

Expression of Interest for 2D Seismic Data Acquisition in Rajasthan Punjab Area under Mission Anveshan

1.0 SCOPE OF WORK:

Oil India Limited (OIL), a Govt. of India Enterprise, presently engaged in exploration, drilling, production and transportation of hydrocarbons, proposes to **acquire approximately 4300 LKM of regional 2D Seismic Data in the un-appraised areas covering parts of RAJASTHAN & PUNJAB** by hiring the services of reputed and competent Service Provider having requisite infrastructure and relevant experience in different parts of the world of carrying out 2D Seismic Data Acquisition. Most of the area of operations falls in Rajasthan and a small part in Punjab. The area of operations consists of the following:

- i. Arid region with sand dunes
- ii. Alluvial plains

Oil India Limited (OIL) intends to acquire 2D Seismic Data, using Vibroseis and Explosive. The total work programme for 2D Seismic Data Acquisition of 4300 GLKM of 150-fold predominantly with Vibroseis as source. However, part of the identified work program also includes 2D Seismic Data Acquisition with Explosive as source (approx.500 LKM) for profiles planned to map the regional connectivity between Rajasthan basin and Ganga-Punjab basin.

The service provider shall have to deploy Two (2) seismic crews, mobilize fit for purpose requisite technical resources along with experienced manpower & adopt terrain specific appropriate technology to meet the objective of the survey and complete the work strictly within the agreed time frame of Eighteen (18) months to be reckoned from the commencement date (i.e. from the date on which the first regular production shot is accepted by Company).

2.0 GEOLOGY OF THE AREA

Rajasthan is partially an arid region with sand dunes and alluvial areas. The seismic profiles/lines were mostly of a regional nature with large distances between adjacent seismic profiles in order to image the entire area in a cost-effective manner since these were virgin areas as far as exploration activity was concerned.

Rajasthan forms north-western part of the Indian Shield. Eastern Rajasthan is characterised by the vast sedimentary stretch constituting the Vindhyan, which is juxtaposed against the rocks of the Bhilwara Supergroup along the Great Boundary Fault. The northern and north-western parts of the State exhibit Upper Proterozoic. Early Cambrian rocks of the Marwar Supergroup which are overlain by sedimentary rocks of different ages of Palaeozoic and Mesozoic Era. Many industrial mineral deposits are found in these rocks. The Deccan Traps are restricted to the southeastern part of the State in Chittaurgarh Banswara area. The Cenozoic rocks are manifested in Barmer and Jaisalmer basins in the west and Ganganagar-Palana shelf in the north. The Quaternary sediments of aeolian and fluvial origin constitute the Thar Desert of Rajasthan. The western desert plain is a sandy desolate expanse of dune fields and rocky pavements. The plain, lying to the west of Aravalli hills, covers 1,75,000 SqKm area of the Rajasthan. It is affected by scanty rainfall. The Luni and Sukri rivers, ephemerally flowing in a south-westerly direction, form the main drainage of the area. A large part of western Rajasthan is characterised by its inland drainage and carries some of the largest salt-lakes, viz., the Sambhar, Didwana, Kuchaman and Talchapar lakes.

3.0 OBJECTIVES OF THE SURVEY:

The main objective of the survey is to map Tertiary, Palaeozoic, and Mesozoic plays in the Bikaner-Nagaur, Jaisalmer and Barmer -Sanchor sub-basins, the Aravalli Mobile Belt. One line is planned to map the regional connectivity between Rajasthan basin and Ganga-Punjab basin.

4.0 LOCATION & LOGISTICS OF THE AREA:

A map showing the location of the survey area is enclosed as **Enclosure-I**. The tentative coordinates of planned profile are given in **Enclosure-II**.

- a) The huge portion of the state of Rajasthan is desiccated and houses the biggest Indian desert—the Thar Desert known as the 'Maru-kantar'. The oldest chain of fold mountains—the Aravalli Range splits the state into two geographical zones- desert at one side and forest belt on the other.
- b) Only 9.36% of the total geographical region lies under forest vegetation. The Mount Abu is the only hill station of the state and houses the Guru Shikhar Peak that is the highest peak of the Aravalli range with an elevation of 1,722 m. The capital city of Rajasthan is Jaipur.
- c) Rajasthan has varying topographic features though a major part of the state is dominated by parched and dry region. The extensive topography includes rocky terrain, rolling sand dunes, wetlands, barren tracts or land filled with thorny scrubs, river-drained plains, plateaus, ravines, and wooded regions.
- d) In a broader way, the topography of Rajasthan can be divided in the following regions- the Aravalli or the Hilly regions, the Thar and the other arid regions, the Plateaus including Vindhaya, and the Malwa, the Fertile plains including the Mewar, the Forest Regions and the Waterbodies including Rivers and Salt Lakes.
- e) Rajasthan is the abode of certain flora and fauna that are particularly endemic to arid regions and are specially adapted biologically to survive in the dry, waterless regions of the state. Owing to the varied topography one can find an assortment of flora and fauna and avifauna in Rajasthan. The forest vegetation that accounts for 9% in Rajasthan is deciduous and has thorny trees, grasses and shrubs. The tree species found are teak, bamboo, varied species of Acacia and Khejri.

4.1 COMMUNICATION:

Rajasthan is connected by many national highways, the most renowned being NH 8, which is India's first 4–8 lane highway. Rajasthan also has an inter-city surface transport system both in terms of railways and bus network. All main cities are connected by air, rail, and road.

- a) There are six main airports at Rajasthan – Jaipur International Airport, Jodhpur Airport, Udaipur Airport and the recently started Ajmer Airport, Bikaner Airport and Jaisalmer Airport. These airports connect Rajasthan with the major cities of India such as Delhi and Mumbai. There is another airport in Kota, but it is not open for commercial/civilian flights yet.
- b) Rajasthan is well connected with the main cities of India by rail. Jaipur, Kota, Ajmer,

Jodhpur, Bharatpur, Bikaner, Alwar, Abu Road, and Udaipur are the principal railway stations in Rajasthan. Kota City is the only electrified section served by three Rajdhani Expresses and trains to all major cities of India.

- c) Rajasthan is well-connected to the main cities of the country including Delhi, Ahmedabad and Indore by state and national highways and served by Rajasthan State Road Transport Corporation (RSRTC) and private operators.

4.2 CLIMATE:

Rajasthan has varying climate. The weather or climate of the Rajasthan can be broadly classified into four distinct seasons. These seasons are classified as follows:

- a) Pre-monsoon, which is the hot season preceding the monsoon and extends from April to June,
- b) Monsoon that occurs in the month of June in the eastern region and mid-July in the western arid regions,
- c) Post-monsoon that commences from mid-September and continues till November and
- d) Winter that extends from December to March, January being the coldest month of the year.

The average temperature in winter ranges from 8° to 28° C (46° to 82° F) and in summer the average temperature ranges from 25° to 46° C (77° to 115° F).

5.0 GENRRAL INFORMATION:

Hiring of services for 2D Seismic Data Acquisition of 4300 LKM (Line Kilometer) covering parts of Rajasthan & Punjab under Mission–Anveshan for hydrocarbon exploration. The service providers will need to acquire a total of 4300 LKM of 2D seismic data within the agreed time frame of Eighteen (18) months. Minimum of two (2) seismic crews must be deployed in the area of operations at all times. The total work programme for 2D Seismic Data Acquisition of 4300 GLKM of 150-fold predominantly with Vibroseis as source. However, part of the identified work program also includes 2D Seismic Data Acquisition with Explosive as source (approx.500 LKM) for a profile planned to map the regional connectivity between Rajasthan basin and Ganga-Punjab basin.

Duration of the Contract will be Eighteen (18) months reckoned from the commencement date (i.e., from the date on which the first regular production shot is accepted by Company under the contract). The service provider has to complete acquisition of 4300 LKM 2D seismic data in the area within Eighteen (18) months.

Under this agreement, the service provider is required to acquire about 4300 LKM of high quality 2D seismic data in the area by deploying minimum of two (2) seismic crews equipped with the latest state-of-art 24-bit Cable/Cable Less/Hybrid Seismic Data Acquisition system with compatible sensors (Cables, geophones/nodes with external geophones/marshy geophones), energy sources (Vibroseis & Dynamite with suitable detonators etc.).

Service providers will be required to deploy minimum in totality Ten (10) Vibrators (of vintage less than 5 years) for both the crews (Minimum four (4) per fleet and One (1) in standby per crew in good working condition) of latest model with sweep control electronics for DGPS positioning and navigation, real time quality control and data monitoring with following features:

- i. Peak force should be greater than of 65,000 lb.
- ii. Frequency Limits 7 Hz to 200 Hz or better
- iii. Capable of generating linear, non-linear, and varying sweeps.
- iv. Vibroseis parameters like number of sweeps, type of sweep, frequency range & sweep length will be finalised on the basis of results of experimental work.

In addition, Service providers shall deploy minimum one bulldozer per crew in good working condition for line clearance.

The resource deployment during execution of entire project is required to be estimated by the service provider considering the fact that approximate a cumulative of 1,07,500 vibro points/ shots are to be taken in such area within the stipulated time frame of Eighteen (18) months commensurate with daily production rate to meet this timeline. It is pertinent to note that project timeline stipulated also includes time required for associated activities like networking, reference pillar fixation, navigation survey, recording of Uphole & LVL data etc.

The detailed requirement of Equipment is mentioned in **Enclosure-III**.

6.0 DETAIL DESCRIPTION OF WORK:

6.1 MOBILISATION:

The service provider shall mobilize all requisite technical resources, vibrators, drilling rigs along with manpower and start the data acquisition in the area within **45 days** from issue of Letter of Award (LoA)/Letter of Intimation (LoI) (whichever is later) by the company. The mobilization period shall be inclusive of Experimental work for optimisation of Vibroseis parameters such as number of sweeps, type of sweep, sweep length & frequency range for the segment of identified work program to be acquired with Vibroseis as source. For the segment of identified work program to be acquired with Explosive as source as per the mutually agreed experimental plan. The entire project is required to be executed on a Turnkey basis by the service provider within the stipulated time frame of **Eighteen (18) months**.

6.2 TOPOGRAPHIC SURVEY:

- a.** Service provider is required to fix a total of **500 satellite points/reference points** all over the areas mentioned above at the locations advised by Company using latest DGPS system. Service provider will take prior approval in writing for location of fixing Satellite Points/Reference Pillars in the area. The exact number of benchmarks /reference points will be mutually decided by Company and the Service provider.
- b.** Service provider will properly fix permanent pillars at every line crossings, road crossing, river crossing and important cultural features with details engraved on the pillars. All these must be validated based on above DGPS observations. The survey accuracy should be within 2 meters.

- c.** Service provider will carry out control survey and line survey operations using latest survey equipment such as DGPS, total stations, etc. with the accuracy within 1 meter from the planned lines. The survey tolerance has to be checked (based on simulated line diagram and digital data to be provided by the Service provider), agreed, and approved by Company prior to commencement of shooting on each line. Any re-survey and re-pegging, if required, will be carried out by the Service provider at his own cost & responsibility.
- d.** The DGPS control point sites ultimately chosen thereof and approved by the company shall be suitably cleared by the Service provider to allow a clear, unobstructed view of the sky for good satellite signal reception. These points will be established by simultaneous Static Differential GPS observations for minimum 72 hours and shall be post processed at the Base Camp using industry standard software. The points observed in the field having data pairs with individual Geometric Dilution of Precision greater than 4 or where two satellites occupy the same quadrant in the sky, or where the satellite elevations are less than 150 from the horizontal shall not be regarded as “good fixes” and should be rejected before data reduction. The reference points established should be sufficiently monumented/archived as permanent structures. Such labelling shall be certified by the company representatives.

6.3 ACQUISITION PARAMETERS:

Company's requirement is continuous data coverage along each profile with best possible symmetric sampling of offsets as per the following parameters:

Srl	Parameters Description	Parameters Value
1	Fold (Nominal)	150
2	Group Interval	20 m
3	VP/SP Interval	40 m
4	Spread	Symmetric Split spread
5	Source	Vibrators (Minimum four (4) vibrators per fleet & One (1) vibrator in standby per crew)/Explosive
6	No. of sweeps	To be determined from experimental trials
7	Sweep length	To be determined from experimental trials
8	Move up between Sweeps	To be determined from experimental trials. One record on tape at each surface sweep location
9	Correlated record length	8 seconds
10	Sample Interval	2 millisecond
11	Total No. of live channels per VP/SP	600 (300-300)
12	Shot hole depth (Explosive is source)	~35 m, shot hole depth will be decided on the basis of near surface modal.
13	Charge Size	Charge size to be adopted shall be decided after the necessary experimental work in the field.

Note:

- i) Final acquisition parameters like Number of sweeps, type of sweeps, frequency range /Sweep length & move up between sweeps shall be decided after the necessary experimental work in the field for vibrator survey. Similarly for the segment of identified work program for acquisition to be done by using explosives as source the parameters

like shot hole depth, charge size, pattern shall be decided after necessary experimental work completed for that purpose.

- ii) The experimental shooting has to be done specifically for different areas with different source type by all the crews as per consultation with Company representative.
- iii) Service provider shall prepare the pre-plots and pre-plan for any recovery shots required to achieve uniform sampling of offsets as far as possible and get it approved from the Company representative. Data acquisition parameters as indicated above are the minimum requirement of Company. Company desires to have symmetric sampling of offsets in each CDP bin as far as possible. service provider needs to perform detailed simulation/modelling/raytracing for the profiles identified and submit their observations and suggestions to Company prior to the start of the survey.
- iv) Work in the area will only start when Company advises service provider of the final acquisition parameters in writing.

6.4 ENERGY SOURCE:

Service provider shall use Vibroseis as energy source for most of the data acquisition work program planned in the sand dunes, desert area and explosives for a part of the data acquisition work program planned to connect Rajasthan and Ganga Punjab basin. Depending upon the logistics and terrain conditions, service provider must ensure the following geophysical requirements:

- a) Adequate energy to image target horizons.
- b) Proper contact of vibrator plate / source coupling.
- c) Proper performance of Vibroseis source units
- d) Shot hole depth must be maintained as per the optimum Shot hole Depth decided after the pre-acquisition experimental survey /based on NSM prepare by analysis of LVL/Uphole data acquired in the field wherever explosive as source used.
- e) The quantity of explosives to be used per shot/shot hole, depth & type of shot hole, drilling requirement will be finalized in consultation with Company's onsite representative and the same will be binding on the Contractor.
- f) The license for storage of explosive in portable magazine for field use against the contract shall be in the name of service provider. Service provider shall arrange to procure, store and transport requisite quantity of explosives (Class -II) and detonators.

6.5 RECEIVERS:

The service provider shall deploy suitable receiver types of Land/Marshy geophones or nodes with internal/external Land/Marshy Geophones which must be of industry standard based on the logistics of the area. Service providers shall use **Analogue (conventional) geophone having natural frequency \leq 10Hz**. The response of geophones to be internal/externally used along with nodes should be as per specification of OEM. Regarding receiver type, sensitivity & seamless interface, service provider must maintain followings up to satisfaction of Company.

- a) All the receivers must be compatible to 24-bit $\Delta\Sigma$ (Delta-Sigma) Technology,
- b) Proper receiver coupling (tightly planted or buried geophones).

6.6 RECORDING EQUIPMENT:

Service provider will deploy latest state-of-art seismic data acquisition system with 24-bit Delta-Sigma technology. The cable or cable less system must be compatible with all accessories/paraphrenia ground electronics, suitable to acquire the required quality data in the logistics and the terrain condition prevailing in the areas mentioned above.

6.7 LVL/ UPHOLE SURVEY:

Considering the rapid varying undulating terrain service provider is required to provide accurate and model validated source, receiver statics model for the entire area by Acquisition & Interpretation of Uphole/LVL survey. Service provider will have to carry out total 1435 numbers of Uphole and 1435 numbers of shallow refraction or LVL seeking prior approval from the Company as per individual LVL/UP- HOLE grid. The depth of Uphole survey should be 50 meters.

6.8 EXPERIMENTAL SURVEY:

- a) Service provider shall carry out all necessary experiments and tests to determine optimum field parameters prior to the commencement/ during the execution of the survey. The tests shall be carried out as per the practice in the international geophysical industry.
- b) The experimental work shall be carried out for a maximum period of 30 days in operation to decide upon No of sweeps, type of sweep, frequency range/Sweep length & move up between sweeps shall be decided after the necessary experimental work in the field for vibrator survey and wherever acquisition to be done by explosives the parameters like shot hole depth, charge size, pattern shall be decided after a necessary experimental work completed for that purpose.

6.9 QC MEASURES:

The service provider will install a state of-the-art workstation with requisite hardware, latest software, accessories, and consumables to carry out following QC tests with acceptable plotting facilities at field site:

- a) Survey processing & plot generation.
- b) Planning of Seismic Survey
- c) Analysis for design of field parameters.
- d) Fold age, offset, and azimuth.
- e) Up-hole / LVL analysis and model-based statics computation.
- f) Monitor display and pre-processing for quality control.
- g) S/N ratio analysis
- h) Online Basic Field QC processing up to stack on site to check the quality of acquired data by analysis of raw shot gather/ geometry merging/ full fold/ brute stack output etc.

6.10 DELIVERABLES:

Service provider shall submit a detailed report on selection of the field parameters within 2 days after completing experimental work. Service provider shall submit to Company report on data quality of the job undertaken during the week. The content of any periodical report shall consist of:

- a) Weekly progress of survey & seismic data recording.

- b) Uphole / LVL survey report with interpretation.
- c) Similarity Tests (for segment of data acquisition with Vibroseis)
- d) Quality Control reports and seismologist reports.
- e) Brute Stack section with used parameters.
- f) Intersection information with survey & statics mismatch if any.
- g) Number of permanent reference points/pillars fixed with detail coordinate, sketch with cultural information.
- h) Shooter log / Explosive consumption/stock report (for segment of data acquisition with Explosives)
- i) Summary of data transmittal to Company.
- j) Summary of Health, Safety & Environment incidents.
- k) List of visitors.
- l) List of personnel, equipment.
- m) Recommendations, if any.

6.11 Service provider will submit /deliver the three sets of recorded data along with all the relevant data to the authorized Company's representative at Duliajan within 10 days of completion/termination of profile/ entire project:

- a) Seismic data of each profile/ entire project on two (2) no. of SSD.
- b) Observer's reports with shot-receiver geometry, shot hole depth, Uphole times, ITB/misfires, skip-recovery, edits, recording parameter, direction of shooting.
- c) Model based Statics information on SSD with hard copies in user defined ASCII format.
- d) Survey data in UKOOA, ASCII format on cartridges and hard copy.
- e) Final report covering the entire operation within 20 days of the completion of work which must include:
 - Review of geophysical objectives & success of the project in meeting the Objectives including the data quality.
 - Detail information on Mob, Demob. of equipment & personnel.
 - Field experiment procedure and results.
 - Sample field record,
 - Up-hole/LVL plot, interpretation of Uphole/LVL data
 - Processed section (Brute Stacks with & without post-stack time migration,
 - Map showing location of Up-hole/LVL survey.
 - Elevation, weathering thickness & Topography map.
 - Note on data quality.
 - Operational summary including details of total survey, shooting progress.
 - Explosive consumption,
 - Logistics etc.
 - Recommendations.
 - Final Maps (both digital and hard copy) in three different mutually agreed scales)
- f) All the Project data should be provided in two SSD disks.

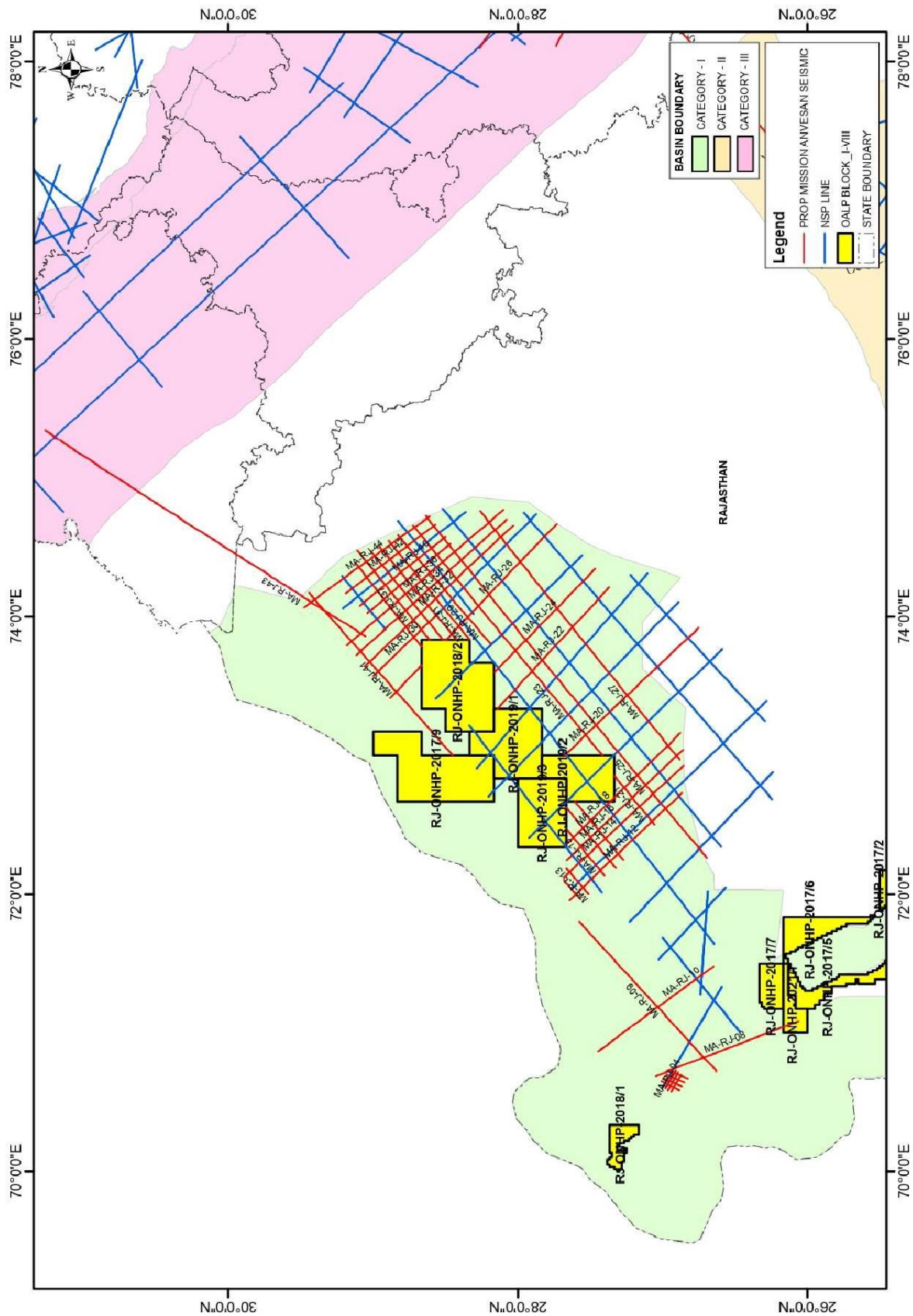
6.12 Service provider will submit/deliver the recorded data along with all the relevant data as mentioned in **ENCLOSURE-IV** to the authorized Company's representative at Duliajan.

7.0 Accordingly, OIL would like to invite interested service providers having requisite work experience & resources to participate in a vendor meet scheduled to be held on **22.04.2024 & 23.04.2024** in physical mode (**09.30 AM IST** onwards) at **Conference**

Hall, Geophysics Department, Duliajan, Assam.

Please forward the e-mail IDs, contact details, copy of any identity card with proof of address and passport size photo of the authorized representatives (max. 2 persons) who will be attending the meeting on behalf of your organization as soon as possible to the e-mail ID: hgp_office@oilindia.in.

MAP SHOWING PROPOSED 2D SEISMIC LINES IN RAJASTHAN BASIN UNDER MISSION ANVESHAN



End Point Coordinates of Profiles identified for data acquisition

**Area/ Basin: Rajasthan
(Datum - WGS 84)**

FID	Name	LKM	X_Start	Y_Start	X_End	Y_End
1	MA-RJ-01	75	74.10212447	28.48475906	73.58006206	28.97967545
2	MA-RJ-02	300	71.96128058	27.56729394	74.16975117	29.44367078
3	MA-RJ-03	107	71.47741216	26.64942104	70.86532071	27.44610993
4	MA-RJ-04	150	71.80028402	27.57730906	70.72539933	26.62997117
5	MA-RJ-05	300	72.18340657	27.32442139	74.47493825	29.11073939
6	MA-RJ-06	283	75.33765368	31.26401885	73.85936652	29.05529621
7	MA-RJ-07	116	70.69124283	27.04603096	71.08106424	26.06324257
8	MA-RJ-08	153	73.79218690	29.18276951	74.76665774	28.10063901
9	MA-RJ-09	70	74.05281781	28.40138551	74.58764143	28.82214872
10	MA-RJ-10	73	73.90549667	28.58329113	74.46821837	29.01726627
11	MA-RJ-11	116	74.06685014	29.47766043	74.69312622	28.58774547
12	MA-RJ-12	80	74.00787011	28.99450802	73.41839570	28.48904013
13	MA-RJ-13	75	72.42203626	27.84773875	72.93791964	27.35034875
14	MA-RJ-14	75	72.37462695	27.81926197	72.89277509	27.32452121
15	MA-RJ-15	75	72.32317757	27.78718737	72.84588562	27.29560392
16	MA-RJ-16	60	72.49523523	27.90236006	73.01447322	27.40816256
17	MA-RJ-17	70	72.24907439	27.29378196	72.79137272	27.70083290
18	MA-RJ-18	70	72.50007014	27.05745576	73.03065666	27.47557279
19	MA-RJ-19	51	72.34637301	27.43743780	72.69285439	27.09657098
20	MA-RJ-20	50	72.41178729	27.47786541	72.75333791	27.14430448
21	MA-RJ-21	55	72.93282158	28.19470804	73.34254130	27.85636875
22	MA-RJ-22	55	72.89723901	28.16640053	73.30920532	27.82973677
23	MA-RJ-23	25	73.14737794	27.74657993	73.33681503	27.89648842
24	MA-RJ-24	25	73.09604213	28.30179642	73.27759126	28.14300159
25	MA-RJ-25	25	73.04257518	28.25658931	73.23058053	28.10356117
26	MA-RJ-26	70	73.97227617	28.53676356	74.50530035	28.95961463
27	MA-RJ-27	70	74.01566494	28.46581071	74.54326277	28.89250240
28	MA-RJ-28	70	74.00902385	29.04190026	74.45707256	28.54818860
29	MA-RJ-29	70	74.07814200	29.09337126	74.50304758	28.58361016
30	MA-RJ-30	75	74.16384151	29.19074480	74.60619942	28.63630864
31	MA-RJ-31	15	70.58394191	26.88737888	70.65094166	27.00836558
32	MA-RJ-32	15	70.61045213	26.86871915	70.67479204	26.99201174
33	MA-RJ-33	15	70.59762745	26.98236060	70.72622486	26.91075534
34	MA-RJ-34	15	70.58521769	26.96417942	70.71577193	26.89348518
35	MA-RJ-35	15	70.57216985	26.94138956	70.70181371	26.87227200
36	MA-RJ-36	15	70.64044230	26.85006678	70.70125152	26.97409571
37	MA-RJ-37	15	70.67132271	26.82750620	70.72949950	26.95305171
38	MA-RJ-38	145	72.12928120	27.40284598	73.24009333	28.26615468
39	MA-RJ-39	150	72.50480638	28.17837918	73.50839534	27.16183047
40	MA-RJ-40	145	72.14193182	27.82512267	73.15774305	26.87811861

41	MA-RJ-41	115	71.95259158	27.64511342	72.72683521	26.86762728
42	MA-RJ-42	150	73.12030441	28.31694374	74.23752686	27.39556189
43	MA-RJ-43	145	73.40978906	28.88419989	74.44211696	27.94649288
44	MA-RJ-44	228	73.01149237	26.91817028	74.75842722	28.26089118
45	MA-RJ-45	150	73.71983721	29.11792247	74.69715774	28.07930209
45	MA-RJ-46	80	73.75934002	28.64870199	74.38009142	29.12057002

EQUIPMENT AND ACCESSORIES TO BE DEPLOYED PER CREW

(Per each crew)

The quantity against certain type of equipment required for carrying out the entire 2D seismic data acquisition survey has been kept open to the service provider. However, for such instances where the quantity is not explicitly mentioned/specified against a particular type of equipment, it is mandatory for the service provider to ensure that number of equipment proposed to be deployed is adequate with the receiver/source efforts as per pre-planned survey design and project timeline already stipulated. The service provider is also requested to take a note of the terrain condition, accessibility, and other factors for the type of the equipment to be deployed which needs to be latest in the industry as per international standard and capable to execute the job within the timeline.

(a) **SURVEY EQUIPMENT:** The following survey equipment(s) must be in perfect working conditions throughout contract period to meet the required survey objectives, receiver/source efforts as per pre-planned survey design and project timeline already stipulated.

- DGPS (RTK) units capable of operating in L1 & L2 modes with required accessories. The vintage of these survey equipment should not exceed five (5) years as on Original Bid Closing date.
- Survey software of latest version as on Original Bid Closing date in adequate quantity for survey data planning, management & processing. The software must be covered under maintenance contract for the entire duration of the contract with OIL.
- Stand-alone workstations should not exceed three (3) years as on Original Bid Closing date.

The service provider must use DGPS (RTK) for reference point fixing and use RTK for control point survey & line implantation. However, in canopy cover area, service provider may use total stations (vintage ≤ five (5) years as on Original Bid Closing date) for control point survey & line implantation. The respective quantities of inventory along with specification for all the survey related activities are to be provided by the service provider as per table below.

SURVEY EQUIPMENTS	
DGPS (RTK) System: Make & Model	
Quantity: 2 Base with radio & 6 Rovers	
Year of manufacture	≤ five (5) years as on original bid closing date
*Total Station: Make & Model	
Quantity: 2 Nos.	
Year of manufacture	≤ five (5) years as on original bid closing date

<i>*In case service provider does not deploy total station system, they have to deploy additional 1 one (01) set of DGPS system for each quantity.</i>	
Softwares: Latest version as on original bid closing date. i. 2D/3D field data management and planning software (AutoCAD/Grapher/Surfer/ArcGIS/Equivalent) ii. Survey data processing (e.g., TBC) software	
Workstation: Minimum one (1) for aforesaid Software	
Operating system: 64-bit or higher Processor: 10 th Generation or higher Ram: 32 GB or higher Storage: 2 TB or higher including minimum 512 GB SSD Graphics: 4GB or higher	
Make & Model	
Year of manufacture	≤ three (3) years as on original bid closing date

B. SEISMIC DATA ACQUISITION RECORDING EQUIPMENT & PERIPHERALS: The vintage of seismic data acquisition recording equipment (& its peripherals) should not exceed **five (5) years** as on original bid closing date and must be in perfect working condition. The number of peripherals (viz. data recording units/ nodes, cables, connectors, inter-connect boxes, sensors, shooting systems, harvester units, battery & charging units, communication devices, data transmission devices, spread QC tools) to be deployed must be adequate to have the capability of sufficient roll over for recording of requisite number of shots per day. The recording equipment & its compatible peripherals must be as per specifications mentioned below to complete the project within the stipulated time frame also considering the source & receiver effort as per survey design.

Seismic Data Acquisition Recording System:

- State of the art line telemetry/node based seismic data acquisition recording system with 24-bit $\Delta\Sigma$ (Delta-Sigma) Technology.
- The vintage of the recording system should not exceed **five (5) years** as on original bid closing date.
- The recording system and its allied accessories must be compatible with **Analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$** suitable to logistics and terrains of the area using Explosive as energy sources.
- The recording system should have the capability to record a minimum of 1000 channels at 2 ms sampling per shot.
- Sufficient cables, Analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$ sensors/nodes with provision of external Analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$ sensors /internal Analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$ for acquisition systems, accessories, encoder/decoder, remote units, interconnected boxes, shooting systems, harvester units, battery & charging units, communication devices, data transmission devices, spread QC tools etc.
- The time break (TB) delay between radio shooting system (confirmed & predicted TB) shall be less than 1 millisecond (ms).

Sensors:

- Service provider must deploy **Analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$** with standard casing which must be industry standard. The response of these digital sensors should be as per specifications of OEM.
- For nodes with internal Analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$ the vintage should not exceed **five (5) years** as on original bid closing date.
- For nodes with external Analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$, the vintage of external sensor should not exceed **three (3) years** as on original bid closing date.
- The analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$ must be fully compatible with seismic data acquisition recording system along with line interface/cables/station units, etc.

The respective quantities of inventory along with specification for seismic data acquisition recording equipment & peripherals are to be provided by the service provider as per table below:

SESIMIC DATA RECORDING EQUIPMENT & PERIPHERALS	
a. 24-bit $\Delta\Sigma$ (Delta-Sigma) Line Telemetry/ node-based recording system	
Make & Model	
Quantity: One (1)	
Year of manufacture	\leq five (5) years as on original bid closing date
2000 channels recording capability at 2 ms sampling per shot	
Data recording format	
b. Seismic Cables/nodes	
Make & Model	
Type of cables:	
Quantity: sufficient for minimum 1200 channels	
Length of single cable (m): as per OEM specification to cater the RI of 30 meter with sufficient provision for detour	
Group Interval (m) (No. of takeout per cable)	
Year of manufacture	\leq five (5) years as on original bid closing date
c. Geophones: Analogue (conventional) geophone having natural frequency $\leq 10\text{Hz}$.	
Make & Model	
Year of manufacture	\leq five (5) years as on original bid closing date for nodes with internal sensors
	\leq three (3) years as on original bid closing date for nodes with external sensors
Sensitivity (Open circuit) for string configuration	140 V/M/S or more
Natural Frequency	$\leq 10\text{ Hz}$ with tolerance $\pm 0.5\text{ Hz}$
Distortion	$\leq 0.3\%$

Spurious Frequency	≥ 140 Hz
Operating Temperature	-40° C to 80° C
Polarity	SEG standard
Quantity: minimum 1200	
d. Shooting Equipment	
Shooting system including Encoder/Decoder with GPS enabled blasting with shot point positioning accuracy of ≤ 2 meter	
Make & Model	GPS Encoder Decoder
Quantity Encoder: minimum 2 Nos Decoder: minimum 8 Nos GPS: Sufficient for operating min. 8 Blasting crews (to be quoted by Service provider)	
Year of manufacture	≤ five (5) years as on original bid closing date
e. Vibrators	
Vibrators with sweep control units including Encoder/Decoder: <ul style="list-style-type: none"> • Peak force of should be greater than of 65,000 lb. • Frequency Limits 7 Hz to 200 Hz or better • Capable of generating linear and nonlinear sweeps. • All-terrain buggies. • Sand Tyres suitable for traversing the terrain in the area. • Each Vibrator with GPS System with point positioning accuracy of ≤ 2 meter. 	
Quantity Vibrator: minimum 5 Nos	
Make & Model of Vibrator	
Make & Model Encoder	
Make & Model Decoder	
Make & Model GPS	
Year of manufacture for vibrators	≤ five (5) years as on original bid closing date
Note: If vibrators are more than five years old, then the Vibrators must have been overhauled during last 5 (five) years ending last day of the month previous to the one in which bids are invited. Documentary evidence in this regard needs to be furnished.	

C. UPHOLE & LVL SURVEY EQUIPMENT: Uphole & LVL Survey equipment should not exceed **five (5) years** as on original bid closing date and must be in perfect working condition. The system must comprise of the followings:

- For Uphole Survey, digital recorder with minimum 4 channels recording capability and down hole cable, hydrophones or geophones suitable for logging up to **50 m** with weight drop or detonator as source.
- For LVL survey, digital recorder with minimum 48 channels recording capability at 0.1 ms sampling interval with weight drop or explosive or detonator as source.

- Suitable cable with minimum 300m length for LVL Survey meeting manufacturer's specifications.
- Geophones for refraction survey shall meet manufacturer's specifications.
- One (1) equipment set for Uphole Survey & One (1) equipment set for LVL Survey.

The respective quantities of inventory along with specification for Uphole & LVL survey recording are to be provided by the service provider as per table below.

UPHOLE & LVL SURVEY EQUIPMENT	
a. Uphole Survey Equipment	
Make & Model	
Quantity: minimum One (1) Nos	
Year of manufacture	≤ five (5) years as on original bid closing date
Data recording format	
4 channels recording capability with down hole cable	
Suitable for logging up to 50 m with weight drop or detonator as source	
b. LVL Survey Equipment	
Make & Model	
Quantity: minimum One (1) Nos	
Year of manufacture	≤ five (5) years as on original bid closing date
Data recording format	
Digital recorder with minimum 48 channels recording capability at 0.1 ms sampling interval with weight drop or explosive or detonator as source	
Cable for Refraction Survey	
Make & Model	
Quantity: minimum One (1) Nos	
Length of cable (m) (customised as per survey requirement)	
Takeout Interval (m) (customised as per survey requirement)	
Year of manufacture	≤ five (5) years as on original bid closing date.
c. Low Frequency & High Sensitivity 4.5 Hz Geophones	
Make & Model	
Year of manufacture	≤ three (3) years as on original bid closing date.
Natural Frequency	4.5 Hz ± 0.5 Hz
Harmonic Distortion	≤ 0.3 %
Sensitivity	>27 Volt/m/sec
No. of Geophones per string	1
Quantity: minimum 60 nos	

d. Hydrophone for Up-hole Survey	
Make & Model	
Quantity: minimum two (2) Nos	
Year of manufacture	≤ three (3) years as on original bid closing date.

D. COMPUTING DEVICES: Stand-alone workstations vintage do not exceed **three (3) years** as on original bid closing date with adequate RAM, disk-space to run the following application **software packages of latest version** at the time of original bid closing date. The respective Software must be covered under maintenance contract for the entire duration of the contract with OIL.

- Stand-alone workstation with software (OMNI/MESA/NORSAR/Equivalent) for 2D seismic survey simulation.
- Stand-alone workstation with software for Uphole & LVL data processing and interpretation along with preparation of Near Surface Model (model based).
- Stand-alone workstation with software for **2D/3D seismic field data QC processing:** Full-fledged 2D/3D Seismic Data Processing software for field QC processing of acquired 3D seismic data. The vintage of the hardware should not exceed **three (3) years** as on the original bid closing date and must be in perfect working condition. The hardware of the proposed workstation including Operating system, Processor, RAM, Storage & Graphics of proposed workstation shall be adequate to run application QC processing software with computational power for processing up to **Post Stack Time Migration (PSTM) for 20% of contractual quantum and interactive visualization for QC purpose** at field base camp site. It must have seamless compatibility for seismic data read from data recording equipment and write project deliverables in suitable media as per NIT requirement. The workstation must be connected to a network plotter, printer/scanner, tape drive for back-ups, etc. The field processing software version (Seismic Processing packages along with version, date of release) shall be of **latest version** as on original bid closing date. The field processing software must be capable of processing 2D Seismic Data up to Post Stack Time Migration. If the workstation for 2D seismic field data QC processing is found not capable for handling the data set during project execution, then suitable replacement of the workstation must be done by the service provider under intimation to Company.
- Dedicated Stand-alone workstation for Company's onsite QC representative which must be connected to network plotter, printer/scanner, etc. to provide the technical inputs to the service provider. Softwares for 2D field data management and planning, software for 2D seismic survey simulation, software for viewing Uphole & LVL raw data, processing, interpretation along with Near Surface Model (model based) must be installed in the dedicated workstation to be assigned for Company's onsite QC representative.
- Minimum five (5) stand-alone workstations (including work station for survey data management) with minimum configuration as mentioned in table below shall be deployed by the service provider.
- The other ancillary equipment viz. network colour laser printer with scanner facility capable of printing A3 paper size, network colour plotter capable of printing 36" paper size and IBM 3592 (E07) cartridge drives, etc. should not exceed **five (5) years** as on original bid closing date and must be in perfect working condition.

The respective quantities of inventory along with specification for computing hardware & software are to be provided by the service provider as per table below:

COMPUTING HARDWARE & SOFTWARE	
a. Software for 2D seismic survey simulation (OMNI/MESA/NORSAR/Equivalent): Latest version as on original bid closing date.	
Workstation: Minimum one (1) for aforesaid software	
Operating system: 64-bit or higher Processor: 10 th Generation or higher Ram: 64 GB or higher Storage: 2 TB or higher including minimum 512 GB SSD Graphics: 4GB or higher	
Make & Model	
Year of manufacture	≤ three (3) years as on original bid closing date
b. Software for Uphole & LVL data processing and interpretation along with preparation of Near Surface Model (model based): Latest version as on original bid closing date	
Workstation: Minimum one (1) for aforesaid software	
Operating system: 64-bit or higher Processor: 10 th Generation or higher Ram: 32 GB or higher Storage: 2 TB or higher including minimum 512 GB SSD Graphics: 4GB or higher	
Make & Model	
Year of manufacture	≤ three (3) years as on original bid closing date
c. Software for 2D seismic field data QC processing: Latest version as on original bid closing date	
Workstation: Minimum one (1) for aforesaid software	
Hard configuration: Operating system: 64-bit or higher Processor: 10 th Generation or higher RAM: 128 GB or higher Storage: 5 TB or higher including minimum 1 TB SSD Graphics: 8GB or Higher	
Make & Model	
Year of manufacture	≤ three (3) years as on original bid closing date
d. Workstation: Minimum one (1) for Company's onsite QC representative in which all the requisite software's mentioned above must be installed for independent QC purpose	
Operating system: 64-bit or higher Processor: 10 th Generation or higher Ram: 32 GB or higher Storage: 2 TB or higher including minimum 512 GB SSD	

Graphics: 4GB or higher	
Make & Model	
Year of manufacture	≤ three (3) years as on original bid closing date
Other ancillary equipment viz. Printer/Scanner, Plotter, Tape Drives, Networking, etc.	
Make & Model	
Year of manufacture ≤ five (5) years as on original bid closing date	

- E. COMMUNICATION EQUIPMENT:** Communication equipment to be provided including walkie-talkies, VHF radios, SSB radios, sufficient for the project and the units must meet the manufacturer’s specifications.
- F. TRANSPORT EQUIPMENT:** The service provider has to decide and bring requisite quantity of specialized transport for crew, explosive vans and jeeps for explosive movement, Instrument van, to carry out seismic survey in areas as described in Scope of Work, Section-II, Part-3. All the available indigenous transport has to be arranged by the service provider, locally. All the transport must be in perfect working condition and meet all the desired specification including insurance and the requisite licenses for the purpose of use. All the vehicles must be equipped with all seat belts, First Aid Kit, Spare wheel, fire-extinguisher etc. as per HSE standards.
- G. SHOT-HOLE DRILLING EQUIPMENT:** Service provider has to deploy appropriate shot hole drilling modalities having capabilities to drill single shot hole up to depth of 30 m apart from Uphole up to depth of **50 m** during the project. The shot drilling equipments proposed for deployment must be in perfect working conditions, capable of drilling in terrains as mentioned in Scope of Work, Section-II, Part-3 (Terms of Reference/Scope of Work).

The respective quantities of inventory along with specification for other equipment(s) are to be provided by the service provider as per table below:

OTHER EQUIPMENT(S)
E. COMMUNICATION EQUIPMENT
Type
Make & Model
Quantity: Sufficient (to be quoted by Service provider)
F. TRANSPORT EQUIPMENT
Type
Quantity: Sufficient (to be quoted by Service provider)
G. SHOT-HOLE DRILLING EQUIPMENT
No. of manual drilling rigs deployment (to be quoted by Service provider)
No. of mechanized drilling rigs deployment (to be quoted by Service provider)
Total Quantity:
Note: Type of drilling equipment/no. of equipment for each type to be deployed by Service provider shall be commensurate with daily production requirement for timely completion of project

ENCLOSURE-IV**SCHEDULE OF SEISMIC ANCILLARY DATA DELIVERY**

Sl. No.	Item	Media (Copies)	Remarks
1	Raw Seismic Data of each Line with source signature for wavelet correction with proper phase & amplitude correction in case of mixed source and receiver along with the model correspondence.	IBM 3592 (E07) tape (1No) External SSD (2 No)	1) 1st copy will be submitted within one (1) week of completion of the Line 2) 2nd copy will be submitted within one week after submission of 1st copy.
2	i. SPS files, Observer's Reports with shot-receiver geometry ii. Shot Hole Depth iii. Up-hole Time iv. Shot and Receiver Statics v. Skip/Recovery information	External SSD (2 No)	
3	Survey data in UKOOA, ASCII format along with Uphole and LVL survey locations	External SSD (2 No)	
4	a) Final Geometry Files in ASCII b) Final Trace kill table c) First Break Pick Table d) Final Statics information e) Final Velocity (SEG Y & ASCII) f) Final Brute Stack in Std. SEG Y format	External SSD (2 No)	
5	Raw Seismic data of the entire project (All recorded shots in Field including NTBC and rejected shots.)	IBM 3592 (E07) tape (1No) External SSD (2 No)	All copies shall be submitted within 15 days after completion of data acquisition.
6	a) Raw Seismic data of the entire block b) SPS files (r, s, x Files) with shot & receiver statistics c) Observer's report d) Recording Parameter e) Header information of Seismic Data f) Skip/Recovery Information g) LVL & Up-hole Locations, Interpretation, Model based NSM, Statistics h) Survey data of Shot & Receiver in UK00A & ASCII Format i) Final Maps in PDF format (Scales: In mutually agreed three different Scales) - Base Maps - Fold coverage map - Up-hole & LVL location Map - Weathered & sub weathered layer thickness map - Weathered & sub weathered layer velocity map - Reference pillar map j) Reports - Weekly Reports - Monthly Reports - Annual Interim Report	External SSD (3 No)	All copies shall be submitted within 15 days after completion of data acquisition

	<ul style="list-style-type: none"> - Final Operational Report - Final Topographical Survey Report - Final Acquisition Report <p>Tape List</p>		
7	<p>Maps-Soft copies in mutually agreed two different Scale</p> <ul style="list-style-type: none"> - Base Map - Coverage map - Location map LVL & Up-hole - Reference pillar map (Scales: In mutually agreed three different Scale) <p>Format: .shp file/.kmz file</p>	External SSD (2 No)	All copies shall be submitted within 15 days after completion of data acquisition
8	<p>Geometry Applied Seismic data of the entire project in std. SEG Y format</p> <ul style="list-style-type: none"> a) Final Geometry Files in ASCII b) Final Trace kill table c) First Break pick file d) Final Velocity (SEG Y & ASCII) e) Final QC Processing Output in Std. SEG Y format 	IBM 3592 (E07) tape (1 No) External SSD (2 No)	All copies shall be submitted within 15 days after completion of data acquisition
9	<p>Processed Output</p> <ul style="list-style-type: none"> a) Raw Data with geometry with navigation information stamped onto SEG-Y header b) Near Surface Velocity Model & relevant maps (to map scale) c) Post Migrated & Pre-migrated CMP gathers with Navigation information, noise suppression, statics solution, gain recovery etc. Applied before and after Q compensation (if applied) d) Final Post Migrated & Pre-migrated CMP gathers (input to PSTM processing flow) e) Final Post Migrated & Pre-migrated stacks section f) Raw Post Migrated & Pre-Stack Time migrated Stack g) Final Post Migrated & Pre-Stack Time migrated Gathers (No mute, with & without NMO) on floating datum h) Final Post Migrated & Pre-Stack Time migrated Gathers (No mute, with & without NMO) on final datum i) Final Post Migrated & Pre-Stack time migrated stack with and without scaling (ASCII) j) Final Post Migrated & Pre-Stack time migrated stacks (Near, Mid and Far “offset/angle” sub stacks (after final noise attenuation without TVF and Gain) k) Final Migration velocity fields used for PSTM (with & without smoothing) l) Final Stacking velocity fields (after High density Velocity picking) 	SEG Y format IBM 3592 (2 copies) & External SSD (2 No)	<p>within fifteen (15) days after completion of processing</p> <p>SEG-Y header</p>

	m) The zero phased Post-stack Time Migrated Gathers (with & without NMO) & stack section with and without scaling n) The zero phased Pre-stack Time Migrated Gathers (with & without NMO) & stack section with and without scaling		
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Note:

- i. Project data delivery format as per OIL's Standard Operating Procedures which will be shared with successful bidder prior to mobilization.
- ii. Two SPS file will be submitted separately one with all accepted shots and second with all accepted & rejected shots.