

Expression of Interest for 2D Seismic Data Acquisition in Ganga Basin 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 5100 LKM of regional 2D Seismic Data in the un-appraised areas covering parts of UTTAR PRADESH, BIHAR & MADHYA PRADESH** 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 Uttar Pradesh, Bihar and some part falling in Madhya Pradesh.

The operational area is mainly alluvial plains. Seismic lines are passing through, plains, cultivated lands, industrial areas, cities, villages, and restricted/sensitive areas etc. The operational area is located near big cities like Shahjahanpur, Lucknow, Varanasi, Gorakhpur & Patna etc. and it lies across two states of Uttar-Pradesh & Bihar. The typical crops grown in these areas are wheat, rice, potato, sugarcane, pearl millet, maize, barley and general fruits. There are a large number of villages and cities within the project area.

Oil India Limited (OIL) intends to acquire 2D Seismic Data, using Explosive. The total work programme for 2D Seismic Data Acquisition of 5100 GLKM of 150-fold with Explosive as source.

The service provider shall have to deploy Three (3) 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 under the contract).

2.0 GEOLOGY OF THE AREA

It forms a part of the Central Ganga Basin and is underlain by the alluvium comprising clay, silt, sand and gravels of Quaternary age. The Indo-Gangetic Plain is the extensive alluvial plain of the Ganga, Indus and Brahmaputra rivers and their tributaries and separates the Himalayan ranges from Peninsular India. The Ganga Plain occupies the central position in the Indo-Gangetic Plain. Geographically, the Ganga Plain extends from Aravalli-Delhi ridge in the west to the Rajmahal hills in the east; Himalayan foothills (Siwalik Hills) in the north to the Bundelkhand-Vindhayan Plateau-Hazarika plateau in the south.

The Ganga basin of northern India contains several Kilometers of alluvial strata and constitutes one of the world's most extensive alluvial plain. The Ganga plains are of great significance, as they constitute an important link now and during the earlier quaternary between the Himalayan Orogen and the Indian Ocean. Indo-Gangetic plain represents a deep (>8 km thick sediments). The length of Ganga Plain is about 1000 km and the width is ranging between 450-200 Km; being wider in the western part and narrower and the eastern part. It occupies an area about 250,000 SqKm.

The Ganga Plain is an active area of sediments from the Himalaya, and some from the peninsular craton. The Indian lithosphere beneath the Ganga Plain shows much inhomogeneity in the form of basement highs and lows. The Himalayan-derived gravel beds are present only in the Bhabar and Terai belt. The gravel horizontal of Central Alluvial Plain is reworked kankar and carbonate-cemented sand. The gravel horizons of the southern part of the Ganga Plain are derived from the peninsular craton. Kankar

development is common in the southern part of the Central Alluvial Plain and in Marginal Alluvial Plain. The top few meters of succession throughout the Ganga Plain show a distinctive fining upward sequence, mostly terminating in mud rich sediments.

3.0 OBJECTIVES OF THE SURVEY:

The main objective of the survey is to know the sedimentary thickness as well as extension of Ganga Basin towards South and to map Tertiary, Palaeozoic. Few lines is planned to map the regional connectivity between Ganga- Basin & Vindhyan Basin & Bundelkhand 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 proposed study area falls in Uttar Pradesh & Bihar covered by Ganga basin comprises of three large topographic divisions of the Indian subcontinent, namely the Himalayan Young Fold Mountains, the Gangetic Plain, and the Central Indian highlands.
- b) The Himalayan Fold Mountains comprises the Himalayan ranges including their foot hills with numerous snow peaks rising above 7000m. Each of these peaks is surrounded by snow fields and glaciers. All the tributaries are characterized by well-regulated flows and assured supply of water throughout the year by these glaciers.
- c) The Gangetic plains, in which the main stem of Ganga lies, situated between the Himalayas and the Deccan plateau, constitute the most of the sub-basin ideally suited for intensive cultivation. It consists of alluvial formation and is a vast flat depositional surface at an elevation below 300m.
- d) The Central highlands lying to the south of the Great Plains consists of mountains, hills and plateaus intersected by valleys and river plains. They are largely covered by forests. Aravali uplands, Bundelkhand upland, Malwa plateau, Vindhyan ranges and Narmada valley lies in this region.

4.1 COMMUNICATION:

Uttar Pradesh & Bihar is well connected by many national highways, the NH 27, is passing through the study area. Both the states has an Interstate & Inter-city surface transport system both in terms of railways and bus network. All main cities are connected by air, rail, and road.

- a) Uttar Pradesh has two (2) International Airport – Lucknow International Airport & Varanasi International Airport. Other Domestic Airport in Uttar Pradesh are Prayagraj Airport, Kanpur Airport, Gorakhpur Airport, & Agra Airport. These airports connect Uttar Pradesh with the major cities of India such as Delhi, Kolkata, and Mumbai.
- b) Bihar is served by several airports, with the Jay Prakash Narayan International Airport in Patna being the primary and largest airport. Other significant airports include Gaya International Airport, Darbhanga Airport, and Bhagalpur Airport. These airports connect Uttar Pradesh with the major cities of India such as Delhi, Kolkata,

and Mumbai.

- c) Uttar Pradesh & Bihar is well connected with the main cities of India by rail. Ghaziabad, Kanpur, Prayagraj, Lucknow, Varanasi, Gorakhpur, are few major railway stations in Uttar Pradesh. Similarly, Patna, Chapra, & Arrah City are few major railway stations in Bihar. These stations are connected with electrified sections served by three Rajdhani Expresses and trains to all major cities of India.
- d) Uttar Pradesh & Bihar is well-connected to the main cities of the country by state and national highways and served by respective State Road Transport Corporation and private operators.

4.2 CLIMATE:

Ganga Basin has varying climate. The weather or climate of the Ganga Basin 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 maximum temperature across the basin is 30.3°C in summer and 21.1°C in winter. The average minimum temperature across the basin is 21.5°C in summer and 6.4°C in winter. The pre-monsoon season is the hottest in the Ganges basin with an average temperature of 31.4°C, with June being the hottest month in the upper basin and May the hottest in the lower basin.

5.0 GENERAL INFORMATION:

Hiring of services for 2D Seismic Data Acquisition of 5100 LKM (Line Kilometer) covering parts of Uttar Pradesh, Bihar & Madhya Pradesh under Mission-Anveshan for hydrocarbon exploration. The service providers will need to acquire a total of 5100 LKM of 2D seismic data within the agreed time frame of Eighteen (18) months. Minimum of three (3) seismic crews must be deployed in the area of operations at all times under this contract. The total work programme for 2D Seismic Data Acquisition of 5100 LKM of 150-fold with Explosive as source.

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 5100 LKM 2D seismic data in the area within Eighteen (18) months.

Under this agreement, the service provider is required to acquire about 5100 LKM of high quality 2D seismic data in the area by deploying 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 (Explosive with suitable detonators etc.).

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 86,500 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, drilling rigs along with manpower and start the data acquisition in the area within **30 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 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	60 m
4	Spread	Symmetric Split spread
5	Source	Explosive
6	Correlated record length	8 seconds
7	Sample Interval	2 millisecond
8	Total No. of live channels per SP	900 (450-450)
9	Shot hole depth	~32 m, shot hole depth will be decided on the basis of near surface modal.
10	Charge Size	Charge size to be adopted shall be decided after the necessary experimental work in the field.

Note:

- i) Final acquisition 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.
- iv) 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 Explosive as energy source for data acquisition work program planned in the Ganga Basin 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) 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.
- d) 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.
- e) 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 LOW DISTORTION and HIGH-SENSITIVITY geophones with natural frequency of 4.5 Hz. The response of geophones to be 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 recording for high bandwidth signal, which is necessary to resolve the thin reservoirs.
- 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 1770 numbers of Uphole and 1770 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 parameters like shot hole depth, charge size, pattern hole, if any.

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

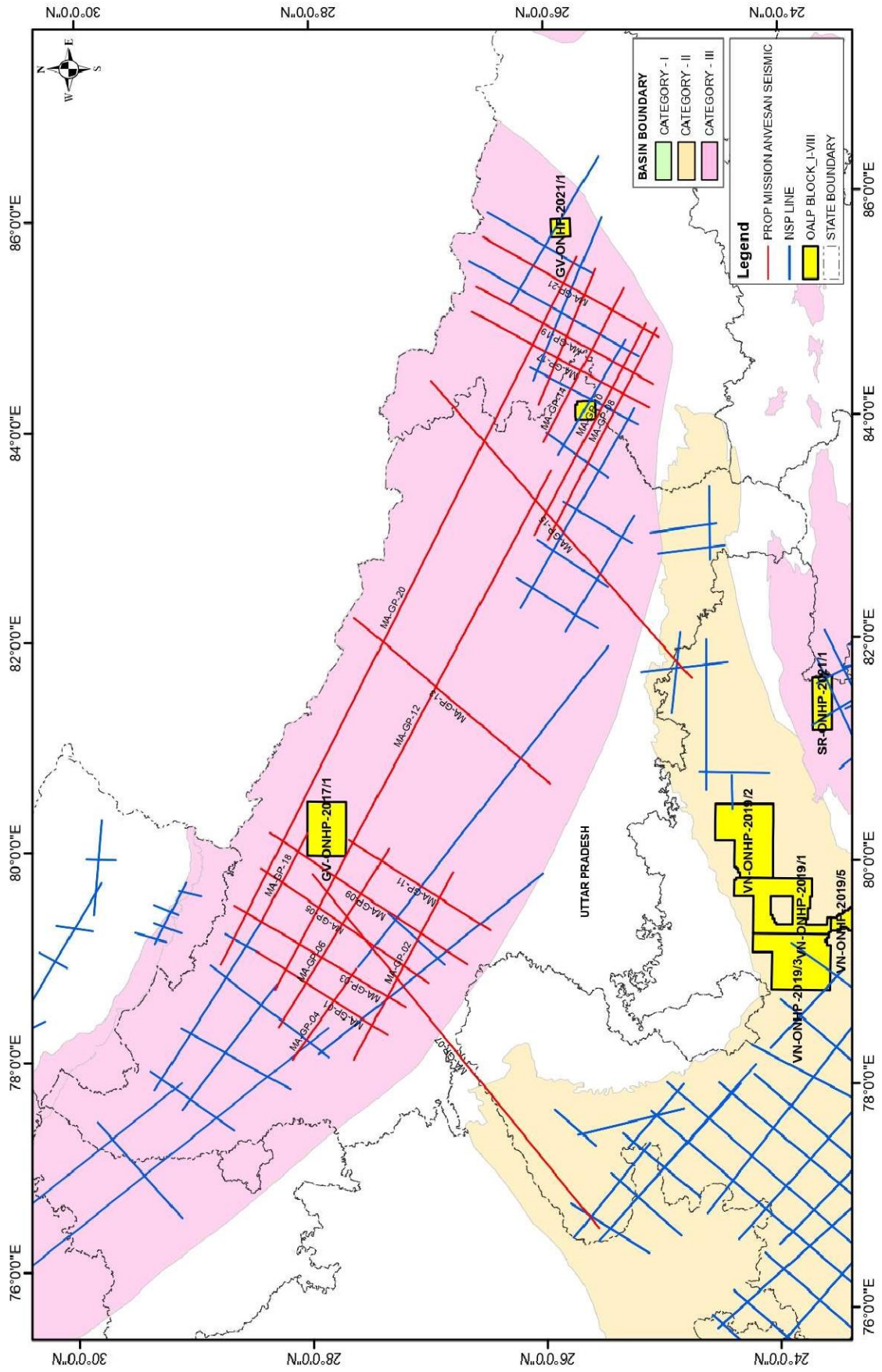
6.12 Service provider will submit/deliver the recorded data along with all the relevant data as mentioned in **ENCLOSURE-IV** to the authorized Company's representative at Duliajan.

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.

ENCLOSURE-I

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



End Point Coordinates of Profiles identified for data acquisition

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

FID	Name	LKM	X_Start	Y_Start	X_End	Y_End
1	MA-GP-01	145.89	78.347095	27.454611	79.101118	28.588059
2	MA-GP-02	196.01	78.110859	27.73746	79.861595	26.910908
3	MA-GP-03	187.16	78.608089	27.306783	79.526187	28.786119
4	MA-GP-04	103.1	78.952526	27.730572	78.095737	28.265948
5	MA-GP-05	190.61	78.833533	27.111705	79.880485	28.558326
6	MA-GP-06	193.71	78.397822	28.389808	80.068815	27.466286
7	MA-GP-07	422.86	76.63258	25.599687	79.82763	28.116964
8	MA-GP-08	220.39	82.904784	26.08988	84.818034	25.118741
9	MA-GP-09	222.53	80.205031	28.482939	79.011688	26.778705
10	MA-GP-10	220.49	82.955775	26.205308	84.858472	25.212958
11	MA-GP-11	156.95	79.330827	26.590681	80.144712	27.806225
12	MA-GP-12	542.64	78.747823	28.427201	83.541947	26.05344
13	MA-GP-13	240.48	80.676439	26.08346	82.21353	27.761475
14	MA-GP-14	160.33	83.800995	26.115353	85.184031	25.393491
15	MA-GP-15	368.23	84.392097	27.068638	81.634697	24.870328
16	MA-GP-16	135.58	84.141891	26.151316	85.366267	25.634556
17	MA-GP-17	190.19	84.091685	25.200147	85.01351	26.698702
18	MA-GP-18	93.17	79.365114	28.55805	80.206438	28.166667
19	MA-GP-19	189.83	84.310985	25.164501	85.241923	26.654183
20	MA-GP-20	730.71	78.969809	28.897234	85.482596	25.788624
21	MA-GP-21	190.51	84.732401	25.105017	85.692264	26.585588

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 \leq 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	\leq five (5) years as on original bid closing date
*Total Station: Make & Model	
Quantity: 2 Nos.	
Year of manufacture	\leq 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 **LOW DISTORTION and HIGH-SENSITIVITY single analog sensors with natural frequency of 4.5 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 2000 channels at 2 ms sampling per shot.
- Sufficient cables, low distortion and high-sensitivity single analog sensors with natural frequency of 4.5 Hz sensors/nodes with provision of external/internal low distortion and high- sensitivity single analog sensors with natural frequency of 4.5 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 **low distortion and high- sensitivity single analog sensors with natural frequency of 4.5 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 low distortion and high- sensitivity single analog sensors with natural frequency of 4.5 Hz, the vintage should not exceed **five (5) years** as on original bid closing date.
- For nodes with external low distortion and high- sensitivity single analog sensors with natural frequency of 4.5 Hz, the vintage of external sensor should not exceed **three (3) years** as on original bid closing date.
- The low distortion and high- sensitivity single analog sensors with natural frequency of 4.5 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:

SESMIC 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	≤ 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 1500 channels	
Length of single cable (m): as per OEM specification to cater the RI of 20 meter with sufficient provision for detour	
Group Interval (m) (No. of takeout per cable)	
Year of manufacture	≤ five (5) years as on original bid closing date
c. Geophones: Low Distortion and High-Sensitivity single analog sensors with natural frequency of 4.5 Hz.	
Make & Model	
Year of manufacture	≤ five (5) years as on original bid closing date for nodes with internal sensors
	≤ three (3) years as on original bid closing date for nodes with external sensors
Sensitivity	80 V/M/S or more
Natural Frequency	≤ 4.5 Hz with tolerance ± 0.5 Hz
Distortion	≤0.9%
Spurious Frequency	≥ 90Hz
Operating temperature	- 40°C to +70°C
Polarity	SEG standard
Quantity: minimum 1500	

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

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. Software 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 UK00A, 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 - Final Operational 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 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.