5.0 CORING SERVICES

5.1 PRIMARY OBJECTIVES

The scope of work is a down hole and a surface handling Coring Services with preliminary total core length around 1980 ft. split as follows:

- 480 ft. in first 2 exploratory wells;
- 780 ft. in extended 4 exploratory wells program;
- 720 ft. in extended 4 appraisal wells program.

A) Primary objective is to acquire undisturbed formation rock for RCA (Routine Core Analysis) and SCAL (Special Core Analysis) in 8 ½" and 12 ¼'' vertical sections (for both sections 8 ½" coring tools should be used). **Damage to the core must be minimized. The value of all of core studies is based entirely upon the quality of the original sample. Every effort should thus be made to adopt drilling practices that provide best sampling conditions.**
All sections of the core will be packed to the containers suitable for transportation.

B) The other objectives to be achieved are:

- Cutting and recovering quality conventional core (core head technology, BHA design) including all associated operations;
- Core recovered gamma-ray logging and digital data transfer from the well site to the Company offices;
- Inner tube cutting, isolation and protection for further RCA & SCAL;
- Packing of cores in core boxes and marking of tubules;
- Ensuring that safe and adapted core handling and core processing procedures are implemented in order to minimize mechanical damages;
- Developing the right strategy for onsite core processing in order to acquire the required information with limited exposure of the core prior preservation and/or packaging.

C) Coring has both engineering and geologic objectives. The more crucial study of core samples, however, begins after the well is drilled. The objectives of a coring program include:

- Defining areal changes in porosity, permeability, and lithology-the data needed for estimates of reserves and mathematical models;
- Defining reservoir water saturation;
- Assisting in the definition of reservoir net pay;
  Providing information for calibrating downhole logs as well as the measured values of electrical properties that will be used to improve log-calculated water saturations;
- Acquiring rock samples for special core analysis studies, including relative permeability, capillary pressure, and formation wettability tests;
- Providing data on porosity, as well as on horizontal and vertical permeability distributions, for use in the design of well-completion programs to ensure that oil is not isolated and left behind the pipe.
- Paleontology and palynology for geological dating and stratigraphic correlation;
- Geochemistry of rock mineralogy, oil, and source kerogen composition;
- Measurement of porosity, permeability, and other petrophysical properties;
- Sedimentological studies of grain texture and sedimentary structures for regional geology.

D) The results of core samples examination become important for:

- Facies analysis and reservoir characterization;
- Reservoir engineering, well stimulation, and production programs;
- Reference material for partners, government agencies, and trade.

5.2 MINIMUM TECHNICAL REQUIREMENTS/ EQUIPMENT SPECIFICATION

A) Coring Assembly for both well sections: 8 ½'' and 12 ¼'' will be the same; Core barrel 6 ¾" with 4"core or 7"⅛ with 4" core (or alternative).

B) In 12 ¼'' hole section coring operations will be followed by reaming and hole enlarging to 12 ¼''.

C) Conventional Coring BHA for 8 ½'' hole is planned to be used. The Contractor shall proposed coring assembly with all elements, including core head specification.

D) Required equipment:
- Core Barrel with stabilizers;
- Coring BHA length –max 2 sections;
- Safety Sub c/w Redress kits;
- Circulating Sub c/w Redress kits;
- Core Saw - Rock core splitting machine;
- Portable Core Gamma Logger and accessories;
- Appropriate handling and operating equipment (necessary subs and X-subs etc.);
- Spares Parts (for Swivel Assembly, Inner Tube Shoe etc.);
- Rock analysis equipment at well-site (optional).

E) Core barrel design shall provide prevention from washout of core, maximum (not less than 80%) core recovery and trouble-free operation of the tool.
Every section of Core Barrel should have a lifting sub and a bottom plug. Lifting subs should have enough place to put the rig tongs on. Bottom plugs should be long enough for the inner tube assembly with lower shoe. Inspection Reports should be available for all Equipment.

F) Required consumables.
- OEM and Inspection Reports should be available for Consumables. Inner tubes should have thread protectors on pin and box connections.
- PDC coreheads or impreg c/w bit breaker, provides the best drilling parameters in all range of the coring intervals, "spring" core catchers, etc
- Inner tube fiberglass
- Material which meets requirements expected BHT – max 93°C, formation pressure –2 800psi,
- Sufficient quantity of the inner tube end caps with locking tape/clamps, core saw blades, core boxes 3ft (1m) length etc.

G) Coring Equipment (filled by the Contractor) as set out in SCHEDULE 1 and SHEDULE 2.

H) Consumables List (filled by the Contractor) as set out in SCHEDULE 2.

I) Miscellaneous.
The Contractor specifies the following data:
- Fishing diagrams and all tools fishing dimensions of the Equipment and Consumables;
- Inspection Procedures M/U Coring BHA, RIH & POOH, Wellsite Core Handling etc.

During all operation all Company's representatives will have free access to equipment and personnel for carrying out the control and check of work.

5.3 PERSONNEL

A) Designated coring engineers must have hands on recent experience with competency in coring service.

B) Coring crew should consist of two (2) coring engineers to cover 24 hours coring operations. In addition, four (4) core-processing engineers are mandatory for all core handling surface operations.

C) Contractor gives guarantee that all Contractor's personnel will work with Company employees and drilling crew as "one drilling team". Company is within his rights to reject any worker by its own decision without explanation a reason.

D) Personnel proposed for coring services on the rig site (filled by the Contractor as set out in SCHEDULE 3)

5.4 REPORTING/ DOCUMENTATION / COMMUNICATION

A) After each coring run detailed report is prepared by coring engineer, consist of coring parameters, start and end depth with all necessary remarks describing various events while coring.

B) After core processing at surface and cut into 1m pieces detailed core box list, core recovery is reported.

C) At the end of the well a final report is provided to the company in digital (Office 365, ASCII, PDF Image file) and paper copies (three copies plus extra copies if requested with written notice). It includes at least:

- Summary of coring;
- Final core data;
- Other data and plots if applicable;
- The reports shall be provided to the company within 10 working days after the end of drilling operations.

D) All the documents need to be sent to the DSV, the Wellsite Geologist and the Operations Geologist. Contact information will be provided on pre-spud meeting.

E) Contractor should present the reports with the following minimum data:

*1) Core Report (*Works/service report) after each cored interval

- Date;
- Core number;
- Depth of core interval;
- Recovery (length and percentage);
- Comments to coring with technical parameters (ROP, WOB, Rotary, Mud Inflow, etc.);
- GR in digital format ASCII (las) and pdf;
- GR with marked points of samples taking (optional data);
- Record-sheet with sample descriptions and analysis (optional data);

2) Gamma-ray plots;

3) Final Well Report - detailed description of coring operation and results.

F) Each of reports/plots should be accepted by Company's Representative.

G) Templates of above mentioned reports and plots are attached in SCHEDULE 4, 5 and 6..

5.5 RATES AND PRICES

A) Mobilization/Demobilization with transportation.

Prices of Mobilization/Demobilization with transportation as set out in SCHEDULE 2.

B) The calculation for the wells at TD ~ 5050ft (1539,5m)

The calculation for coring services for one well - coring approximately -180 feet.

1. Example of coring program.

Core No	Well diameter	Core length	Lithostratigraphy, lithology	Approximated depth (ft)
#1 - #3	8 ½"	3 cores x 60ft	Tahara,(sandstone, mudstone, claystone, shale)	(2630 – 2690) ft (802 – 820) m
			Awaynat Wanin (sandstone, mudstone, claystone, shale)	(3007 – 3067) ft (916.5 – 935) m
			Mamuniyat (sandstone, mudstone, claystone, shale),	(4384 – 4444) ft (1336 – 1355) m

Table 1 Example of coring program – well TD 5050 ft (1539.5 m)

Coring program proposition and/or equipment is set out in SCHEDULE 1.

2. Price for **1 ft** and for **60 ft** of Conventional Coring service is set out in SCHEDULE 2 including all related costs below:

- Personnel and equipment Operation time;
- Consumables Cost (including PDC coring bits, inner tubes, core boxes, inner tube end cups & locking tape/clamps, pneumatic core saw blades and etc.);
- Basic core surface handling (core cutting, core protection, core marking, core gamma).

3. Price for personnel proposed by Contractor is set out in SCHEDULE 3.

4. Price of equipment offered by Contractor is set out in SCHEDULE 2.

5. Additional Service.
   Prices of any additional services as set out in SCHEDULE 2.

C) The calculation for the wells at TD ~ 3 609ft (1 100m)

The calculation for coring services for one well - coring aprox.180 feet.

1. Example of coring program.

Core No	Well diameter	Core length	Lithostratigraphy, lithology	Approximated depth (ft)
#1	12 ¼" Tool 8 ½"	1 core x 30ft (OPTIONAL)	Marar (sandstone, mudstone, claystone, shale, limestone)	(1953 – 1983) ft (595 – 604) m
#2 - #5	8 ½"	3 cores x 60ft and 1 core x 30ft (*OPTIONAL)	Tahara,(sandstone, mudstone, claystone, shale)	(2478 – 2538) ft (755 – 773) m
			Awayat Wanin III&IV (sandstone, mudstone, claystone, shale)	(2927 – 2987) ft (892 – 910) m
			Tadrart (sandstones with minor mudstones)	(3069 – 3129) ft (935 – 953) m
			Intra-Acacus* (alternating shales and sandstones)	(3215-3245) ft (980-989) m

Table 2 Example of coring program – well TD 3609 ft (1100 m)

2. Price for **1 foot, 30ft** and for **60 ft** of Conventional Coring service is set out in SCHEDULE 2 including all costs below:

- Personnel and equipment Operation time;
- Consumables Cost (including PDC coring bits, inner tubes, core boxes, inner tube end cups & locking tape/clamps, pneumatic core saw blades and etc.);
- Basic core surface handling (core cutting, core protection, core marking, core gamma).

3. Price for personnel proposed by Contractor is set out in SCHEDULE 3.

4. Price of equipment offered by Contractor is set out in SCHEDULE 2.

A) Lost in hole equipment.

Price for lost in hole equipment is set out in SCHEDULE 2

B) The following services are included in the price:

1. Transportation of all Contractor Equipment, Personnel and materials to and from wellsite
2. Preparation of all necessary documents including Visa, works permit and related documentation required for Contractor Personnel, certificates, licenses, obtaining the necessary consents, rights of ways, permits and clearance customs duties from Libyan authorities,
3. Personal Insurances for all travel/working time from mobilization to termination of the service,
4. All Contractor payments for the workers: wages, bonuses, overtime hours, deduction etc,
5. All repair, replacement and maintenance work with Contractor's Equipment including spare parts and consumables.
6. During services performance Contractor should have spare parts and reserve equipment needed to work without demurrages

7. Travel time and any associated personnel expenses for Contractor Personnel to the rig location.
8. Communication equipment - one Thuraya phone in each car
9. HSE Policy, procedures & system should be carried during whole Service
10. Safety equipment – personal protective equipment in good condition such as safety glasses, safety boots, overalls, etc. for each of Contractor's Personnel.
11. Enough quantity of Crew Vehicles.

C) The following services shall be secured for Contractor:

1. Forklift or crane for loading and unloading of Contractor equipment at the rig site;
2. Water, compressed air and power supply 220/230V/50Hz will be delivered from the rig,
3. Food and accommodation for Contractor's Personnel at the rig site,
4. First aid and ambulance services for Contractor's Personnel if Rig Doctor recommend transportation injured worker to the hospital for emergency medical treatment.

SCHEDULE 1

CORING SERVICES PROGRAM AND EQUIPMENT

[Filled by the Contractor]

SCHEDULE 2

RATES & PRICES

[Filled by the Contractor]

Item	Q-ty	Description	Lump sum USD
1	1	Equipment and personnel with transportation to/from concession 113 blocks 1&2 including all costs of the delivery to the field and removal after termination of services with all travel worker's expenses	

Table 3 Equipment and personnel mobilization/demobilization with transportation.

Item	Q-ty	Description	Operating daily rate USD	Stand-by daily rate USD
1	2			
2	2			

Table 4 Coring equipment with technical description (including coring barrel, safety and circulating subs, equipment for gamma ray logging) and Price of equipment offered by Contractor- well TD 5050 ft (1539.5 m).

Item	Q-ty	Description	Operating daily rate USD	Stand-by daily rate USD
1	2			
2	2			

Table 5 Coring equipment with technical description (including coring barrel, safety and circulating subs, equipment for gamma ray logging) and Price of equipment offered by Contractor - well TD 3609 ft (1100 m).

Item	Description	Unit	Price USD
1	Rate for	**1 ft**	
2	Rate for	**30 ft**	
3	Rate for	**60 ft**	

Table 6 Price for 1 ft and for 60 ft of Conventional Coring service including all costs - well TD 5050 ft (1539.5 m).

Item	Description	Unit	Price USD
1	Rate for	**1 ft**	
2	Rate for	**30 ft**	
3	Rate for	**60 ft**	

Table 7 Price for 1 ft, 30ft and for 60 ft of Conventional Coring service including all costs - well TD 3609 ft (1100 m).

Item	Description	Q-ty	Unit price USD	Total price USD
1	Sample plugging (rate for 1 sample)			
1a	Sample plugging (rate for 20 sample)			
2	Core preservation			
3	Rock analysis at well site (please list all possible analysis)			
4	Additional services offered by Contractor			

Table 8 Price of additional Service- well TD 5050 ft (1539.5 m).

Item	Consumables Description	Q-ty	Unit price USD	Total price USD
1				
2				
3				
4				
5				

Table 9 Consumables List including but is not limited to PDC coring bits, inner tubes, core boxes, inner tube end cups & locking tape/clamps, pneumatic core saw blades and etc.) provided for 60 feet core.

Item	Q-ty	Contractor's Personnel description	Operating daily rate USD	Stand-by daily rate USD
1	2			
2	2			

Table 10 Price for personnel proposed by Contractor - well TD 5050 ft (1539.5 m).

Item	Q-ty	Contractor's Personnel description	Operating daily rate USD	Stand-by daily rate USD
1	2			
2	2			

Table 11 Price for personnel proposed by Contractor - well TD 3609 ft (1100 m).

SCHEDULE 3

CONTRACTOR'S PERSONNEL

[Filled the Contractor]

1. **List of Personnel**

Contractor is obligated to recruit the personnel identified below on specified positions required to enable the successful execution of the services.

The members of the Project Team are as follows:

Name (first and last)	Date of birth	Nationality	Position in the project/ Specification/Service

Table 12 Members of the project.

(K) Key Personnel

Please note, Contractor considers the rotation and it will be applied in practice during project execution.

2. **CV of Personnel**

[To be provided by the Contractor]

SCHEDULE 4

TEMPLATE OF CORE REPORT (WORK/SERVICE REPORT)

[To be provided by the Contractor]

SCHEDULE 5

TEMPLATE OF GAMMA-RAY PLOTS

[To be provided by the Contractor]

SCHEDULE 6

TEMPLATE OF FINAL WELL REPORT

[To be provided by the Contractor]