

OIL & GAS DEVELOPMENT COMPANY LIMITED



TENDER ENQUIRY NO. PROC-SERVICES/CB/EXPL-4939/2021

**HIRING OF SERVICES FOR 3D SEISMIC UNCONVENTIONAL
RESERVOIR CHARACTERIZATION STUDY FOR IDENTIFICATION
OF THE SWEET SPOTS IN LOWER INDUS BASIN OF PAKISTAN**

Note:

Bid bond of **USD 1,500/- (US Dollar One Thousand Five Hundred Only)** to be submitted with the technical bid.

The master set of tender documents (services) uploaded on OGDCL website (www.ogdcl.com) is the integral part of this TOR.

HIRING OF SERVICES FOR 3D SEISMIC UNCONVENTIONAL RESERVOIR CHARACTERIZATION STUDY FOR IDENTIFICATION OF THE SWEET SPOTS IN LOWER INDUS BASIN OF PAKISTAN

1. INTRODUCTION

- 1.1 Oil and Gas Development Company Limited (hereafter referred to as Company) is national exploration and production Company of Pakistan. The company is involved in hydrocarbon exploration and production activities in all parts of the country. The company intends to hire services for 3D seismic unconventional reservoir characterization to optimize the advance planning of lateral well trajectory in unconventional reservoir of Lower Indus Basin, Pakistan.
- 1.2 The study area falls in Tando Allah Yar E.L operated by OGDCL in Sindh province of Pakistan. The study area comprises of **six (06) wells** which drilled upto 4000 meter in Chiltan formation (Jurassic) and **3D seismic data approximately 150 Square Kilometers** as in Annexure-I. The more area may be added subject to the results of the study as and when required basis after the mutual consent.
- 1.3 The area of Interest comprises of Cretaceous shale reservoirs and lies within time window range of 1000-3000 msec in seismic data. The area falls in extensional regime characterized by normal faults. The generalized stratigraphy of Pakistan is provided in Annexure-II.
- 1.4 All available geological and geophysical data required for study will be provided to the consultant. Final PSTM CDP-Gathers with NMO and Seismic Velocities Volume in SEG-Y Format are available as input data set.
- 1.5 The contractor is required to make sufficient arrangements to perform the stipulated task within agreed time frame to meet the targets of the project.

2. Objectives:

The main objectives of the study are:-

- 2.1 Classify the rock facies with respect to shale reservoir quality (TOC, Porosity and Water Saturation etc.).
- 2.2 Rock physics feasibility of the rock facies.

- 2.3 Facies probability analysis at well locations using post/prestack seismic attributes and elastic rock properties.
- 2.4 Determine and mapping of brittleness on key reservoirs.
- 2.5 Identify natural fractures and their orientation in the reservoirs.
- 2.6 Propose well trajectories in favorable reservoir facies (sweet spots).

3. SCOPE OF WORK

The study will be carried out into 03stages, I. Rock physics feasibility II. Inversion feasibility III. Reservoir characterization on 3D Seismic.

3.1 Rock physics Feasibility: The main objectives of the intended project are listed but not limited to, as follows:

- 3.1.1 Well data conditioning. QC/prediction of Vs and Rho
- 3.1.2 Assess and correct data for presence of anisotropy, in wellbores
- 3.1.3 Derive dynamic elastic properties.
- 3.1.4 Interpret image logs for fracture orientation, density and other stress indicators.
- 3.1.5 Petrophysical analysis.
- 3.1.6 Define the geologically possible ranges of variation in shale reservoir properties (Kerogen/TOC, Porosity, fluids saturation). Use the ranges in stimulation to increase the number of data points for further analysis.
- 3.1.7 Rock physics analysis to establish the relationship between petrophysical and elastic properties of targeted reservoirs which can be extracted from seismic data.
- 3.1.8 AVO analysis on synthetic AVO gathers from the insitu reservoir properties and also from the reservoir properties perturbation/substitutions.
- 3.1.9 Facies definition on the basis of reservoir properties (important for shale reservoir characterization) on wells at seismic scale.
- 3.1.10 Facies probability analysis at well locations using post/prestack seismic attributes and elastic rock properties.
- 3.1.11 Lab Data calibration with the reservoir facies.

3.2 Seismic Data Evaluation And AVO Conditioning (Prestack Inversion Feasibility)

- 3.2.1 Prestack seismic data conditioning on NMO corrected offset/angle gathers
- 3.2.2 Perform quantitative seismic-well ties for all angle stacks.
- 3.2.3 Identification of natural fractures on post stack attributes and its validation from well data.

3.3 Reservoir Characterization on 3D seismic: Based on the results of both the feasibilities, the OGDCL will decide whether to proceed for 3D seismic reservoir characterization study or not. The following deliverables as per annexure-V will be provided by the contractor, if it is found feasible.

- 3.3.1 Dynamic elastic rock parameterization of the subsurface e.g. Absolute Acoustic Impedance (AAI), Relative Acoustic Impedance (RAI), Shear Impedance, V_p / V_s Poisson's ratio, μ -rho, λ -rho etc.
- 3.3.2 Convert to volumes of static elastic rock properties.
- 3.3.3 Generate maps of petrophysical properties on key intervals
- 3.3.4 Obtain brittleness volume and stress regime from elastic parameters and predict natural fractures along with their orientation to identify completion quality.
- 3.3.5 Facies probability volumes for identification of sweet spots.
- 3.3.6 Propose well trajectories to intersect favorable reservoir facies in an optimal alignment with stresses

4. TECHNICAL EVALUATION CRITERIA

- 4.1 The technical evaluation will be based on the technical evaluation criteria table Annexure-III. The potential bidders are required to strictly follow the sequence of Technical Evaluation Criteria and submit their proposals accordingly. The bidder obtaining less than 75% points in total and less than 50% in each category in the technical evaluation will be declared as technically non-responsive and its financial proposal will not be opened.
- 4.2 For final bid evaluation 70 % weightage will be given for technical evaluation and 30% for financial evaluation. The lowest bidder will attain maximum points in financial evaluation and other will be ranked on sliding scale .The points

obtained in technical evaluation and financial evaluation will then be combined and contract will be awarded to the bidder obtaining maximum points.

- 4.3 The contractor/bidder must have minimum of five (05) years of experience in unconventional reservoir characterization and completed adequate number of projects with good average over the year. The bidders shall provide company profile and experience and completion certificate of each project in detail. It should mention the project execution center.
- 4.4 The contractor must have state of the art of seismic inversion software, hardware and qualified/experienced man power. The bidders shall include list of professionals undertaking the seismic projects along with their CVs entailing complete job description.
- 4.5 The contractor must have workable project schedule and turnaround time. The bidders should submit project schedule in the form of Gantt chart.
- 4.6 The contractor must provide schedule for OGDCL professional in the project for QC purpose and skill transfer. OGDCL professionals (at least 02 professionals at each stage as per Annexure-III, Cat. No. 7) will participate at mentioned stages at contractor's premises within Pakistan or outside the Pakistan. OGDCL will bear all such costs and however, bidder will provide the invitation letter for visa facilitation purpose. Any delay due to visa, air tickets etc. will, however, be accommodated by the contractor.

5. RATES FOR FEASIBILITY AND 3D SEISMIC RESERVOIR CHARACTERIZATION

- 5.1 The contractor shall specify the feasibility cost and 3D reservoir characterization cost separately. After the results of rock physics and seismic inversion feasibility studies, the best workflow for reservoir characterization will be decided and the payments will be made accordingly.
- 5.2 The costs of Rock physics, seismic inversion feasibility studies and 3D seismic reservoir characterization as per Turn-Key rates in US\$ as given in Annexure-IV.
- 5.3 All payments will be made against actual verified invoices upon completion of the project.

6. DATA COLLECTION/INPUTS

- 6.1 On award of contract OGDCL will provide all available related Geological, Geophysical, Petrophysical and Geochemical etc. data.
- 6.2 For data collection a team of experts from consulting firm will visit OGDCL offices in Islamabad with no cost to OGDCL. The team will be comprised of at least one concerned professional.
- 6.3 The professionals will review and scrutinize the data during their stay in Islamabad. They will provide report about the quality of available data.
- 6.4 Data collection must start within a week with a kickoff meeting after signing the contract and duration of the project will start from complete data handling over and its acceptance.
- 6.5 The data obtained from any new drilled well during the study period will be provided to the Consultant to refine their work for a concrete recommendation.
- 6.6 The consultant will treat all data and information supplied by OGDCL and those acquired by him during the study with utmost confidentiality and will sign an agreement of confidentiality.
- 6.7 All such material will be returned to OGDCL after the completion of the study.
- 6.8 OGDCL will also provide adequate space and secretarial help to the consultant during their visit for data collection or presentation.

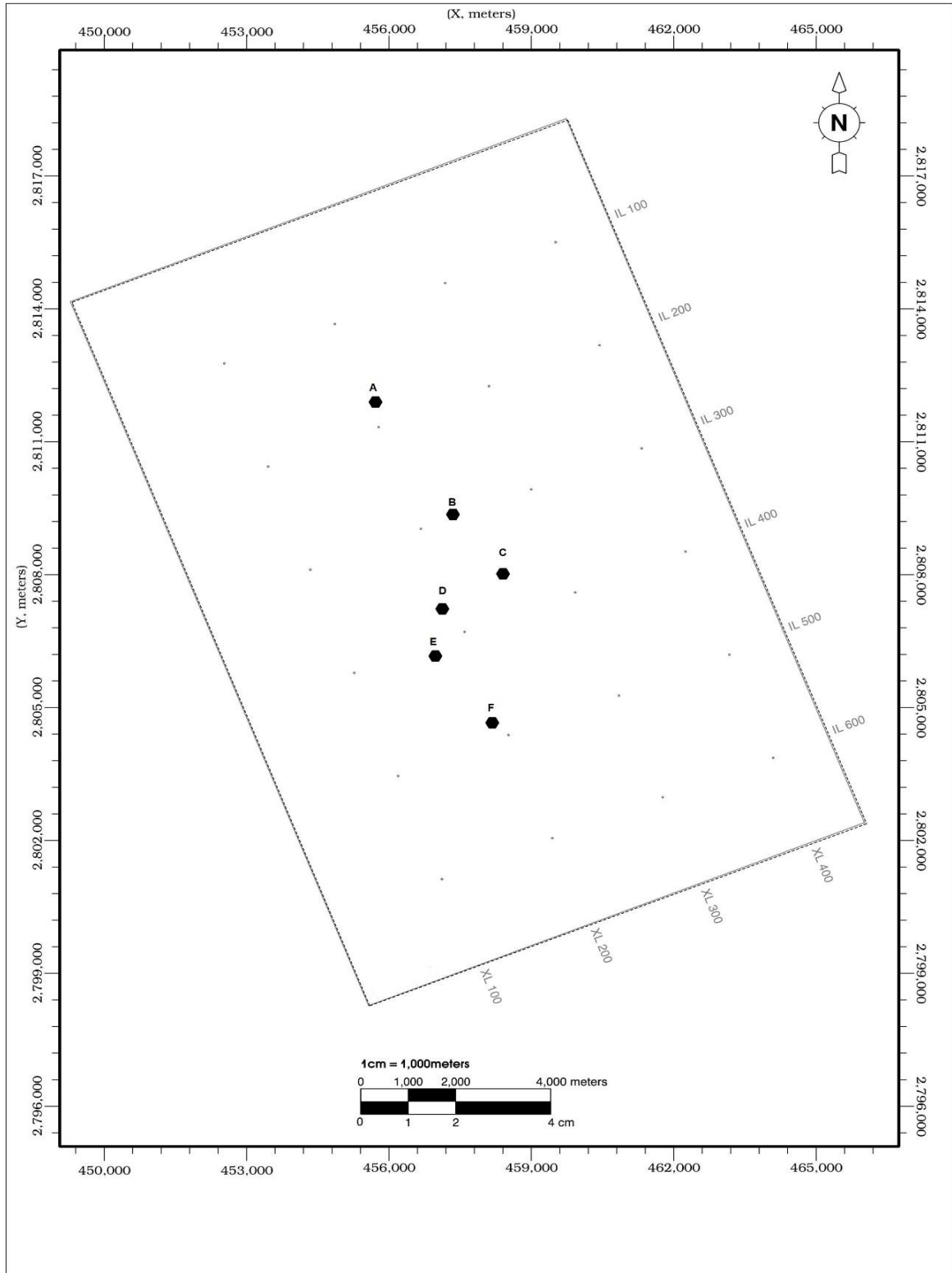
7. DELIVERABLES, PRESENTATION & REPORTS

- 7.1 A draft report for each of the study should reach OGDCL at least two weeks ahead of each presentation as well as the draft of the final report, which includes the results of all phases.
- 7.2 The consultant should submit weekly report at the end of every week and detailed fortnightly progress report to OGDCL, covering the work performed during that period.
- 7.3 Contractor violating these rules (delay in submission of reports) will be treated as delay in the invoices which may impact the invoices of the contractor.
- 7.4 On completion of the study, the consultant will send 01 copy of draft report to OGDCL. After final presentation and incorporating OGDCL input, the contractor

will provide 03 copies of the final report (Hard and soft) reports with necessary amendment/changes as an outcome of discussion in presentation.

- 7.5 The final report will be submitted within one month after the receipt of the comments from OGDCL.
- 7.6 The report will include in detail, all aspects of the study with the interpretation, conclusions and recommendations derived from the study.
- 7.7 At the end of the study consultant will present final report to OGDCL's professionals in Islamabad with no cost to M/s OGDCL.

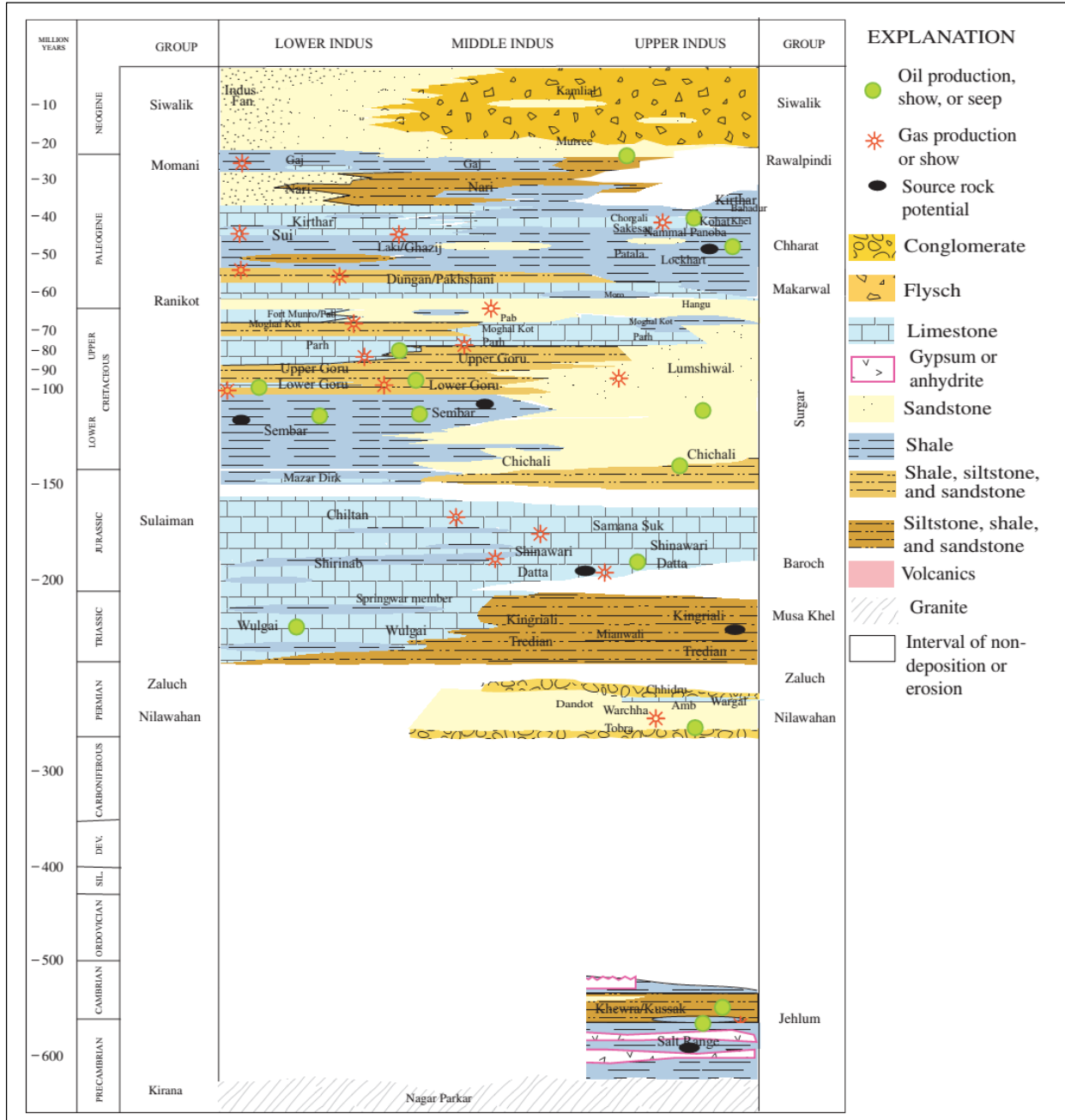
STUDY AREA FOR 3D SEISMIC UNCONVENTIONAL RESERVOIR CHARACTERIZATION



Annexure-II

GENERALIZED STRATIGRAPHY OF PAKISTAN

(MODIFIED BY OGDCL, 1996; Quadri and Quadri, 1996; Kemal, 1992; Raza, 1992; Iqbal and Shah, 1980; and Shah, 1977)



Annexure-III

TECHNICAL EVALUATION CRITERIA FOR UNCONVENTIONAL RESERVOIRS CHARACTERIZATION

S. No.	Description of Technical Information	Qualifying Criteria	Max. Marks
1.	No. of pre-stack seismic inversion projects with completion certificate in last 05 years (Please provide Client list as per Annexure III-A.)	<p>≥ 05 projects = 05 marks</p> <p>03-04 projects = 03-04 marks</p> <p>Less than 03 projects=0 marks</p>	05
2.	3D Seismic Unconventional Reservoir Characterization projects in last 10 years (Please provide Client list as per Annexure III-A.)	<p>≥ 05 projects = 15 marks</p> <p>03-04 projects = 06-08 marks</p> <p>Less than 03 projects=0 marks</p>	15
3.	Rock physics feasibility for reservoir characterization	<p>Up to 03 months = 05 marks</p> <p>03 to 04 Months = 2 mark</p> <p>More than 04 Months = 0 marks</p>	05
4.	Turnaround Time for reservoir characterization	<p>Up to 03 Months = 05 marks</p> <p>03 to 04 Months = 02 marks</p> <p>More than 04 Months = 0 marks</p>	05
5.	Detail sequence of workflow for the study	<ul style="list-style-type: none"> • Cover 100% of proposed scope of work=30marks • Cover 91%-100% of proposed scope of work = 25 marks • Cover 81%-90% of proposed scope of work= 20 marks • Cover less than 80% of proposed scope of work= 0 marks 	30
6.	<p>Manpower (Qualification and Experience in unconventional reservoir characterization)</p> <p>Resume of permanently employed manpower (Give complete details of experience as per attached Annexure III-B).</p>	<ul style="list-style-type: none"> • Professional Qualification : 02 or more up to PHD in Geosciences = 5 marks • Professional Qualification : 01 PHD in Geosciences = 3 marks • M.SC/M.Phil. in Geosciences = 2 marks • More than 05 professionals with pre stack seismic inversion 	35

		<p>minimum experience of 10 years=10 marks</p> <ul style="list-style-type: none"> • 03 to 05 professionals with pre stack seismic inversion minimum experience of 10 years =07 marks • Less than 03 professionals with pre stack seismic inversion minimum experience of 10 years =5 marks • Three or more professionals with unconventional reservoir characterization experience of minimum 05-years =20 marks • 02 to 03 professionals with unconventional reservoir characterization experience of minimum 05-years = 10 marks • Less than two professionals with unconventional reservoir characterization experience of minimum 05-years = 3 marks 	
7.	OGDCL professional participation in the unconventional reservoirs characterization		05
TOTAL MARKS (Qualifying Marks 75%)			100

Annexure-III

LIST OF PROJECTS/CONTRACTS OF SEISMIC INVERSION DURING THE LAST FIVE AND UNCONVENTIONAL RESERVOIR CHARACTERIZATION STUDY LAST TEN

S.No.	Contract No./Date	Description of Work	Amount (Million us \$)	Year	Client Name
1					
2					
3					

Annexure III-B**LIST / RESUME OF MANPOWER PERMANENTLY EMPLOYED BY THE COMPANY:**

S. No	Name of the Staff	Designation	Academic Qualification (Years)	Professional Qualification	Certificate Acquired(Copies to be Attached)	Experience/job description
1.						
2.						

Annexure-IV**RATES OF 3D SEISMIC UNCONVENTIONAL RESERVOIR CHARACTERIZATION**

S. No.	Description	US Dollar
1.	Rock physics feasibility study for reservoir characterization (Lump Sum & @ per well)	
2.	Seismic Data Evaluation And AVO Conditioning, per 3D volume.	
3.	Reservoir characterization on 3D seismic (Lump Sum & @ per Sq. km)	

Annexure-V**DELIVERABLE OF 3D SEISMIC UNCONVENTIONAL RESERVOIR CHARACTERIZATION**

S. No.	Description	Format	Recommended Media	No. of Copies.
1.	Edited and conditioned Well Logs (including but not limited to DTC, DTS, RHOB), TD pairs etc.	ASCII	Portable drive	02 sets
2.	Conditioned gathers, Estimated Wavelet. Near, mid and far	SEGY	Portable drive	02 sets Each

	Angle/offset gathers & Angle/offset Stacks, Stack Volumes, Synthetic Seismograms, Rock physics analysis and cross plots etc.			
3.	Vp, Vs, P-Impedance, S-Impedance, Density, Vp/Vs , Poison's Ratio, Mu-Rho, Lambda Rho volumes	SEGY volumes	Portable drive	02 sets Each
4.	Effective Porosity, Fluids Saturation, TOC, Brittleness index Volumes. Reservoir properties maps of prospective zones.	SEGY	Portable drive	02 sets Each
5.	stress regimes and natural fractures along with their orientation	ASCII/SEGY	Portable drive	02 sets Each
6.	Facies probability volumes	SEGY	Portable drive	02 sets Each
7.	Planned well trajectories	ASCII	Portable drive	
8.	Provisional Report	MS Word PDF	Portable drive	02 sets Each
9.	Final Report	MS Word PDF	Portable drive & colored Hard Copy	03 sets Each