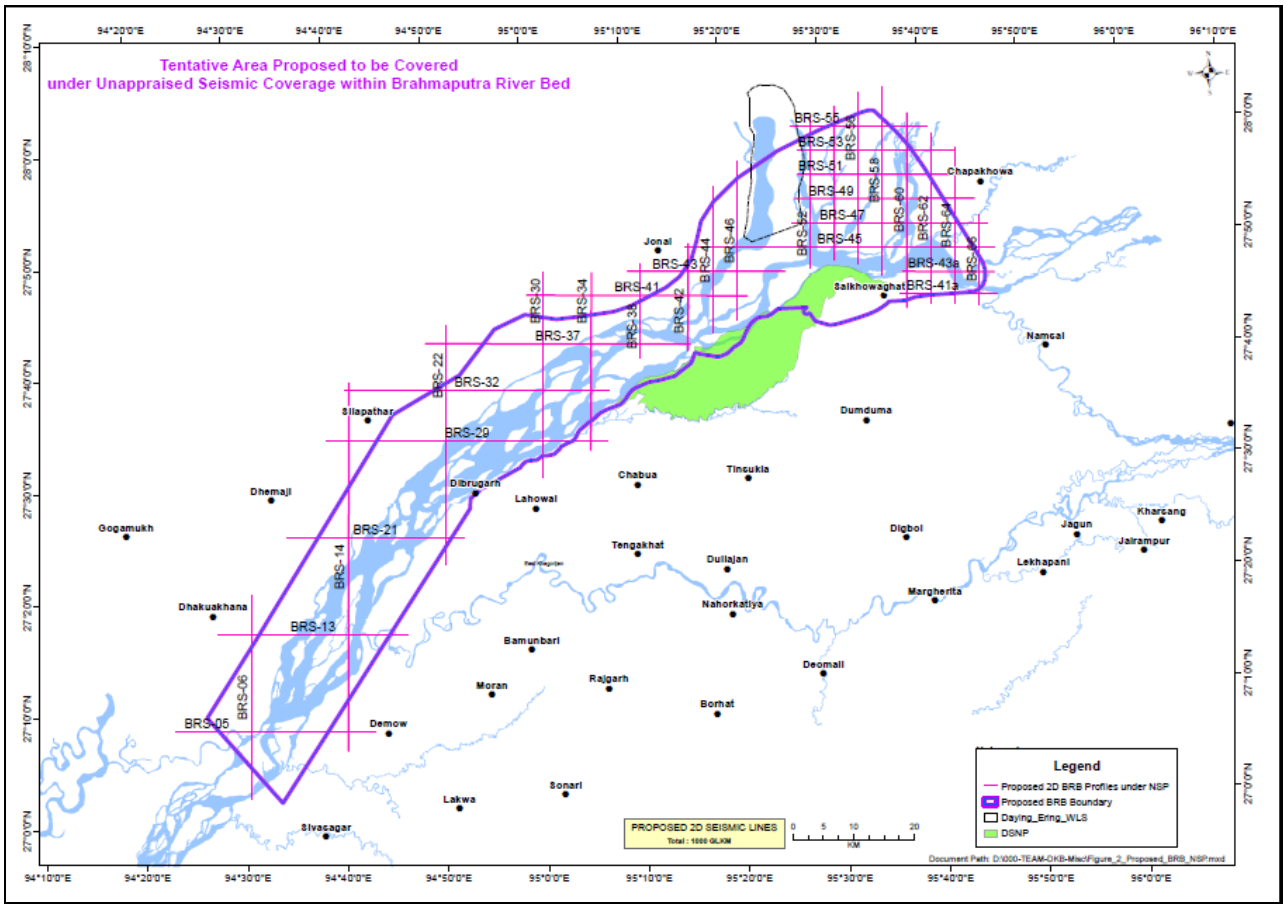

Fig-1: Map showing the proposed area of 2D seismic survey.

Annexure-II

END POINTS CO-ORDINATES OF THE 2D SEISMIC PROFILES IN THE PROPOSED AREA

Profile Name	Long_Start	Lat_Start	End _Long	End_Lat	GLKM
BRS-06	94° 31' 15"	27° 20' 27"	94° 30' 33"	27° 2' 11"	33.72
BRS-14	94° 41' 44"	27° 39' 6 "	94° 40' 22"	27° 6' 13"	60.72
BRS-22	94° 51' 40"	27° 43' 54"	94° 50' 48"	27° 22' 37"	39.30
BRS-30	95° 1' 37"	27° 48' 19"	95° 0' 50"	27° 30' 2"	33.77
BRS-34	95° 6' 29"	27° 48' 9"	95° 5' 44 "	27° 32' 19 "	29.25
BRS-05	94° 23' 15"	27° 8' 29 "	94° 43' 8 "	27° 7' 51"	32.83
BRS-13	94° 27' 42"	27° 17' 2"	94° 46' 46"	27° 16' 25"	31.45
BRS-21	94° 35'0.4"	27° 25' 28"	94° 52' 42"	27° 24' 54 "	29.16
BRS-29	94° 39' 16"	27° 34' 1"	95° 7' 25"	27° 33' 5 "	46.31
BRS-37	94° 49' 34"	27° 42' 23"	95° 16' 7"	27° 41' 27"	43.65
BRS-42	95° 16' 20"	27° 50' 25"	95° 15' 51"	27° 40' 52"	17.64
BRS-44	95° 19' 12"	27° 55' 25"	95° 18' 26"	27° 42' 22"	24.12
BRS-46	95° 21' 34"	27° 57' 35"	95° 20' 55 "	27° 43' 26 "	26.13
BRS-52	95° 29' 6"	28° 1' 22"	95° 28' 27"	27° 47' 45"	25.16
BRS-54	95° 31' 34"	28° 2' 10"	95° 30' 57"	27° 48' 26 "	25.32
BRS-56	95° 34' 2"	28° 3' 16"	95° 33' 19"	27° 48' 3"	28.10
BRS-58	95° 36' 29"	28° 3' 45 "	95° 35' 40"	27° 46' 55"	31.10
BRS-60	95° 38' 51"	28° 1' 18"	95° 38' 1"	27° 43' 56"	32.08
BRS-62	95° 41' 11"	27° 59' 25"	95° 40' 26"	27° 44' 15"	28.04
BRS-64	95° 43' 36"	27° 58' 5"	95° 42' 54"	27° 44' 9"	25.74
BRS-66	95° 45' 42"	27° 51' 58"	95° 45' 18"	27° 43' 54"	14.89
BRS-41a	95° 37' 27"	27° 45' 14"	95° 47' 6"	27° 44' 51"	15.84
BRS-45	95° 16' 0"	27° 50' 9"	95° 47' 2 "	27° 48' 59"	50.97
BRS-47	95° 26' 54"	27° 51' 54"	95° 46' 25 "	27° 51' 10"	32.04
BRS-49	95° 27' 13"	27° 54' 5"	95° 45' 15"	27° 53' 25"	29.60
BRS-51	95° 27' 37"	27° 56' 14"	95° 44' 36"	27° 55' 34"	27.87
BRS-53	95° 27' 45"	27° 58' 23"	95° 43' 36"	27° 57' 47"	25.99
BRS-55	95° 27' 3"	28° 0' 35"	95° 40' 50"	28° 0' 4"	22.59
BRS-38	95° 11' 22"	27° 48' 44"	95° 11' 0"	27° 40' 22"	15.47
BRS-41	94° 59' 54"	27° 46' 23"	95° 22' 3"	27° 45' 34"	36.38
BRS-43	95° 10' 9"	27° 48' 11"	95° 25' 57"	27° 47' 37"	25.95
BRS-43a	95° 37' 45"	27° 47' 9"	95° 46' 57"	27° 46' 47"	15.40
BRS-32	94° 41' 18"	27° 38' 34"	95° 7' 55"	27° 37' 41"	43.65

Annexure-III

TENTATIVE ACQUISITION PARAMETERS

Total estimated quantum of job	1000 GLKM
Total Number of profiles	33
Minimum number of crews	2
Range of Profile Length	14km (min) to 60 km(max)
No. of Active Channels /shot	800 (400+ 400)
Type of Shooting	Symmetric Split Spread
Group Interval	20 mts
Shot Interval	40 mts
Minimum Offset	10 mts
Foldage	200
Maximum Offset	8000 mts
Offset Distribution	Uniform
Record length	8 Sec
Sampling interval	2 ms
Shot Hole Depth	~ 20 m, however the final shot hole depth to be adopted shall be decided after the necessary experimental work in the field.
S/N ratio	High, Min.120 dB dynamic range, with 24-bit Delta-Sigma recording technology and suitable noise. Shaping filter etc. to match the best record in the area
Data Format	SEG-D/SEGY Demultiplex format in 'SEG' normal polarity.
Source	Explosive/Airgun/ Marine Vibrators/ any other Eco Friendly Source
Type of shot hole drilling	Mechanized Shot Hole Drilling with the provision of Casing while drilling to arrest possibility of Shot Hole collapsing due to Sand Pressure, pebbles, small boulders etc.

Annexure-IV

TENTATIVE PROCESSING SEQUENCE

A. Tentative Processing Sequence (Pre-Stack Time Migration):

- Reformat to internal format.
- Geometry preparation.
- Trace editing
  - i. Filtering for data balancing of the acquisition instrument spectrum
  - ii. Discard noisy traces
  - iii. Reverse polarity corrections
  - iv. Despiking
- Computation of Refraction statics using Delay time, Head wave & diving wave tomographic methods etc. Compare Refraction statics solution with elevation & Field statics and application of the one producing best results.
- Amplitude Recovery analysis & Application (Spherical Divergence, Time function etc.).
- Random & coherent noise attenuation (in multiple domains).
- Surface Consistent Deconvolution (X-T or Tau-P domain).
- Surface Consistent Amplitude Compensation.
- 1st pass velocity analysis (every 1000 m).
- Residual Statics computation & application.
- 2nd pass velocity analysis (every 500 m).
- Residual Statics computation & application.
- 3rd pass velocity analysis & Residual statics calculation (as required in consultation with company's representative).
- Multiple attenuation.
- Residual Noise attenuation (in multiple domains including Offset domain).
- Common offset regularization & interpolation.
- Q compensation (Phase & Amplitude).
- Initial Kirchhoff PSTM (generation of initial migrated gathers & stack).
- Migration velocity analysis on migrated gathers (every 250 m).
- Final Kirchhoff PSTM with migration velocity.
- Acquisition footprint removal.
- Residual Noise attenuation.
- Multiple attenuation.
- Residual moveout analysis & application.
- High density automatic velocity analysis.
- Final PSTM stack.

- Zero phasing of PSTM gathers & preparation of zero phase stacks.
- Preparation of angle stacks (Near, Mid & Far) - should be compliant for Reservoir Geophysical studies..
- **Post Stack Processing:**
- Deconvolution after stack for spectral enhancement and remnant multiple attenuation.
- Random Noise Attenuation.
- Remnant linear noise attenuation.
- Time variant filter.
- Spectral balancing.
- Coherency enhancement.
- Residual spatial and temporal amplitude compensations.
- Scaling.

B. Tentative Processing sequence (for Kirchhoff Depth Migration):

- Initial Velocity Model from PSTM velocity field
- Input Pre-Migrated gathers from PSTM sequence and preparation for PSDM
- Including pre-conditioning
- Horizon picking & Anisotropic (Tilted Transverse Isotropic) velocity model building (Iterative depth-interval Velocity, epsilon, delta Model Building, Minimum of 4 iterations) utilizing all available geophysical and geological data such as stacking velocity, well logs and markers (if any), interpreted horizons etc.
- Multiple iterations of Kirchhoff PSDM and tomographic inversions
- Final velocity model preparation & refinement using high quality of RMO estimation, tomographic velocity update etc.
- Final Kirchhoff PSDM with final velocity model
- Residual Moveout Correction
- Final mute & stack
- Post Stack Processing (Depth variant filtering, signal enhancement, scaling etc.)

Note: In addition to the above, if any processing is required to be done for the improvement of the quality of the 2D data from Transition zone area, the same have to be applied during processing.

Performa-A

EXPERIENCE DETAILS OF SEISMIC DATA ACQUISITION IN LAST 7 YEARS

SN	Contract No	Contract Period	Client	Country/ Location	Volume of work (2D/3D)	Terrain conditions	Equipment used

Performa-B

EXPERIENCE DETAILS OF SEISMIC DATA PROCESSING IN LAST 7 YEARS

SN	Contract No	Contract Period	Client	Country / Location	Processing Type	Volume of work	Software used	Processing objective(s)

Performa-C

EXPERIENCE DETAILS OF SEISMIC DATA INTERPRETATION IN LAST 7 YEARS

SN	Contract No	Contract Period	Client	Country / Location	Processing Type	Volume of work	Software used	Interpretation objective(s)

Proforma-D

PROFORMA FOR BUDGETORY QUOTES

S.N. No.	Item	Unit Of Measurement	Qty.	Unit Rate (Currency) In INR/USD	Total Price (Currency) In INR/USD
	Area: Brahmaputra River Bed				
A. 2D SEISMIC DATA ACQUISITION					
A1	Mobilization Charges	Lump sum	1		
A2	Cost for Experimental Recording	Per Day	20		
A3	Standby Charges for Equipment and Crew	Per Day	20		
A4	Force Majeure Charges	Per Day	20		
A5	Operating charges per Ground Line Kilometre (GLK) of Full fold 2D seismic data Per GLKM	Per GLKM	1000		
A6	LVL Survey Rate Per location	Per Location	750		
A7	Up-hole Survey Rate Per location	Per Location	750		
A8	Cost of Fixing DGPS Reference Pillar Per location	Per Location	500		
A9	Demobilization Charges	Lump sum	1		
Total A=A1+A2+A3+A4+A5+A6+A7+A8+A9					

B. 2D SEISMIC DATA PROCESSING					
B1	Charges for Pre-Stack Time Migration (Pre-STM) of 2D Seismic Data.	Per GLKM	1000		
B2	Charges for Pre-Stack Depth Migration (Pre-SDM) of 2D Seismic Data	Per GLKM	1000		
Total B= B1+B2					
C. 2D SEISMIC DATA INTERPRETATION					
C1	Charges for Interpretation of 2D Seismic Data.	Per GLKM	1000		
C2	Structural Restoration and Cross Section Balancing of 2D Seismic Data.	Per Location	5		
C3	Pressure Regime Analysis of 2D Seismic Data.	Per Location	5		
C4	Submission of Report with Recommendations for Exploration and ranking of leads/prospects.	Lump Sum	1		
Total C= C1+C2+C3+C4					
Grand Total= "A+B+C"					

Note:

1. The above quoted rates should be inclusive of all the taxes applicable including but not limited to corporate tax, Personnel Tax and other statutory levies.

2. Please note that OIL shall not issue any Essentiality Certificate (EC) under this project for exemption in Custom's Duty.

3. The budgetary quotation is being sought for budgetary purposes only, i.e.to assess the market and project viability. It may be noted that the award of work will be made subsequently after invitation of bids through e-tendering as per laid down procedures/guidelines of OIL.