SHELL EXPLORATION AND PRODUCTION COMPANIES IN NIGERIA

Drilling and Completion Proposal
AWOBA KFMY-3 Gas Appraisal Well

SPDC-XX-20XX-XXXX

Version 1.0

July, 2011

DOCUMENT CONTROL

A1 Change History

Date	Version	Author	Ref. Indicator	Description
July, 2010	1.0	FES-Special Studies	UIG/T/DFSS	First draft version
Date	2.0	Team Name		Published version

A2 Ownership and Authorization

	Name	Ref. Indicator	Signature	Date
Document Owner	FES-Special Studies	UIG/T/DFSS		
Document Custodian	Swamp Asset Team	UIG/T/DSSE		

A3 Revision Date

Revision 1.0 prepared by the FES team in July-2011

A4 Purpose

The purpose of this document is to outline an appraisal drilling proposal for Awoba KFMY-3 well aimed at ascertaining the presence of oil rim in the Awoba K3000A reservoir and testing the structural definition in the eastern flanks of the K3000A and K6400A reservoirs. This is in support of the Awoba NAG Development project.

A5 Target Readership

UIG/T/DD, PTW/DNG, NAPIMS, DPR & Partners

A6 Legend

PG – Production Geologist; RE – Reservoir Engineering; PT – Production Technologist
WE – Well Engineer; CR – Well Proposal Coordinator

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HSSE Critical ACTIVITIES (Wells) Sign-Off:

Position	Activity Number(s) Reviewed	Name	Ref Ind.	Signature	Date
Production Geology Discipline Principal	1a, 2a,3a				
Reservoir Engineering Discipline Principal	4a				
Petrophysics Discipline Principal	5b, 8, 9a-d, 11				
Geospatial Information Head	16,17				

Production Technology Discipline Principal	6a, 6b, 10, 12, 13, 14,15				
Well Engineering Discipline Principal	19				

A full description of HSSE Critical Activities can be found in Appendix 1

Final Approval:

Mina Cookey UIG/T/DFSS (Snr. Front End Studies Project Manager) Signature / Date :	Vincent Nwabueze *UIG/T/DS* (Swamp East Asset Development Lead) Signature / Date :
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CC:
ADM, FES, TWD, TDLE, TWD-WELLSITE
DPR, NAPIMS, JV
Document Control

Date: 31st July 2011

The Director,
Department of Petroleum Resources,
Ministry of Energy,
7 Kofo Abayomi Street, Victoria Island.
Lagos.

Dear Sir,

WELL LOCATION NOTICE

AWOBA KFMY-3 APPRAISAL WELL

We have the pleasure of submitting for your consideration and approval the Well Location and Drilling Notice for a deviated appraisal well, Awoba KFMY-3. Enclosed are the well proposal, horizon maps, geological cross section, correlation panel, seismic section, petrophysical logs, hydrocarbon distribution plots, well-cost estimate and a bank draft of five thousand naira (N5, 000.00) for well entry fees.

The well is proposed to appraise the Awoba K3000A reservoir to establish fluid contact(s) and the presence of a developable oil rim in order to facilitate development decisions for the reservoir being considered for inclusion in the Awoba NAG Development project scope. It is also proposed to deepen the well to appraise reservoir quality and structure of the K6400A reservoir in order to narrow the uncertainties in the volumetric estimate for this important reservoir. The well is scheduled for drilling in Q4 2012 by a Swamp Rig.

Your early approval of this proposal will be appreciated.

Yours faithfully,

For: THE SHELL PETROLEUM DEVELOPMENT

COMPANY OF NIGERIA LIMITED

Mina Cookey (Mrs.)
Senior FE Project Manager Special Studies
.

cc: The Operations Controller,

Department of Petroleum Resources,

Ministry of Petroleum Resources,

Port Harcourt, Rivers State

The Shell Petroleum Development Company of Nigeria Limited

Date: 31st July 2011

The Director,
Department of Petroleum Resources,
Ministry of Energy,
7 Kofo Abayomi Street, Victoria Island.
Lagos.

Dear Sir,

DRILLING, COMPLETION AND WELL LOCATION NOTICE: Awoba KFMY-3

We submit herewith the following information:

1. Name and type of well: Awoba KFMY-3 Appraisal well
2. OPL or OML number: OMLs 18 and 24
3. Surface Co-ordinates: 488,201mE, 59453mN (Mid Belt)
4. Reasons for choice of location: Existing Location (SPDC Right Of Way)
5. Elevation above sea level: 57.5ft (To be confirmed after location preparation)
6. Name of Rig and owner: TBC
7. Proposed Spud Date Q4, 2012
8. Anticipated Mud Program: See below and section 3.8

Hole Size (in)	Depth Interval (ft ah)	Mud Type	Mud Wt (psi/ft)	Yield Pt	Fluid Loss (cc)	LOT Equiv. EMMG (psi/ft)	Pore Pressure (psi/ft)
17 ½" / 16	0 – 6400	WBM	0.46 – 0.48	25 – 40	<6	0.624*	0.434
12 ¼"	6400-13000	POBM	0.48 – 0.56	20 – 25	3 - 4	0.719*	0.439
8 ½"	13000 - 15383	POBM	0.52 – 0.56	20 – 25	3 - 4		0.463

*Based on generic LOT prediction for swamp East

Details for the main hole

9. Casing Program: 13-3/8" casing ca. 6,400 ftah. 9-5/8 casing ca 13,000 ftah, 7" Liner 15375 ftah
10. Logging Program:

FEWD (GR/RES/DIR); EWL: (GR/RES/NEU/DEN/SONIC; GR/RCI; GR/SWS; GR/Checkshot)and EWL (GR/CCL/SBT)

See below and section 3.6 for details

LWD/MWD Program			
The basic suite of logs for reservoir identification and fluid typing will be acquired via LWD as seen in the table below:			
Hole Size (in)	**Logging depth Interval ft ahd**	**LWD/MWD Tools**	**Objective / Justification**
24" Stove pipe	+/- 400	Nil	
17 ½" / 16"	6410'	MWD/APWD + GR/DIR	For stratigraphic and structural control.
12 ¼"	13010'	MWD: GR/DIR/RES EWL: GR/SBT	For stratigraphic and structural control. Cement bond evaluation in the 9-5/8" cased hole
8 ½"	15383'	MWD: GR/DIR/RES EWL:GR/Resistivity/DEN/NEU/SON EWL: GR/RCI EWL: GR/SWS EWL: GR/CCL/SBT EWL: GR/Checkshot	For stratigraphic and structural control For HC detection and fluid typing For pressure and fluid analysis, contacts definition in K3000A and K6400A reservoirs For cement bond log evaluation in 7" liner Well to seismic tie
NOTE: MWD Measurement while drilling EWL Electric Wireline logging 1. Real-time via IA-Insight Anywhere (RTOC)			

11. Projected Total depth: 15,383 /15,045(ft ah / ft TVD)

12. Well Deviation plan:

Main Hole

Drill 17 ½" hole vertically from surface to 6410 ftah. Lower 13 3/8" casing to 6400 ftah and cement to surface. Drill out shoe track and drill 12 ¼" hole vertically to 8500 ftah. Kick off 12 ¼" hole from 8500 to 9250 ftah (9236 ft TVD) with 2.50 deg/100ft DLS to reach an inclination of 18.74 deg at an azimuth 184.22 deg. Drill 12 ¼" hole tangentially to 13010 ftah (12797ft TVD). Lower 9 5/8" casing to 13000 ftah (12789 ft TVD) and cement to 500 ft inside the 13 3/8" casing. Drill out shoe track and drill 8 ½" hole tangentially to 15383 ftah (15045 ft TVD). Lower 7" liner to 115375 ftah (15039 TVD) and cement liner.

Side track hole - (After the 8 ½" main open hole is plugged back to 13000 ft.)

Kick off the well in 8 ½" hole from 13100ftah (12882 ft TVD)and drill to 14100ftah (13758ft TVD) reaching 38 deg inclination at 184.22 deg azimuth. Drill 8 ½" hole tangentially to 15422ftah (14800 ft TVD). Lower 7" Liner to 15410 ftah (14790 ft TVD) and cement to 500ft inside 9 5/8" casing.

13. Coring: Only sidewall cores will be acquired from select intervals. A full-diameter core not required/planned, as cores have been acquired previously in Awoba field)..

14. Completion: Lower completion – cased and perforated only , no sand control required for both reservoirs.

Upper completion – 3 ½" tubing – carbon steel, TRSCSSV , PDHG planned. (in K3000A reservoir, if developable oil rim is found and the well optimally placed)

Yours faithfully,

For: THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED

Mina Cookey (Mrs.)
Senior FE Project Manager Special Studies

cc: The Operations Controller,
Department of Petroleum Resources,
Ministry of Energy,
Port Harcourt, Rivers State.

Table of Contents

Executive summary

This well proposal (KFMY-3) documents the detailed drilling and completion plan for the appraisal well identified in the Awoba Gas Field development plan (Ref. 1).

The primary objective of this well to appraise the Awoba K3000A reservoir to establish fluid contacts and presence of developable oil rim in the reservoir (only GDT previously logged). This is required to facilitate pending development decisions on including this target reservoir in the immediate plans for the Awoba NAG development project. If a viable oil rim is not encountered, the gas resource in the K3000A reservoir would be unlocked for immediate development. The Awoba NAG development project is presently challenged and the inclusion of additional gas resource volumes is expected to significantly improve the project econolmics. The secondary objective is to deepen the well to K6400A reservoir to establish reservoir properties and a depth control point on the eastern flank of the Awoba structure in order to reduce the uncertainties in the in-place volumes.

In the event that appraisal results in the K3000A reservoir shows that a developable oil rim is not present, the well will be suspended to be used for future development activities in the field. However, the well will be completed as an oil producer on the K3000A reservoir if a developable oil rim is encountered and the well optimally placed for development (a notional completion design for this scenario is included in this well proposal). If the reservoir fluid contacts in the K3000A cannot be fully established from drilling of initial hole, consideration will be given to plugging the well back and sidetrack to a more suitable subsurface location where the primary fluid contacts would be established. A notional sidetrack trajectory has been included, but will be subject to revalidation during drilling of this well.

The K3000A accumulation is presently defined by a gas-down-to (GDT) at 13,918 ftss with an associated initial in place gas volume of about 145 Bscf. Development of the K3000A cannot proceed until it is known whether the reservoir contains a developable oil rim or otherwise.. Presently the volumetric uncertainty range in the K3000A reservoir is 210/145/96 Bscf (P15/50/85),

The volumetric uncertainty range in the K6400A reservoir is more significant (P15/50/85 = 426/317/241 Bscf), with a range of 185 Bscf between the low and high case. This uncertainty range is principally due to the lack of well control on the eastern end of the structure. The K6400A is the largest gas reservoir in Awoba, representing 41% of gas and 53% of condensate to be developed by the base case field development plan. Therefore reduction of the K6400A volumetric uncertainty will have a significant value impact on the Awoba gas development.

The well is scheduled for drilling in Q4 2012 by a Swamp Rig and is best drilled from a new surface location close to Awoba-04. The surface location shall be from existing Awoba-04 well slot; hence new land take is not required. The well cost (drilling, completion and testing) is about 33million USD (contingent side track option cost inclusive). See Appendix 5 for detail well cost.

Well Data Sheet

WELL: Awoba KFMY-3
Surface location
(Surface drilling location is Awoba-4)
Easting: 488,201m
Northing: 59,453m
DFE: 57.5ft (To be confirmed after location preparation)

OBJECTIVE: To appraise K3000A & K6400A reservoir

FORMATION TOPS

Table A: Awoba KFMY-3 Markers/Tops

Sand	Depth ft tvss / ahbdf	Uncertainty (+/- ft tvd)
G1000	10,055/10,175	+/-50
Fault	10,657/10,810	+/-70
G2000	10,707/10,863	+/-100
G8000	11,985/12,212	+/-80
H7100	12,504/12,761	+/-80
H8000	12,949/13,231	+/-90
K2000	13,516/13,830	+/-90
K3000A	13,935/14,272	+/-110
K6400A	14,609/14,984	+/-150
TD	14,988/15,384	+/-150

REFERENCE SYSTEM

Horizontal Coordinate Reference System
Universal Transverse Mercator Projection
CRS Name (EPSG): Minna/Nigeria Mid Belt
EPSG Code: 26392
Geodetic datum: Clarke 1880 Ellipsoid
Horizontal Units: m

Verical Coordinate Reference System
Vertical datum: LAGOS
Elevation/Depth Positive/Negative
Vertical Units: ft

Table B: Awoba KFMY-3 Well Static Prediction

Gross thickness (ft tvt)	K3000A: 97
	K6400A: 278
Net Sand thickness (ft tvt)	K3000A: 78
	K6400A: 217
Initial Pressure Top Reservoir (psi)	K3000A: 6,042
	K6400A: 6,380
Current Pressure Top Reservoir (psi)	K3000A: 6,040
	K6400A: 6,370
Reservoir Temperature (degF)	K3000A: 222
	K6400A: 234

LOCATION COORDINATES

Well-head at 488,201mE, 59,453mN
(Located within Awoba-04 surface location)

Table C: Subsurface Target Coordinates and Marker Tops

Sand	E (m)	N (m)	ft tvdss
K3000A*	488,162	58,927	13,935
K6400A*	488,157	58,856	14,609
TD	488,154	5,8817	14,988

* Target sand

Target tolerance: see section 3.2.
Pilot Hole: No
OML: OMLs 18 and 24
Rig: Swamp Rig
Spud Date: Q4, 2012

WELL AZIMUTH - 184.22 deg.

Well Deviation Summary

Main Hole

Drill 17 ½" hole vertically from surface to 6410 ftah. Lower 13 3/8" casing to 6400 ftah and cement to surface. Drill out shoe track and drill 12 ¼" hole vertically to 8500 ftah. Kick off 12 ¼" hole from 8500 to 9250 ftah (9236 ft TVD) with 2.50 deg/100ft DLS to reach an inclination of 18.74 deg at an azimuth 184.22 deg. Drill 12 ¼" hole tangentially to 13010 ftah (12797ft TVD). Lower 9 5/8" casing to 13000 ftah (12789 ft TVD) and cement to 500 ft inside the 13 3/8" casing. Drill out shoe track and drill 8 ½" hole tangentially to 15383 ftah (15045 ft TVD). Lower 7" liner to 115375 ftah (15039 TVD) and cement liner.

Side track hole - (After the 8 ½" main open hole is plugged back to 13000 ft.)

Kick off the well in 8 ½" hole from 13100ftah (12882 ft TVD)and drill to 14100ftah (13758ft TVD) reaching 38 deg inclination at 184.22 deg azimuth. Drill 8 ½" hole tangentially to 15422ftah (14800 ft TVD). Lower 7" Liner to 15410 ftah (14790 ft TVD) and cement to 500ft inside 9 5/8" casing.

DRILLING HAZARDS

See text in section 4 for details.

MUD PROGRAM

17-½" Hole: WBM / 0.46-0.48 psi/ft
12-¼" Hole: POBM / 0.48-0.56 psi/ft
8 ½" Hole: POBM / 0.52-0.56 psi/ft

COMPLETION DESIGN

Lower completion – cased and perforated only , no sand control required.

Upper completion – 3 ½" tubing – carbon steel, TRSCSSV , PDHG planned.

LOGGING REQUIREMENTS

17-½" Hole: FEWD (GR/DIR)
12-¼" Hole: FEWD (GR/RES/DIR)
9-5/8" casing hole: GR/SBT
8-1/2" Hole: FEWD (GR/RES/DIR)
EWL: (GR/RES/ NEU/DEN/SONIC)
EWL: (GR/RCI), EWL (GR/SWS)
7" liner hole: GR/CCL/SBT
GR/Checkshot

CASING PROGRAMME

13-3/8", 68ppf, K55, BTC, 6400 ftah
9-5/8" 47ppf, SLX/BTC, 13000 ft ah
7" 29 ppf, SLX/BTC, 15575 ftah

CORING REQUIREMENTS:

None

SAMPLING REQUIREMENTS

- Cuttings
- PVT

WELL COST:

USD: about 33million
(contingent side track option cost inclusive)

1 Introduction

The Awoba field is located 40 km southwest of Port Harcourt in SPDC's Eastern Swamp operations area and straddles OML 18 and 24. The field was discovered in 1981 by well Awoba-2 and came on stream in May 1992. A total of nine wells have been drilled in the field to date. Currently the field has a total of 10 producing (oil) drainage points. The cumulative oil production from the Awoba Field stands at 138MMstb as at 31/12/2010. The field has 27 hydrocarbon bearing sands between 7000-15000 ftss. Nine of the reservoirs are NAG reservoirs containing free gas and condensate in place volumes of 930 Bscf and 136 MMbbls respectively.

Earlier development plans for the field focused on the oil reservoirs. The Awoba NAG Development Plan (Ref 1) proposes the first development of free gas in Awoba with plans to develop a total of 319 Bscf of NAG and 25 MMstb associated condensate reserves. This project is presently challenged and the inclusion of additional gas resource volumes from the K3000A will significantly improve the project robustness; hence, the need to ascertain the presence of developable oil rim in this key reservoir via this appraisal well. The Awoba NAG project has been re-phased (to repeat DG3 in November 2013) to allow sufficient time for this appraisal drilling and further subsurface evaluation. After this appraisal drilling, the selected concept for the Awoba NAG project will be revalidated.

Further oil development opportunities within the field, which are generally much shallower than the NAG opportunities, were evaluated separately as part of the Awoba FOD project (Ref 2) in which six oil development wells are planned to be drilled between Q4 2012 and 2013. The synergy between the two projects includes the use of the same rig to drill all the wells in one drilling campaign, possibility of deepening any of the oil development wells to the appraisal target (which wasn't feasible), a global EIA and SCD program e.t.c

Table 1.1: Well Objectives, Rewards and Risks

Introduction	
Business Context	The appraisal of the K3000A is included in the Awoba NAG project base plan to assess both the volumetric upside and the possible presence of a developable oil rim. The outcome of the appraisal drilling is proposed to reduce depth uncertainties in the eastern flank and evaluate fluid type and contact uncertainties in the K3000A reservoir. This volumetric upside will add to the existing gas development opportunities, and may justify the drilling of one additional development well as well as further improve the economics of the project.
Well Objectives	To establish fluid type, contact information and structural depth in the K3000A reservoir, and also reservoir properties and structural depth in the K6400A reservoir.
Expected Reward	The K3000A accumulation definition is currently restricted by a gas-down-to at 13,918 ftss with an associate initial in place gas volume of about 145 Bscf.

Major associated risks (Summary)	This well will likely encounter some faults (see Table 4.1 and 3.2). Drilling through these faults may lead to mud losses. However, nearby Awoba-04 successfully drilled through all these faults so learning's from Awoba-04 will be integrated into this well.

2 Sub-Surface Description

Table 2.1: Sub-surface Description Overview

Sub-Surface Description	
Structural and Reservoir Geology (PG)	The Awoba structure is a collapsed crest anticlinal structure at shallower levels and, towards deeper intervals, dominantly becomes an east-west trending rollover anticline, controlled by a south hading boundary fault that stretches from Santa Barbara through Awoba North West, Awoba, Krakama and to Cawthorne Channel. This fault also controls the depositional and structural history of these fields. At depth (K-reservoir levels) a minor NW-SE trending synthetic fault defines the eastern flank of the accumulation, separating the Krakama and Awoba fields Reservoirs in Awoba field are predominantly shoreface and distributary/tidal channel deposits, which represents a proximal, deltaic, depositional setting, with tidal influence. Thick marine shales (150-250 ft) overlying the K-sand reservoirs provide top seals, while intra reservoir marine shales in most levels are correlatable field wide and present likely vertical barriers/baffles to fluid flow. The K3000A reservoir is 86 ft in average thickness and is subdivided into three sub-units separated by correlatable shales/heterolithics. The sub-units represent cyclic shoreface sequences and are intersected by channel incisions (e.g. wells Awoba-2 & 3). This reservoir has a net-to-gross ratio of 0.81. The K6400A reservoir with average thickness of 277 ft is subdivided into seven sub-units separated by correlatable shales/heterolithics. The K6400A reservoir was fully cored in Awoba-8 and consists of cyclic lower to upper shoreface sequences, without significant channel incisions. The reservoir quality deteriorates from east to west and has an average net-to-gross ratio of 0.78. See the attachments below for more information: - Attachment 1: Surface Location Map - Attachment 2: Seismic Cross-section - Attachment 3a & b: Reservoir Horizon Map - Attachment 4:Reservoir Structural cross-section - Attachment7: West-East Correlation Panel through Awoba Field
Reservoir Properties and Fluid Distribution (PP)	The K3000A reservoir has an average porosity of 0.19 and an average gas saturation of 0.79. Five (5) wells penetrated this reservoir and all of them logged a GDT with the deepest seen by well 6. Hence, the oil rim in the reservoir remains uncertain. The K6400A reservoir on the other hand has been transverse by 4 wells and has clearly seen a GWC as can be seen in the fluid distribution plots (see details of the Petrophysical properties and contacts in Tables 2.2 and 2.3).

Reservoir Data, Reserves and Historical performance (RE)	No well is currently completed on the K3000A and K6400A. Consequently there has been no production from the reservoirs. Reservoir fluid properties are captured in Tables 2.4 and 2.5 below.
Major Subsurface uncertainties (PG/PP/RE)	The major uncertainties are fluid type, contact and structure in the K3000A reservoir, and also reservoir properties and structure in the K6400A reservoir.

Table 2.2: Petrophysical Properties for Awoba Field Reservoirs

Sand Sand Top(ftss)	N/G (frac)	Ave Porosity (frac)	Av. HC Column (ft)	Fluid Type
K3000A	0.81	0.19	86	GAS/ Oil?
K6400A	0.78	0.14	216	GAS

Table 2.3: Fluids Contacts of penetrated reservoirs

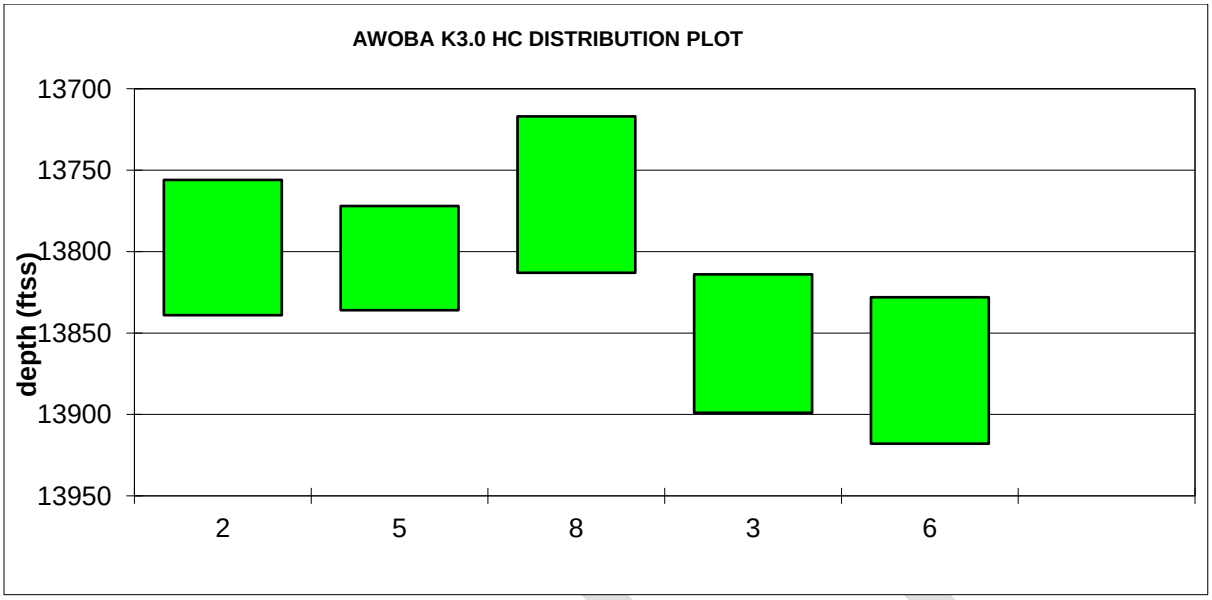
Reservoir	GDT/GWC/GOC ftah /ftss	WUT/OWC ftah / ftss	Remarks
K3000A	13918 ftss (GDT)		Deepest GDT seen in Awoba 06
K6400A	14732 ftss (GWC)		GWC logged by Awoba 03

Table 2.4: Reservoir Fluid and Temperature Data (Based on 2010 Awoba NAG FDP)

Reservoir	CGR (b/MMscf)	Gas density s.g. (air=1)	Condensate density (API)	Reservoir Temperature (degF)
K3000A	162.1	0.671	50.1	222
K6400A	131.5	0.7864	67.4	234

Table 2.5: Reservoir Resource Volume (Expectation volumes based on 2010 Awoba NAG FDP)

Reservoir	FGIIP (Bscf)	CIIP (MMstb)	Gas UR (Bscf)	Condensate UR (MMstb)	Np (MMstb)	Gp (Bscf)
K3000A	145	23.5	-	-	-	-
K6400A	317	50.7	103.2	13.6	-	-


AWOBA K3.0 HC DISTRIBUTION PLOT
depth (ftss)
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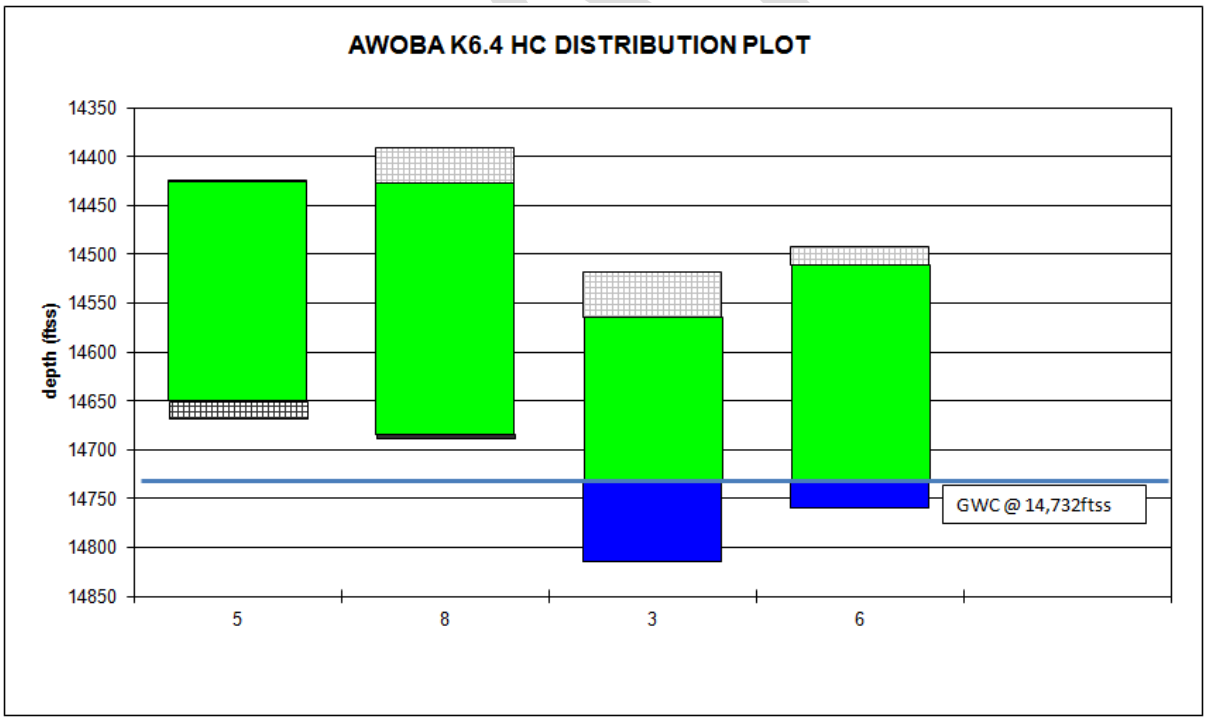
13750
13800
13850
13900
13950
2
5
8
3
6


AWOBA K6.4 HC DISTRIBUTION PLOT
depth (ftss)
14350
14400
14450
14500
14550
14600
14650
14700
14750
14800
14850
GWC @ 14,732ftss
5
8
3
6

3 Well Design

3.1 Surface location Coordinates

Table 3.1: Surface Coordinates

Surface Location	Northing (m)	Easting (m)	DFE (ft)	Remarks
Awoba KFMY-3	59,453	488,201	57.5	To be reconfirmed after location preparation

3.2 Reservoir Targets and Tolerances

The sub-surface coordinates for well Awoba KFMY-3 are shown in Table 3.2. The actual along hole (ah) depths are approximate and dependent on the actual well path and DFE.

Table 3.2: Subsurface Coordinates

Target	Depth		Coordinates		Depth Uncertainty
	TVD ftss	MD ft ahbdf	Northing (m)	Easting (m)	TVD (ft)
Fault	8,489	8,546	59,452	488,201	+/-100
Fault	9,346	9,426	59,401	488,197	+/-100
G1000	10,055	10,175	59,326	488,192	+/-50
Fault	10,657	10,810	59,264	488,186	+/-70
G2000	10,707	10,863	59,259	488,187	+/-100
G8000	11,985	12,212	59,127	488,177	+/-80
H7100	12,504	12,761	59,073	488,173	+/-80
H8000	12,949	13,231	59,027	488,170	+/-90
K2000	13,516	13,830	58,969	488,165	+/-90
K3000A	13,935	14,272	58,927	488,162	+/-110
K6400A	14,609	14,984	58,856	488,157	+/-150
TD	14,988	15,384	5,8817	488,154	+/-150

3.3 Planned Well Trajectory

Table 3.3.1: Well Trajectory Overview

Well Trajectory Overview	
Objective	K3000A and K6400A
Targeting and Tolerance	Well Trajectory: A circle of 25m radius centered on planned trajectory Targets: A circle of 25m radius centered on target
Trajectory	The planned well trajectory for well KFMY-3 is a simple conventional deviated well. Refer to Appendix A4.1 below for the detailed trajectory
Total Depth	The planned total depth for well Awoba KFMY-3 is 14,988ftss / 15,384ftah just below the base of K6400A reservoir
TD Criteria and Justification	The total well depth (14,988ftss / 15,384ftah) is to ensure that the deepest appraisal objective (K6400A reservoir) is achieved. This total depth accommodates rathole for logging and completion. Note that the base of K6400A reservoir (close to the TD) has a depth uncertainty of +/-150ft.
Contingency	In the event that a sidetrack is required due to failure to achieve appraisal objectives then see Attachment 5: Contingency Plan (for the contingency plan decision tree) and Section 3.10 for more information. If the main hole is unsuccessful the 8 ½" hole will be plugged back to 13100ftah and the hole will be side tracked. The side track hole will follow as per the side track deviation plan in Well Data Sheet above.

The full deviation report and notional well trajectory (vertical section and plan views) are shown in Appendix 2.

Table 3.3.2: Awoba KFMY-3 well trajectory summary

Please refer to Appendix A4.1: Awoba KFMY-3 Deviation Data table

3.4 Depth, Properties and Pressure Prognosis

The predicted pressures are not static and are subject to change as production continues. The pore pressure prediction will be reviewed and updated where necessary before final drilling programme is issued.

Table 3.4: Pore Pressure Prediction at Top Reservoir for well Awoba KFMY-3

Reservoir	Top Depth *(ftss)*	*(ftah)*	Fluid Type	Initial Reservoir Pressure *(psia)*	Current Reservoir Pressure at Minimum *(psia)*	Expected *(psia)*	Maximum *(psia)*	Min Grad (psi/ft)	Exp Grad (psi/ft)	Max Grad (psi/ft)	Remark (indicate deviations from hydrostatic - depleted or overpressured)
G1000	10055	10175	Water	4369	4352	4374	4396	0.433	0.435	0.437	Used actual RFT data for expected pressures, based on good structural control from existing wells
G1500	10389	10528	Water	4514	4498	4519	4541	0.433	0.435	0.437	Used actual RFT data for expected pressures, based on good structural control from existing wells
G2000	10707	10863	Water	4677	4607	4657	4679	0.430	0.435	0.437	Used actual RFT data for expected pressures, based on good structural control from existing wells
G2100	10808	10971	Water	4725	4680	4702	4723	0.433	0.435	0.437	Used actual RFT data for expected pressures, based on good structural control from existing wells
G4000	10959	11130	Water	4785	4724	4767	4811	0.431	0.435	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G5000	11200	11384	Water	4875	4829	4872	4916	0.431	0.435	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G5500	11425	11621	Water	4963	4926	4970	5013	0.431	0.435	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G6000	11438	11635	Water	4880	4774	4801	5019	0.417	0.420	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G8000	11985	12212	Oil	5250	5104	5141	5257	0.426	0.429	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G9000	12345	12593	Water	5393	5327	5370	5413	0.431	0.435	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
H7100	12504	12761	Oil	5408	4702	4724	5539	0.376	0.378	0.443	Used RE prediction. High case based on maximum trends in undepleted overlying and deeper reservoirs (G90 & H87)
H8000	12949	13231	Oil	5574	5438	5477	5775	0.420	0.423	0.446	Used RE prediction. High case based on maximum trends in undepleted overlying and deeper reservoirs (G90 & H87)
H8700	13363	13668	Water	5809	5769	5813	6063	0.432	0.435	0.454	Expected based on actual RFT data, while high pressures based on QI exp prediction
K2000	13516	13830	Gas/Water	5876	5861	5880	6147	0.434	0.435	0.455	Expected based on actual RFT data, while high pressures based on QI exp prediction
K2500	13735	14060	Water	5977	5931	5975	6268	0.432	0.435	0.456	Expected based on actual RFT data, while high pressures based on QI exp prediction
K3000	13918	14254	Gas/Oil	6042	6014	6040	6373	0.432	0.434	0.458	Expected based on actual RFT data, while high pressures based on QI exp prediction
K3200	14060	14404	Water	6131	6073	6116	6450	0.432	0.435	0.459	Expected based on actual RFT data, while high pressures based on QI exp prediction
K5000	14416	14780	Water	6307	6228	6271	6650	0.432	0.435	0.461	Expected based on actual RFT data, while high pressures based on QI exp prediction
K6400	14609	14984	Gas/Water	6380	6305	6370	6760	0.432	0.436	0.463	Expected based on actual RFT data, while high pressures based on QI exp prediction

Based on the above pressures the well head system for the proposed well will be made up of a 13-5/8" x 11" -10K Standard Wellhead for 13-3/8" and 9-5/8" casing

3.5 Shallowest and Deepest Hydrocarbons

Table 3.5: Details of shallowest and deepest hydrocarbons

	Reservoir	HC type	Depth ft tvss	Remark
Shallowest HC	G8000	Oil	11,985	Depth uncertainty of +/- 80ft
Deepest HC	K6400A	Gas	14,609	Depth uncertainty of +/- 150ft

3.6 Evaluation Requirements and Data Acquisition Plan

Although Awoba field has currently 9 well penetrations, the Awoba KFMY-3 will be drilling into the eastern flank of the reservoir, further away from Awoba 4. Mud logging will hence be required in this well. This well will be appraising the eastern flank of the reservoirs (K3000A and K6400A), currently penetrated by no well and hence, sonic data and checkshot data would be required for improving existing time-to-depth conversion and well to seismic tie. RCI will also be logged in the K3000A and K6400A reservoirs for contacts definition, PVT analysis and pressure measurements. Details can be seen in the tables below.

Table 3.6.1: Mud-logging program

Mudlogging Programme			
Mud logging is required to properly analyze the lithology, carry out pore pressure evaluation while drilling and geochemical analysis in the deeper reservoirs on the eastern flank of the Awoba field.			
Samples	**No. of Sets**	**Interval**	**Spacing**
Washed and Dried		13000ft-TD: d_c-exponent calculations Geochemical analysis as required	/10ft in shales /100ft
Bulk Unwashed		13000ft-TD Carry out lithology, fluorescence and geochemical analyses Gas chromatography analysis	50ft

Table 3.6.2: MWD/LWD logging program

LWD/MWD Programme			
The basic suite of logs for reservoir identification and fluid typing will be acquired via LWD as seen in the table below:			
Hole Size (in)	**Logging depth Interval ft ahd**	**MWD Tools**	**Objective / Justification**
24" stove pipe		Nil	
17 ½"	6410'	MWD/APWD + GR/Dir (real-time)	For stratigraphic and structural control.
12 ¼"	13010'	LWD: GR/DIR/RES	For stratigraphic and structural control & HC detection
8 1/2"	15383'	LWD: GR/DIR/RES	For stratigraphic and structural control & HC detection
NOTE: MWD Measurement while drilling *Real-time via Insight Anywhere			

Table 3.6.3: Electric Wireline Logging Programme for Main Hole

Wireline Programme		
The wireline logs will be taken in different runs due to the uniqueness of the data to be acquired in each run. Cement bond log (SBT) and the checkshot data would be taken in the 9-5/8" cased hole.		
Wireline Logging Program – 12 ¼" section		
Run #	Tool suite	Evaluation criteria
Run 1	EWL: GR/SBT	Cement bond evaluation in the 9-5/8" cased hole
Stand-by		
Wireline Logging Program –8 1/2" section		
Run #	Tool suite	Evaluation criteria
Run 1	EWL: GR/RES/DEN/NEU/SONIC	For fluid typing and well to seismic tie in the deeper reservoirs
Run 2	EWL: GR/RCI	For pressure data and PVT fluid sample analysis in the gas reservoirs – K2000, K3000A & K6400A.
Run 3	EWL: GR/SWS	For bio-stratigraphy analyses and fluid identification in K3000A reservoir
Run 4	EWL: GR/CCL/SBT	Cement bond evaluation in the 7" cemented liner
Run 5	EWL: GR/Checkshots	For well-to-seismic tie in the 7"cemented liner
Stand-by		
EWL: Electric Wireline Logs		

Table 3.6.4: Tentative Logging Programme for the KFMY-3 Sidetrack

MWD/Wireline Program		
Depending on the results of the main hole, a sidetrack is planned to kick-off at 13,000ftah. This logging program assumes that SWS, sonic, pressures and checkshot data have been acquired in the main hole.		
Wireline Logging Program –81/2" section		
Run #	Tool suite	Evaluation criteria
Run 1	LWD: GR/DIR/RES/DEN/NEU	For stratigraphic and structural control For fluid typing
Run 2	EWL: GR/CCL/SBT	Cement bond evaluation in the 9-5/8" cased hole
EWL: Electric Wireline Logs		

3.7 Casing Plan

The casing scheme and design data are shown in Tables X and X

Table 3.7.1: Planned Casing Scheme

Casing size (in)	Interval (ft ah)	Weight (ppf)	Grade	Conn.	Drift (in)	Burst (psi)	Collapse (psi)	Tensile (1000lb)
24" stove pipe	~400	186	X-52	Weld	0.75" Thick	Min yield – 52000 psi Min Tensile – 66000 psi		
13-3/8" Surface Casing	0-6400	68	K-55	BTC	12.259	3450	1950	1069
9 -5/8" Production Casing*	0 – 13000	47	N-80	BTC/SLX	8.525	6870	4760	1086
7" Production Liner	12500 – 15375	29	N-80	BTC/SLX	6.059	8160	7020	597

Note: In case the side track hole is drilled the 7" Liner will be lowered at 15585 ftah.

Table 3.7.2: Casing Design Data

Casing size (in)	13-3/8"; 68ppf; J /K-55	9-5/8"; 47 ppf; N80	7"; 29 ppf47ppf; N80
Collapse Safety Factor	1.13	1.79	3.67
Burst Safety Factor	1.10	1.60	2.45
Axial Safety Factor	1.98	1.59	4.87
Triaxial Safety Factor	1.25	1.39	2.58

3.8 Mud Program

The provisional mud program for is shown below.

Table 3.8: Mud Program

Hole Size (in)	Depth Interval (ft ah)	Mud Type	Mud Wt (psi/ft)	Yield Pt	Fluid Loss (cc)	LOT Equiv. EMMG (psi/ft)	Pore Pressure (psi/ft)
17 ½" / 16	0 – 6400	WBM	0.46 – 0.48	25 – 40	<6	0.624*	0.434
12 ¼"	6400-13000	POBM	0.48 – 0.56	20 – 25	3 - 4	0.719*	0.439
8 ½"	13000 - 15383	POBM	0.52 – 0.56	20 – 25	3 - 4		0.463

Note : Mud weight to be raised, if necessary, for borehole stability, well control or other issues

*Based on generic LOT values for swamp east.

3.9 Drilling Plan and Work Scope

1. Drive 24" stove pipe to refusal at +/- 400 ft.

Main Hole

2. Drill 17 ½" hole vertically from surface to 6410 ftah.
3. Lower 13 3/8" casing to 6400 ftah and cement to surface.
4. Drill out shoe track and drill 12 ¼" hole vertically to 8500 ftah.
5. Kick off 12 ¼" hole from 8500 to 9250 ftah (9236 ft TVD) with 2.50 deg/100ft DLS to reach an inclination of 18.74 deg at an azimuth 184.22 deg.
6. Drill 12 ¼" hole tangentially to 13010 ftah (12797ft TVD).
7. Lower 9 5/8" casing to 13000 ftah (12789 ft TVD) and cement to 500 ft inside the 13 3/8" casing.
8. Drill out shoe track and drill 8 ½" hole tangentially to 15383 ftah (15045 ft TVD).
9. Carry out well evaluation.

If the K3000A appraisal objective of the main hole is achievel AND the oil rim is viable:

10. Lower 7" liner to 115375 ftah (15039 TVD) and cement liner.
11. Perforate the interval and complete the well with dual 3 ½" carbon steel tubing with CaTS, TRSCSSV and other completion accessories.
12. Lift oil and hand over the well.

If the K3000A appraisal objective for the main hole is not fully met

10. Plug back main hole to 13100 ftah. Kick off the well in 8 ½" hole from 13100ftah (12882 ft TVD)and drill to 14100ftah (13758ft TVD) reaching 38 deg inclination at 184.22 deg azimuth.
11. Drill 8 ½" hole tangentially to 15422ftah (14800 ft TVD).
12. Lower 7" Liner to 15410 ftah (14790 ft TVD) and cement to 500ft inside 9 5/8" casing.
13. Complete the well with 3 ½" carbon steel tubing with PDHG, TRSCSSV and other completion accessories.
14. Lift oil and hand over the well.

If the K3000A appraisal objective in main hole is fully met, but the oil rim is not viable:

10. Plug back 8 ½"main hole to 500 ft inside 9 5/8" casing.
11. Tag, pressure test and inflow test the well.
12. Install a bridge plug above the top of the suspension plug.
13. Lower 5000 ft. of kill string and shut in the well.

3.10 Contingency plans (Appraisal wells only)

In the event that after drilling the main hole into K3000A reservoir, the residual margin of undifferentiated hydrocarbon column is still in excess of 20ft, then a sidetrack will be required to eliminate/reduce the uncertainty in fluid contact/type.

See Attachment 5: Contingency Plan (contingency plan decision tree) for more information.

3.11 Well Cost Estimate

The appraisal well has a contingent sidetrack option as stated above. Hence the cost estimation for this well includes drilling up to the 8 ½" " main hole to 15383 ftah, plugging it back to 13000 ftah, drilling the 8 ½" side track hole to 15595 ftah, lowering 7" Liner, completing and testing the well.

Level of cost estimate (50/50) and contingency – Level-II with no contingency.
Template - BP11
Rig assumptions and rate – Swamp Rig
Time estimates – Level – II with NPT
Duty / VAT, etc. – 5% VAT and 2.5% SCD.

Well	Drilling	Completion	Testing	Total
KFMY - 3	21,424,440	3,597,217	1,277,582	26,299,239
KFMY – 3 with Sidetrack	28,050826	3,957,394	1,277,582	33,285,802

4 Drilling Constraints, Hazards, Risk and Mitigation Plans

An overview of the anticipated drilling constraints, hazards, risks and mitigation plans is shown in the table below.

Table 4.1: Overview of Drilling Constraints, Hazards, Risks and Mitigation plans

Overview/Summary	
Shallow Geology and Subsurface Features:	The Awoba field geology clearly shows that from 100 ftss to the top of the D3000 sand (6406 ftss) a massive sand body with some shale units of thickness ranging from 10 to 285 ft. The risk expected will be possible borehole caving and that has been taken into consideration by the casing plan. See attachment 5 The shallowest hydrocarbon bearing sand along this well path is an oil leg of G8000 reservoir.
Shallow Gas	Based on available 3D seismic data, no shallow gas accumulation has been confirmed in Awoba field. Nine wells have been drilled in this field and none encountered shallow gas (refer to Attachment 4 (seismic section along the well path).
Faults	This well path encounters faults at about 8,489ftss/8,546ftah, 9,346ftss/9,426ftah and 10,657ftss/10,810ftah. Drilling through these faults may lead to mud losses. However, nearby Awoba-04 successfully drilled through all these faults and learning's from it will be applied in this well.
Shale/Wellbore Stability	
Hole Cleaning	Main hole is planned with an inclination of 19 deg. Hence circulation issues are unlikely. Side track hole is planned with 45 deg inclination and hence circulation issues like lack of cutting transport, formation of cutting beds etc are expected.
Hole Cleaning	Shallow losses were encountered in Awoba #8. It is recommended to keep LCM stock during drilling the surface hole.
Collision Risk	KFMY-3 is proposed to be drilled from Awoba #4 location. No collision risk exist however the trajectory needs monitoring while drilling w.r.t Awoba #4
Pressure Depletion	In the reservoir sequence from surface to the TD of this well, only H7100 reservoir has been identified as significantly depleted (minimum pressure gradient of 0.376). All pressures for the remaining reservoirs are expected to be hydrostatic.
Overpressure Analysis	No overpressures are expected in the Awoba field although the deeper gas reservoirs have a maximum expected pressure slightly higher than the hydrostatic (0.435). See plots for details.
Depth Uncertainty of Reservoir Top	There is a likely chance of encountering the targeted reservoirs shallower or deeper than prognosed because the subsurface targets are located down deep of the eastern flank where there is no well control. The depth uncertainty for these reservoirs ranges from +/- 110ft to +/-150ft.

5 Notional Completion Design

The Awoba KFMY-3 appraisal well is a Single String Single Producer well planned to deliver 2,697bopd from Awoba K3000A reservoir. The well is planned as an appraisal well to ascertain oil rim presence or absence in Awoba K3000A reservoir and secondary objective to ascertain structural control point in Awoba K6400A. If a significant oil rim (>20ft) is discovered in K3000A then the well will be completed to produce oil from K3000A reservoir; otherwise, the well would be suspended. Awoba K2500 reservoir was used as analogue for all reservoir properties in this proposal however there is a plan to update with K3000A data acquired from the well during drilling as soon as it is available.

5.1 Design Considerations / Completion Philosophy

The design objective of Awoba KFMY-3 appraisal well is to provide a robust completion that will produce the expected well potential throughout its operational life. The completion is designed to have a high level of reliability that will require minimum intervention during its operational life. The Awoba KFMY-3 well is expected to come on stream at a production rate of 2,697bopd using a 3 ½" Tubing as this is expected to deliver the expected potential from the K3000A reservoir. Carbon steel material was selected for the tubing and other well accessories as the expected corrosion as a result of reservoir fluids and reservoir conditions over the life time of the well is minimal. (Basis of design is 0.98 mole% CO2, No H2S and 0.06 – 0.12 mole % Cl-).

Sand control: Based on historical experience in the Awoba field, the depths of the reservoirs and the outcome of FIST analysis as stated in the Awoba FOD FDP, there is a low probability of sand failure in this well across any of the potential reservoir intervals hence sand control would not be deployed.

Perforation: Notionally the well would be cased and perforated along a cumulative length of 30ft. This perforation interval is recommended as it is found to be optimal based on dynamic modeling analysis results. The reservoir interval would be perforated 6 spf , 60 degrees phasing using a Baker 2" cased and perforated wireline deployed gun with charge named 2007 Predator XP LS. This gun was found optimal for the reservoirs using the Shell Perforation Optimization tool (SPOT). The gun was able to deliver an Area Open to Flow (AOF) of 100 Mstb for Awoba K3000A reservoir.

Wire line Re Entry Guide: The WEG would be made of carbon steel. This is required in order to guide the wire line string while running in and out of hole as well as prevent tools from falling into the wellbore.

Completion Tubing: The tubing selected for SSS well is 3-1/2", 12.7ppf, C 75 Carbon steel tubing. Based on flow analysis, this tubing size can achieve the production rates required from the Awoba K3000A over well lifecycle. The 3 1/2" tubing for this well would be made of carbon steel as the possibility of corrosion of tubing over the life of the well is minimal due to low CO2 and chloride contents from produced reservoir fluids.

Production Packer: A hydraulically set 9 5/8" X 3 ½" Retrievable production packer would be installed at 14100 ftah in order to isolate tubing and casing annulus.

TR-SCSSV: In accordance with Shell HSE policy, all wells capable of natural flow will have a SSV installed. The setting depth for the SCSSV will be +/- 150 ft AH, below the catering depth. The SCSSV will have a 3.25" RPT landing nipple profile for future installation of insert SCSSV (should the TR-SCSSV fail) or wire line plugs. The valve is manufactured from Carbon steel as expected corrosion level is minimal over the lifecycle of this well.

Gas lift mandrels: The Dummy valves would be installed at 2097, 3955, 5544, 6866, 7932 and

8563ftah. This was determined as results of preliminary gas lift design and optimization using PROSPER.

Final specifications for equipment to be installed will be included in the Completion Programme.

5.2 Well Modeling

Well modeling for the Awoba KFMY-3 was done using PROSPER ™. The unconstrained initial potential for the 3 1/2" tubing producing from Awoba K3000A reservoir is 2,697 bopd against a flowing tubing head pressure of 2365 psi, expected reservoir pressure of 5997 psi, skin of 5 and drawdown of 137psi. The well is expected to produce against the HP manifold. The Closed in Tubing head pressure (CITHP) for the well is expected at 2,416 psi.

Lift die out sensitivity results indicate no productivity at water cut of 90% and reservoir pressure of 2,000psi for Awoba K3000A reservoir .This reservoir is characterized with strong aquifer drive hence artificial lift would not be required. This was supported by results from dynamic modeling. Gas lift is not required however dummy gas lift valves were included as part of the completion to facilitate gas lift implementation in future.

5.3 Clean-up and Unloading Plan

After drilling the well, the hole filled with mud would be cleaned up with bit and casing scrapers made up on the drill pipe then circulated clean to brine with viscous pill ahead. Cleaning fluid would be pumped in at a controlled rate as per programme and later displaced with water. Hole would be circulated to inhibited work over fluid with recommended TDS.

The well hook-up and testing would be done as soon as possible. The well would be tested to the flow station to determine its potential. The well would be hooked up immediately after completion and unloaded to the Awoba flow station.

As part of the test, the FTHP (Flowing Tubing Head Pressure), CHP, Separator temperature and Pressure, Bean Or Orifice size and differential pressure, Gas/Oil/Water rate, BS&W, Salinity of produced water, CO2 and Sand Content would be measured.

The manifolds at the Awoba facilities are designed such that every string can be independently diverted to the test separator for the purpose of well testing at the flow station. There is sufficient capacity in the existing system to accommodate the testing requirements of the new Awoba ISMV- 1 well.

5.4 Key Completion Installation Risks

Well Bore Stability: Shale instability could negatively impact the quality of the open hole thereby increasing the risk of not getting completion string to the required depth. The risk is mitigated by the use of synthetic-based fluids and minimizing openhole exposure time.

Filter Cake Removal: The reservoir section will be drilled with synthetic-based mud, which will form CaCO3 based filter cake. Prior to setting the lower completion, the carbonate filter cake must be properly removed to preclude well productivity being drastically reduced. To mitigate this risk, predesigned filter cake breaker pills will be circulated in the open-hole using the Cementing unit.

Well head Issues: No well head issue is anticipated during the installation of the well head. However the well head, tubing hanger seal and hanger plug would be inspected and cleared of any debris. After installation of the well head, the Xmas tree body and all other connections would be pressure tested against the two way check valve or plug set in the tubing hanger for potential leak points.

5.5 Well Function Specification

a) Carbon steel material choice for tubing and completion equipments as the corrosion expected over the life of the well is negligible.
b) Non premium connection would be used for the tubing and casing connections.
c) Sand control will not be installed in this well but rather a cased and perforated completion is proposed due to the history of wells in the field.
d) The bore clearance of tubing and completion accessories will be sufficient for carrying out through tubing intervention jobs with slick line and coil tubing.
e) All the completion equipment and tubing size of 3 1/2" are standard stock size of SPDC and have fishing necks for any future work over job in the well.
f) Tubing stress analyses were carried using Well cat out for the proposed Awoba KFMY-3 well. Since SPDC stock grade is C 75 tubing so this grade of tubing was used for the analyses. Different loads were analyzed on this grade. The results can be seen in the tubing design envelope shown in figure A 3.1. Results from the analyses indicate for the 3 ½" tubing the recommended weight of tubing is 12.7ppf. The plot clearly shows expected activities such as Production, Over pull, Pressure Test, Shut in, Pump to Kill and Tubing leak is within the design envelope of the tubing.
g) Tubing Retrievable Surface Controlled Sub Surface Safety Valves installed in this well in line with HSSE policy of SPDC.
h) Production packer would be installed in this well to isolate tubing and casing annulus.
i) This completion was designed without a permanent down hole gauge for real time monitoring of pressure and temperature.
j) This completion is designed to have a landing nipple for the provision of installation of a plug.
k) Dummy gas lift valves are introduced as part of this completion for future gas lift considerations.

5.6 Reservoir Overbalance Data

Work-over Data and Reservoir Overbalance Data are presented in this section.

Type of job	Drill and complete
Rig	N/A
DFE	57.5ft (To be confirmed after location preparation)
Programmed workover fluid	Brine
Well Content	To be drilled
Proposed Gradient	**0.434 psi/ft (1.02 SG)**
Over-balance Requirements:	200 psi

Table 5.7.1: Reservoir Overbalance Data

Programmed Parameters		Value
Sand		K3000A
Depth of Top Completion Interval	[ft tvss]	13,935
Depth of Top Completion Interval	[ft ahbdf]	14,272
Reservoir Pressure at Top Interval	[psia]	6,042
Reservoir Gradient at Top Interval	[psi/ft]	0.434
Brine Pressure at Top Interval	[psi]	6,242
Overbalance Pressure	[psig]	200
Are losses expected		N

6 Surface Facilities

The well is planned as an appraisal well that will be suspended if the hydrocarbon type encountered in K3000A reservoir is mainly gas. However, if an oil rim is encountered and the well optimally placed the well will be completed as an oil producer and production (via a new 4" x 5km flowline using RoW for existing Awoba-04) will be phased in sync with the concurrent Awoba FOD oil evacuation strategy (Reference Awoba FDP February 2008).

The Awoba field has one single bank flow station on a piled foundation. It has a nominal capacity of 40,000 bpd. The oil is exported from the station through 2 x 6" x 3.2 km delivery line to the Awoba Manifold on the Niger Coastal Trunk line (NCTL). AG will be processed through the Awoba Gas Plant located adjacent to the Flow station. The Gas Plant has a nominal capacity of 55 MMscf/d and has four stages of compression with TEG dehydration. There is an ongoing exercise to replace the existing reciprocating pumps in the flow station with Centrifugal Pumps. The gas from the AG plant is transported via an 8" x 28.5 km pipeline to the Cawthorne Channel gas plant export manifold near Cawthorne Channel 2 flow station, and then onto NLNG via GTS-1 pipeline. Access to the Awoba Field facilities is by waterway. There is a helipad in Awoba for emergency evacuation

6.1 Hook-up

If the well is eventually competed as an oil well the well head system for the proposed well will be made up of the following

- 13-5/8" x 11" -10K Standard Wellhead for 13-3/8" and 9-5/8" casing
- 3-1/2" – 10K Xmas tree suitable for the above with 2x openings for optic / electric / hydraulic lines

7 CASHES and Sustainable Development

An overview of CASHES and SD issues are outlined in the table below (more details can be seen in 2009 FDP (Ref. 1)

Table 7.1: CASHES and SD issues

Overview/Summary	
Gas Management	Gas-liquid separation is carried out in a conventional three-stage separation train consisting of XHP, HP and LP vessels, and a surge vessel that provides the buffer volume during short term swings in production. The vessels are all equipped for two-phase separation only. The HP and LP vessels (purchased 1991) have vane pack internals, while the XHP Vessel built in 1973 has no internals. Separator instrumentation and control appears to be in good condition. Controllers act smoothly and all levels and pressures are steady, indicating a stable system. This also indicates that there is little or no slugging into the XHP, HP or LP separators. The gas from the AG plant is transported to the Cawthorne Channel gas plant export manifold and then to the NLNG.
Drilling Fluid and Cuttings Management	*Insert text* Drilling wastes consist of drilled cuttings, spent mud and brine, and wastewater. Drilling waste will be managed in line with FEPA regulations while striving to reduce, re-use or re-cycle. All waste that cannot be re-used or re-cycled should be properly disposed. Wastewater based mud (WBM) and brine will be re-injected or sent to the Thermal Desorption Unit (TDU) site. Drilled cuttings will be slurrified and also re-injected into either existing CRI well or transported to TDU site. Where no ccutting re-injection (CRI) exists or proves inadequate, the drilled cuttings would be transported to TDU or a mobile TDU will be used. Efforts should be made to have a CRI per field or catchment's area to facilitate waste disposal in view of possible community disruption in re-injecting drilled waste generated in one community into a CRI well in another community. Pseudo oil based mud (POBM) left at the end of a well operation will be re-used in other wells. Brine used for initial completion could be re-cycled, while excess or unwanted brine will be disposed at a CRI well. For other wastes are also generated at the Wellsite a chemical sewage treatment plant will handle sanitary waste. Domestic waste will be transported to dedicated SPDC handling facilities. Paper waste shall be segregated, shredded and recycled or burnt. Spent lube oil and diesel spills will be collected in dedicated storage tanks and taken to disposal sites. Other industrial wastes such as plastics, metals, rubber and wood will be segregated on site and collected in designated baskets. The baskets will be transported to base for disposal

	by approved means.
Land Take	No new land will be acquired because the well will be drilled from existing well location (Awoba-4). Further checks have indeed confirmed that the existing RoW around well -4 will be able to accommodate additional wellhead slots for KFMY-2 (Awoba FOD project) and KFMY-3 (this appraisal well)
Environment Impact Assessment (EIA) Approval	An EIA report covering all projects within OMLs 18 & 24 (Awoba and Awoba NW fields) have been finalized based on baseline requirements carried out in the fields. This report has been sent to regulators and addresses the requirements for the following projects: • Awoba FOD • Awoba NW Appraisal and FOD • Awoba NAG Development • Awoba NAG Appraisal -subset of Awoba NAG project (this project) • Awoba North & NE exploration prospects Public display of this report is planned in September 2011

References

1. Awoba Gas Field Development Plan 2009 (unpublished)
2. Awoba Field FOD Field Development Plan 2008
3. 01/01/2010 ARPR

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List of Attachments (See attachments folder in livelink)

Attachment 6: Awoba KFMY-3 Gas Appraisal Well Note for file
Attachment 7: West-East Correlation Panel through Awoba Field

Appendix 1 HSSE Critical Activities

HSE Critical Task			Discipline	Close Out of HSE Critical Task
Activity		Potential HSE Impact		
1a	Define well coordinates and monitor well trajectory	Well collision and control issues	PG / PS / WE	The surface coordinates of KFMY-3 has been selected carefully to minimise footprints on the Awoba field. Well KFMY-3 is proposed to be drilled from an existing location (Awoba-004). All coordinates (geographical, surface and for subsurface targets are in sync with the objectives of the well. KFMY-3 trajectory is considered to optimal relative to Awoba-004, Awoba-006 and another newly planned well (KFMY-2) hence collision risks and control issues don't exist
2a	Well depths prognoses including overburden interpretation. Define casing setting depths including TD of a well.	Well integrity and well control issues	PG/PS	Well depths prognoses have been evaluated and the overburden interpretation firmed up. The casing setting depths including TD of a well have also been defined
3a	Predict shallow Gas	Diverter drilling and well control issues. Impact on rig move and platform installation. Soil Boring	PG	Based on available 3D seismic data no shallow gas accumulation has been confirmed in in Awoba field. Also none of the 9 existing wells encounter any shallow gas.
4a	Predict H_2S presence.	Loss of life and material integrity.	RE	From available Awoba PVT reports, there is no H2S presence in the fluid samples taken from different reservoirs
5b	Predict pore and fracture pressure in undeveloped reservoir.	Well control issue	PP	From available RFT data and QI seismic pore pressure analysis; the maximum expected pressures in the deeper reservoirs are slightly higher than the hydrostatic pressure (0.435). See PPP table and plot for details.
5c	Predict pore and fracture pressure in developed reservoir.	Well control issue	RE	From available pressure data, the developed Awoba reservoirs were initially hydrostatically pressured. However, production from these reservoirs have yielded pressure declines of 2-3% with the exception of the significant decline (12%) seen in H7100. Pressures predicted were used in well and drilling designs.
6a	Predict produced fluid composition, especially contaminants like CO2 and mercury and potential formation water composition.	Corrosion and material integrity.	PT	The CO2 and CL- content of the reservoir fluids indicate low probability of corrosion of tubing and flow lines over the life of the well.
6b	Predict and manage scaling plus reservoir souring impact from water	Corrosion and material integrity including hazard to life	PT	There is no water injection planned in this field.

	flooding/water injection			
7	Predict sand production	Facility / flow-line integrity and loss of containment (LOC).	PT	Past experience from the field and Sonic response shows low probability of sand failure over the life of the well.
8	Interpret cement bond integrity and casing wear log.	Zonal isolation and potential casing integrity.	PP	The cement bond log will be run in the 9 5/8“. There are gas intervals in the shallower levels, thus the use of gas resistant cement is recommended.
9a	Plan logging	Generic HSE considerations for wire-line and logging while drilling operations	PP	Pre job planning to be conducted with logging contractor. Logging requirements meet data gathering requirements and take into consideration the hole conditions (e.g. deviation), thus the use of Pipe Conveyed Logging for this well. Pre-job safety meetings should be held before logging operations.
9b	Plan logging	Radioactive sources-environment impact, surface handling risks to people, loss of sources in hole	PP	Radioactive handling permit will be obtained prior to drilling. Ensure contractors also have valid NNRA permits. Logging programme takes into account all HSE requirements and regulations regarding use, transport, storage and handling of radioactive source. Plan secure and isolated locations for radioactive sources and explosives. Isolate area prior to rigging up radioactive sources or deploying explosives.
9c	Plan logging.	Explosives-potential for loss of life. HSE management of surface and down hole operations	PP	Strict adherence to safety precautions when executing jobs with explosives (e.g. radio silence, voltage checks etc.). Sensitize the rig on dangers of using mobile phones during explosive jobs and restrict non-essential personnel from operational area. Pre-job safety meetings must be held before commencement of any such operation.
9d	Plan logging	Pressurized formation fluid samples-surface handling: potential for loss of life	PP	Ensure that the contractor uses pressure tested sampling vessles and that proper procedures for handling and transporting pressurized vessels are adhered to. Sample bottles should be properly labeled with the well name, date and depth of sampling, temperature and formation pressure, and “DANGER: PRESSURE INSIDE”.
9e	Plan logging	Explosives, Airguns – Potential loss of life. HSE management of TZ and VSP survey operations	PP	Ensure that storage areas for these are cordoned off for safety purposes. Radio silence should be maintained before commencement of the operations.

10	Plan perforation and guns retrieval.	Hazards to life and facilities (misfired or unfired charges to surface).	PT	The well will be perforated overbalance using Baker 2.0", 6 spf, 60 deg Phased deep penetration wire line carrier guns with charge name 2007 Predator XP LS. The SPDC standard perforation program would be followed. Recommended over balance must be adhered to in order to achieve safe gun retrieval and prevent well impairment.
11	Predict and monitor reservoir compaction and subsidence.	Loss of wells, facility / platform integrity.	PP	Typical compaction for Niger Delta is less than 1ft, hence subsidence is negligible.
12	Predict wellhead and produced fluid temperature.	Wellhead growth, surface flow-lines limitation and stress integrity.	PT	Temperatures predicted using WELLCAT was made. This will be calibrated post drilling and completion. See Figure A3.1b for Awoba KFMY-3 oil well head Temperature prediction plot.
13	Plan (and execute) stimulation.	Unsafe handling of chemicals (SHOC), equipment failure due to acid corrosion.	PT	In planning and execution of stimulation activities, safe Operation and handling of chemicals is targeted. Optimum treatment design will be carried out and clear labelling of chemicals as well as corrosion inhibitors put in place.
14	Establish safe operating boundaries (maximum allowable annular surface pressure, maximum closed-in pressure, erosion and corrosion limits etc) for well integrity PT management	Loss of well integrity.	PT	The well has been modelled and well operating envelope determined as part of this Well Proposal. This includes maximum CITHP. Erosional velocity considerations have been carried out. This will be calibrated post drilling and completion and will be part of hand-over documents in line with standard SPDC Practices. Annulus pressure manual will be updated with correct information.
15	Prepare and maintain data to support emergency response.	Lack of data or wrong data during emergency response may aggravate the emergency.	PT	All relevant well data and latest well information will be made readily available to support rapid response activities. The relevant well data include, completion diagram, well status, reservoir pressure and temperature, blow out rate, well performance curves e.t.c. Plans will be put in place that all emergency response files are created and these information above are captured

16	Predict subsurface foundation.	Environmental impact – to avoid punch through or installation of structures on coral areas.	GG	N/A
17	Position anchors in the right place (Geomatics demarcation survey).	Incorrect positioning may result in damage to structures, pipelines, sub-sea wellhead and corals.	GG	
19	Define casing scheme and apply tri-axial software analysis to confirm life	Well integrity and well control issues	WE	Casing design was in three steps consisting of 13 3/8", 9 5/8" casings and 7" Liner. The STRESSCHECK software was used to perform tri-axial analysis and found that the load limits for the well are within the capacities for the selected weights and grades of the casings

Appendix 2 Pore Pressure Prediction

Plot of initial and current pressure and gradient at datum for penetrated reservoirs.

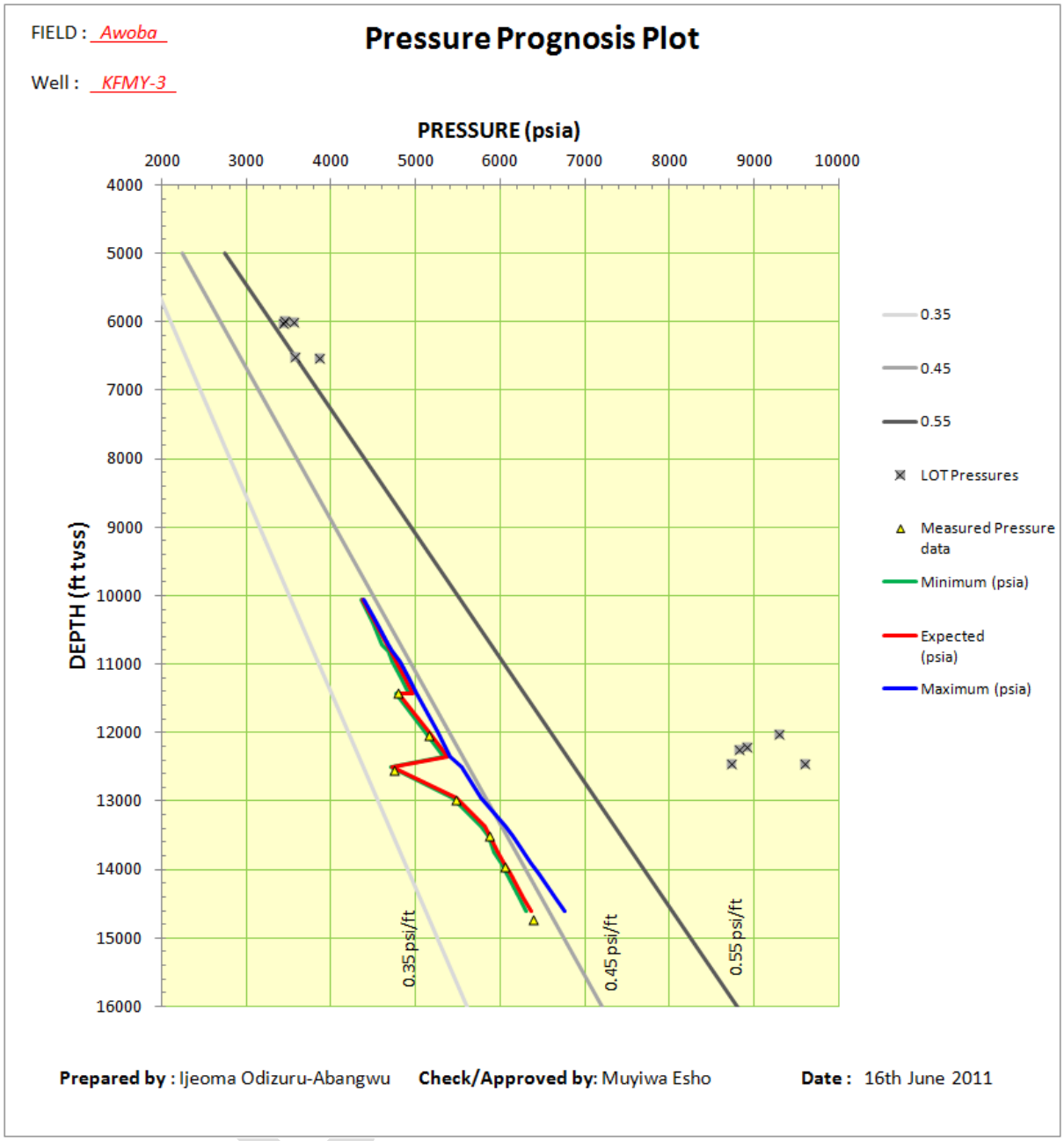
TableA2.1: Pore Pressure Prediction at Top Reservoir for well Awoba KFMY-3

Reservoir	Top Depth *(ftss)*	*(ftah)*	Fluid Type	Initial Reservoir Pressure *(psia)*	Current Reservoir Pressure at Minimum *(psia)*	Expected *(psia)*	Maximum *(psia)*	Min Grad (psi/ft)	Exp Grad (psi/ft)	Max Grad (psi/ft)	Remark (indicate deviations from hydrostatic - depleted or overpressured)
G1000	10055	10175	Water	4369	4352	4374	4396	0.433	0.435	0.437	Used actual RFT data for expected pressures, based on good structural control from existing wells
G1500	10389	10528	Water	4514	4498	4519	4541	0.433	0.435	0.437	Used actual RFT data for expected pressures, based on good structural control from existing wells
G2000	10707	10863	Water	4677	4607	4657	4679	0.430	0.435	0.437	Used actual RFT data for expected pressures, based on good structural control from existing wells
G2100	10808	10971	Water	4725	4680	4702	4723	0.433	0.435	0.437	Used actual RFT data for expected pressures, based on good structural control from existing wells
G4000	10959	11130	Water	4785	4724	4767	4811	0.431	0.435	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G5000	11200	11384	Water	4875	4829	4872	4916	0.431	0.435	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G5500	11425	11621	Water	4963	4926	4970	5013	0.431	0.435	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G6000	11438	11635	Water	4880	4774	4801	5019	0.417	0.420	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G8000	11985	12212	Oil	5250	5104	5141	5257	0.426	0.429	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
G9000	12345	12593	Water	5393	5327	5370	5413	0.431	0.435	0.439	Used actual RFT data for expected pressures, based on good structural control from existing wells
H7100	12504	12761	Oil	5408	4702	4724	5539	0.376	0.378	0.443	Used RE prediction. High case based on maximum trends in undepleted overlying and deeper reservoirs (G90 & H87)
H8000	12949	13231	Oil	5574	5438	5477	5775	0.420	0.423	0.446	Used RE prediction. High case based on maximum trends in undepleted overlying and deeper reservoirs (G90 & H87)
H8700	13363	13668	Water	5809	5769	5813	6063	0.432	0.435	0.454	Expected based on actual RFT data, while high pressures based on QI exp prediction
K2000	13516	13830	Gas/Water	5876	5861	5880	6147	0.434	0.435	0.455	Expected based on actual RFT data, while high pressures based on QI exp prediction
K2500	13735	14060	Water	5977	5931	5975	6268	0.432	0.435	0.456	Expected based on actual RFT data, while high pressures based on QI exp prediction
K3000	13918	14254	Gas/Oil	6042	6014	6040	6373	0.432	0.434	0.458	Expected based on actual RFT data, while high pressures based on QI exp prediction
K3200	14060	14404	Water	6131	6073	6116	6450	0.432	0.435	0.459	Expected based on actual RFT data, while high pressures based on QI exp prediction
K5000	14416	14780	Water	6307	6228	6271	6650	0.432	0.435	0.461	Expected based on actual RFT data, while high pressures based on QI exp prediction
K6400	14609	14984	Gas/Water	6380	6305	6370	6760	0.432	0.436	0.463	Expected based on actual RFT data, while high pressures based on QI exp prediction

TableA2.2: Pore Pressure Prediction at Datum Depth for well Awoba KFMY-3

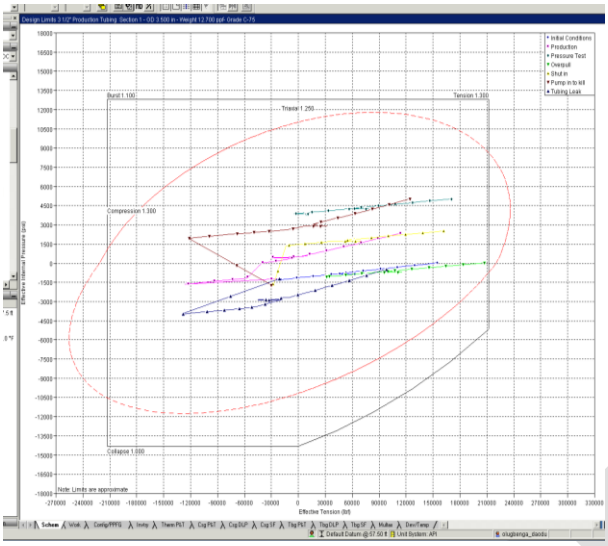
Reservoir	*Datum depth (ft tvss)*	Pressure and Gradients at Top Reservoir				Pressure Depletion *(psi)*	Pressure Depletion *(%)*
		Initial Pressure *(psia)*	Initial Gradient *(psi/ft)*	Current Pressure *(psia)*	Current Gradient *(psi/ft)*		
G1000	10044	4369	0.435	4369	0.435	0.0	0%
G1500	10377	4514	0.435	4514	0.435	0.0	0%
G2000	10751	4677	0.435	4677	0.435	0.0	0%
G2100	10862	4725	0.435	4725	0.435	0.0	0%
G4000	11000	4785	0.435	4785	0.435	0.0	0%
G5000	11208	4875	0.435	4875	0.435	0.0	0%
G5500	11409	4963	0.435	4963	0.435	0.0	0%
G6000	11370	4883	0.429	4782	0.421	-101.0	-2%
G8000	12068	5253	0.435	5160	0.428	-93.0	-2%
G9000	12398	5393	0.435	5393	0.435	0.0	0%
H7100	12645	5430	0.429	4763	0.377	-666.9	-12%
H8000	12926	5559	0.430	5464	0.423	-95.0	-2%
H8700	13355	5809	0.435	5809	0.435	0.0	0%
K2000	13505	5876	0.435	5876	0.435	0.0	0%
K2500	13740	5977	0.435	5977	0.435	0.0	0%
K3000	13925	6044	0.434	6044	0.434	0.0	0%
K3200	14094	6131	0.435	6131	0.435	0.0	0%
K5000	14500	6307	0.435	6307	0.435	0.0	0%
K6400	14630	6372	0.436	6372	0.436	0.0	0%

Figure A2.3: Pore Pressure Prognosis plot for well Awoba KFMY-3

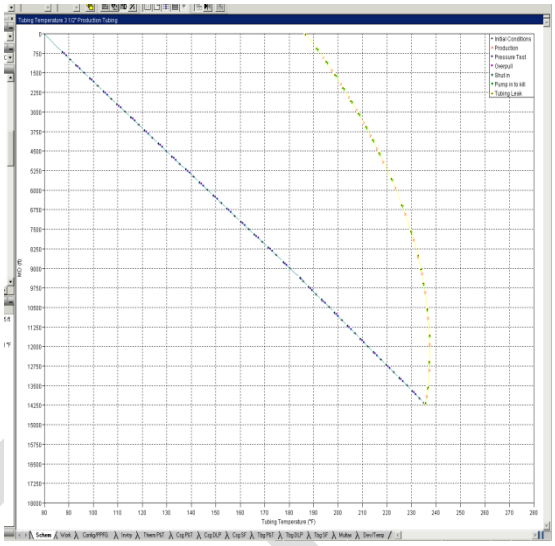


Appendix 3 Notional Production Technology

A3.1 Tubing String Design Analysis



Multiple load design limit envelope for Awoba KFMY-3 producing from K3000A reservoir.



Temperature profile for the Awoba KFMY -3 producing from K3000A reservoir at static and dynamic conditions

A3.2 MAASP Calculation

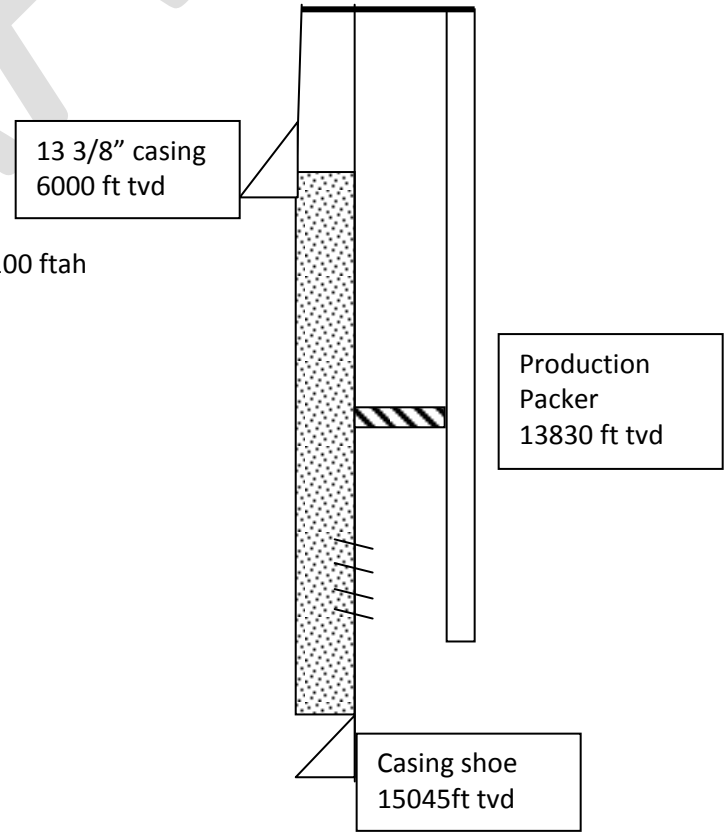
Casing Scheme

24-in Stove pipe

13 3/8-in Casing at 6000ft tvd/ 6000 ftah

9 5/8" Production packer depth at 13830 ft tvd/14100 ftah

9 5/8-in Casing at 15045 ft tvd/ 15384 ftah.



Applicable Annuli: A and B

<u>Production (A) annulus</u>

3 ½" Tubing Collapse
MAASP < (P_C)-(D x MG)

P (collapse) 3 1/2" 12.7 # C75 = 14,349 psi
D: Production packer TVD = 13,830 ft tvd
MG: annular fluid grad=0.445 psi/ft
MAASP < 8194 psi

9 5/8" Casing Burst
MAASP < (P_b)/1.1-(DxMG)

P(burst) 9 5/8" 53.5# N80= 7,930psi
D : Depth of Production Packer = 13,830 ft tvd
MG : annular fluid gradient = 0.445 psi/ft
MAASP < 1054psi

A-Annulus MAASP = minimum(8194,1054) = 1,054psi

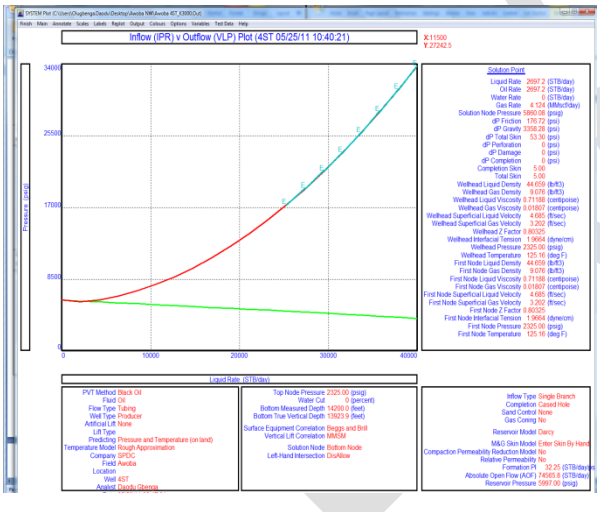
9 5/8"-13 3/8" Csg Annulus: B-Annulus

13 3/8" Casing Burst MAASP < $(P_b)/1.1-(D \times MG)$
P(Burst) 13 3/8" 98# N80= 6,530 psi
D : Depth of shoe = 15,045 ftss
MG : annular fluid gradient = 0.52 psi/ft
MAASP < 2,816 psi

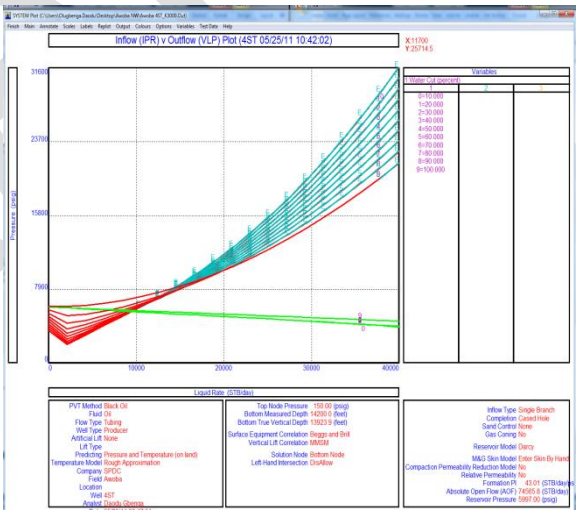
9 5/8" Casing Collapse MAASP < (Pc)-(D x MG)
P (collapse) 9 5/8" 53.5# N80= 6,620 psi
D: Depth of TOC = 6,000 ftss
MG: annular fluid gradient = 0.52 psi/ft
MAASP < 3,500 psi

B-Annulus MAASP = minimum (2816, 3500) = 2,816 psi

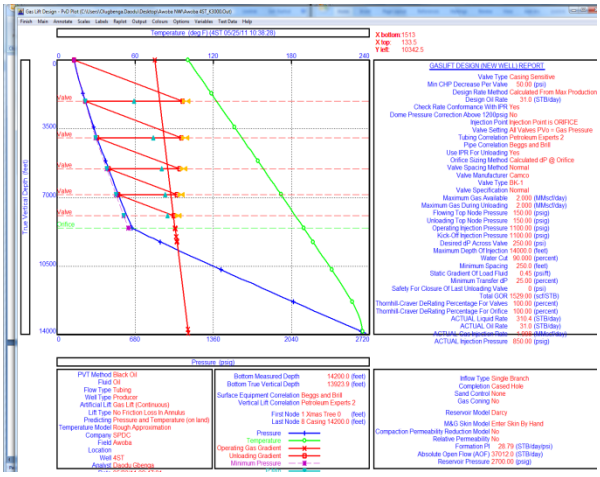
A3.2.1 Inflow Vs Outflow Profiles, Lift die out sensitivities and Gas lift design outcome



Inflow vs. outflow diagram for Awoba KFM-3 producing from K3000A reservoir.



Lift die out sensitivities for Awoba KFMY-3 producing from K3000A reservoir



Gas lift design outcome for Awoba KFMY-3 producing from K3000A reservoir

A3.3 Notional Reservoir Completion Data

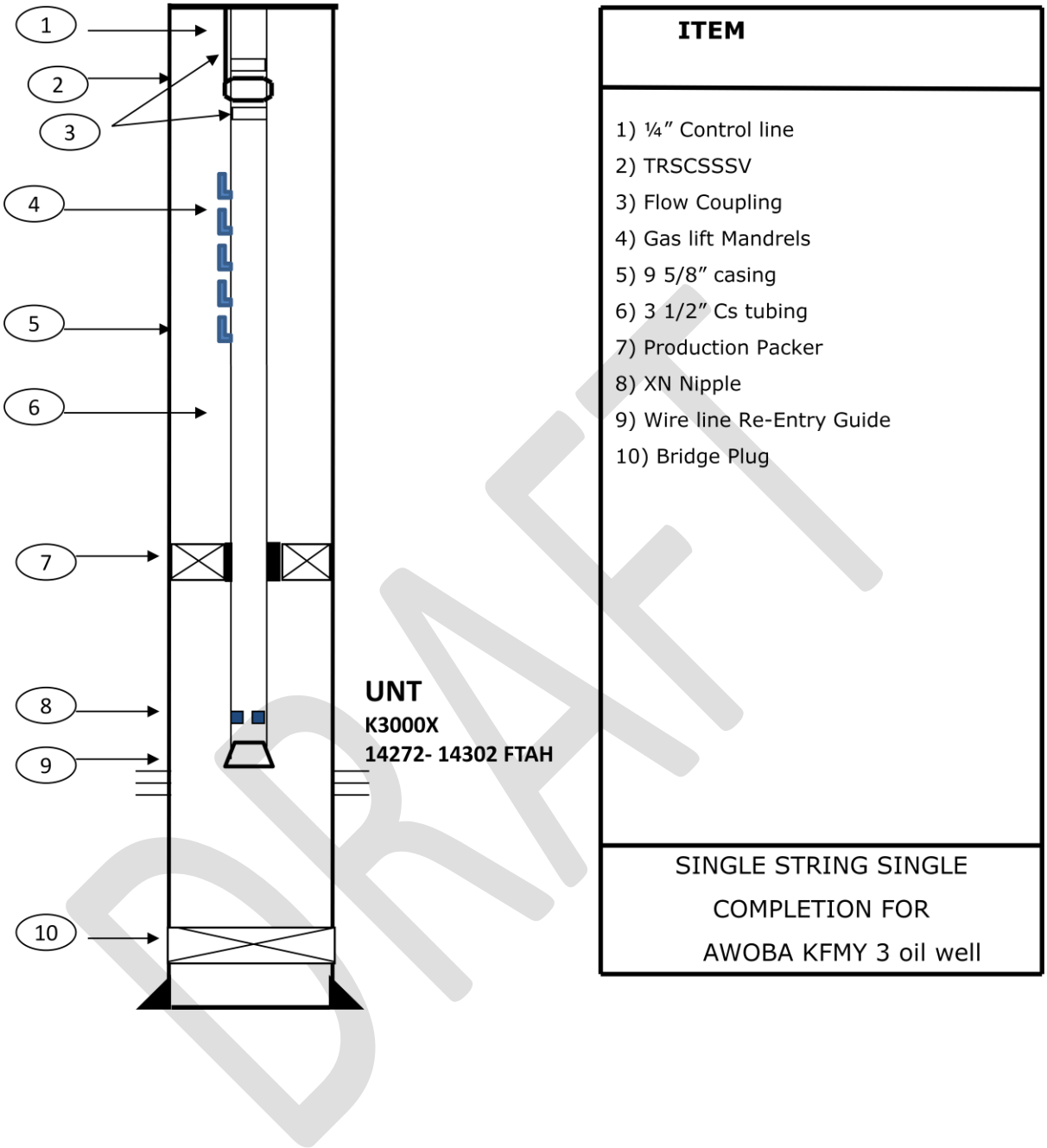
Reservoir Completion Data is presented in table A3.3.1

Table A3.3.1: Reservoir Completion Data

Target Reservoir		**Sand**
Casing size and type		9 5/8" Production casing
Setting Depth	[ftah]	15,384
Expected Top Sand	[ftss/ftah]	13,935/14,272
Average Sand Thickness	[ft tvd]	86
Well TD	[ftss/ftah]	14,988/15384
Does the Reservoir have a gas cap? Type?		Yes
Average OGOC / PGOC*	[ftss]	N/A
Average OOWC / POWC*	[ftss]	N/A
Average OGWC / PGWC*	[ftss]	N/A
Provisional Completion Interval	[ftah]	14,272- 14,302
Length of Completed Interval	[ftah]	30
Gas S.G.	[air=1]	0.07 psi/ft
Oil Density	[psi/ft]	0.25
Water Density	[psi/ft]	0.435
Expected THP	[psia]	2365
Max. CITHP	[psia]	2416
Expected Tech. Pot.	[MMscf/d]	2697
Expected Drawdown	[psi]	137
Expected GOR	[stb/MMscf]	1529
Tubing size [in]/Material		3 1/2" Carbon Steel
PDHG installation?		No
Sand Exclusion Type		None
Gas Lift Required?		No

A3.4 Proposed Notional Completion Diagram

Figure A3.4.1: Proposed Notional Completion Diagram for well Awoba-KFMY-3



A3.5 Proposed Production Allocation

The Awoba KFMY-3 oil well would be hooked up to the manifold at Awoba and flowed to the Awoba Flow station from there. The manifolds at the Awoba facilities are designed such that every string can be independently diverted to the test separator for the purpose of well testing at the flow station. This is done monthly in order to allocate production to different reservoirs. There is sufficient capacity in the existing system to accommodate the testing requirements of the new Awoba KFMY-3 oil well.

A3.6 Notional Well Functional Specification Sheet

Table A3.6.1: Notional Well Functional Specification Data

Well Functional Specification - PT	
New Document Definition: WFS acts as the framing document for a Well Delivery Opportunity. The WFS provides Functional Specifications required to deliver the well opportunity as defined by the Business Case - In effect the WFS is a Statement of Requirement	
Identification	
Opportunity Statement - Business Case and Rationale for developing the opportunity	To Appraise the K6400A and complete Awoba in K3000A with potential to deliver 2,670bopd from this reservoir
Field / Block	Awoba
Well Name	KFMY 3
Well Type Exp / App / Dev / Str / WO	Appraisal/ Development
Well Category Producer / Injector	Producer
HPHT Well (>10K or 150 ºC) State P & T	N/a
Timing	
Expected Spud Date	
Expected Completion Date	
Predicted time to intervention	
Well Data	
Water Depth	
Subsurface Architecture (vertical / slanted etc)	Conventional/ Deviated
Production Casing (size, wt, depth)	9 5/8", 47ppf,15045 ft tvd/15384 ftah
Liner (size, wt, depth)	n/a
Deviation, max DLS	18.75
Any known problem (wellhead, debris etc)	none
Reservoir Info	
Target 1 (formation name)	K3000A
Depth of top target (TVD ss/ AHD)	13,935 ft TVDss/14272 ftah
Expected Res Pressure, fluid, H2S,CO2, Cl-, solids	6042 psi,0 H2S,0.98 CO2,0.117mole % Cl-
Additional Information	n/a
Additional Well Information	
Max /likely/minimum life of well	10 years
Expected Flow Rates Oil / Gas / Water	2670bopd
Expected Flowing THP / Temperature	2365psi/ 125oF
Maximum Flowing THP / Temperature	2365psi/ 186oF
Expected Shut-in THP / Temperature	2416psi/ 186oF
Maximum Shut-in THP / Temperature	2416psi/ 186oF
Well Operating Envelope: Production Load Cases - Steady State; Transient; Bull heading; Start/Stop; Lifecycle Load Cases etc	Analyzed using Well Cat, selected tubing found optimal.

Deposits (hydrates/asphaltenes/scales)	n/a
Fluids	
Drilling Fluid	Mud
Completion Fluid - Formation Damage Acceptance	Brine
Clean Up Requirements	Yes
Safety or environmental issues	Yes
Completion	
Work over frequency and requirements	No work ever planned over the life of this well.
Required well& reservoir surveillance activities. Specify Largest Tool OD for Future Surveillance/Lifecycle issues	Periodic logging would be carried out to investigate contact movement. Pressure buildup tests would be carried out yearly as currently the case in SPDC.
Planned well maintenance activities (e.g. scale treatments)	None
Type (Single, dual, other) incl Initial Well Schematic	Single String Single
Tubing Size required for inflow performance (PI Curves)	3 1/2"
Metallurgy - Expected Well Conditions	Carbon Steel
Annulus Isolation, nipple strategy for production isolation, setting depth, and monitoring requirements	Retrievable Production Packers set at 14000 ftah
TRSSSV requirement - setting depth	150ftah
Special elastomer requirement (P, T, fluid)	n/a
Minimum ID for inflow	6.125"
Special equipment requirements	n/a
Reservoir Data Requirement - functional specification for sensors - accuracy / compatibility etc	Monthly BHP acquisition, monthly well tests, PVT analysis during initial drilling and during mid life and late life of the well and cased hole data acquisition during mid and late life of the well.
Artificial lift Requirements & design- ESP/Gas Lift Etc	None however dummy valves would be included in the completion for future gas lift application.
Zonal Isolation and Production Requirement	Retrievable Production Packer
Sand face Requirement (prediction) - Selected Strategy based on inflow requirements / sand prediction for optimized lifecycle. SC system selection incl Screen Selection for SAS/ESS/IGP/EGP, proppant selection based on Particle Size Distribution/ Formation Rock Strength; fluids selection, Zonal Isolation requirements.	No sand control required

Suspension requirements	Brine
Stimulation requirements (No/acid/frac/both), proppant/fluids)	Acid stimulation
Perforating	
Zone Details - Tops; Separation; Possible re-perforation at later date	13,935fttvd/14,272ftah
Special measurements, eg. pressure measurement while perf?	Overbalance of 200psi
Inflow performance and gun performance requirements - Gun type / size charge, shots/ft, Perf Length, overbalance / underbalance. Specify reservoir access requirements and deployment (TCP/WL/CT).	Reservoir intervals 14,272– 14,302ftah in Awoba K3000A reservoir would be perforated overbalance using Baker 2.0", 6spf, 60 deg Phased deep penetration wire line carrier guns with charge name 2007 Predator XP LS
Production logging (type and OD; Debris Tolerance)	Fluid Contact monitoring
Well Start-Up Requirements	
Underbalance Required	200 psi
Artificial Lift	No
Other -e.g. Bean Up Rate	n/a
Production test, duration, data requirements	Yes,1 day, BHP, CBL ,Bean change out etc
Rig on or off site (Clean Up to Host)	Rig Offsite
Zones to be tested	K3000A
Concept (all co-mingle, sep test, abandon)	Sep test, abandon
Well Destination	
Completed for immediate production	Yes (if developable oil rim is found in K3000A)
Hooked up with rig on site	No
Tested with rig on site	No
Suspended	Yes (If only gas is found in K3000A)
Interventions - job scope defined and with value statement	None Planned
Future abandonment	Yes
Deepened in future	Yes
Sidetracked in future	Yes
Other future requirements / needs	None
Well Integrity	
MAASP	A annulus 1054 psi, B annulus 2816 psi.
Well Kill Strategy	Bullhead
Miscellaneous	
Quality Indicators / acceptance criteria	n/a
Special objectives	n/a
Possible new technology application	PDHG
Lessons learnt from similar wells	Perforation length, Sand control, THP

Equipment Provision - Functional requirements defined.	yes
Service Provision - Functional requirements defined.	yes
Risk Register - initial risk register defined and included in WFS.	yes
QA/QC - identify any special requirements	yes

Appendix 4: Well Trajectory

Figure A4.1 KFMY-3 Main hole trajectory (Plan and section view)

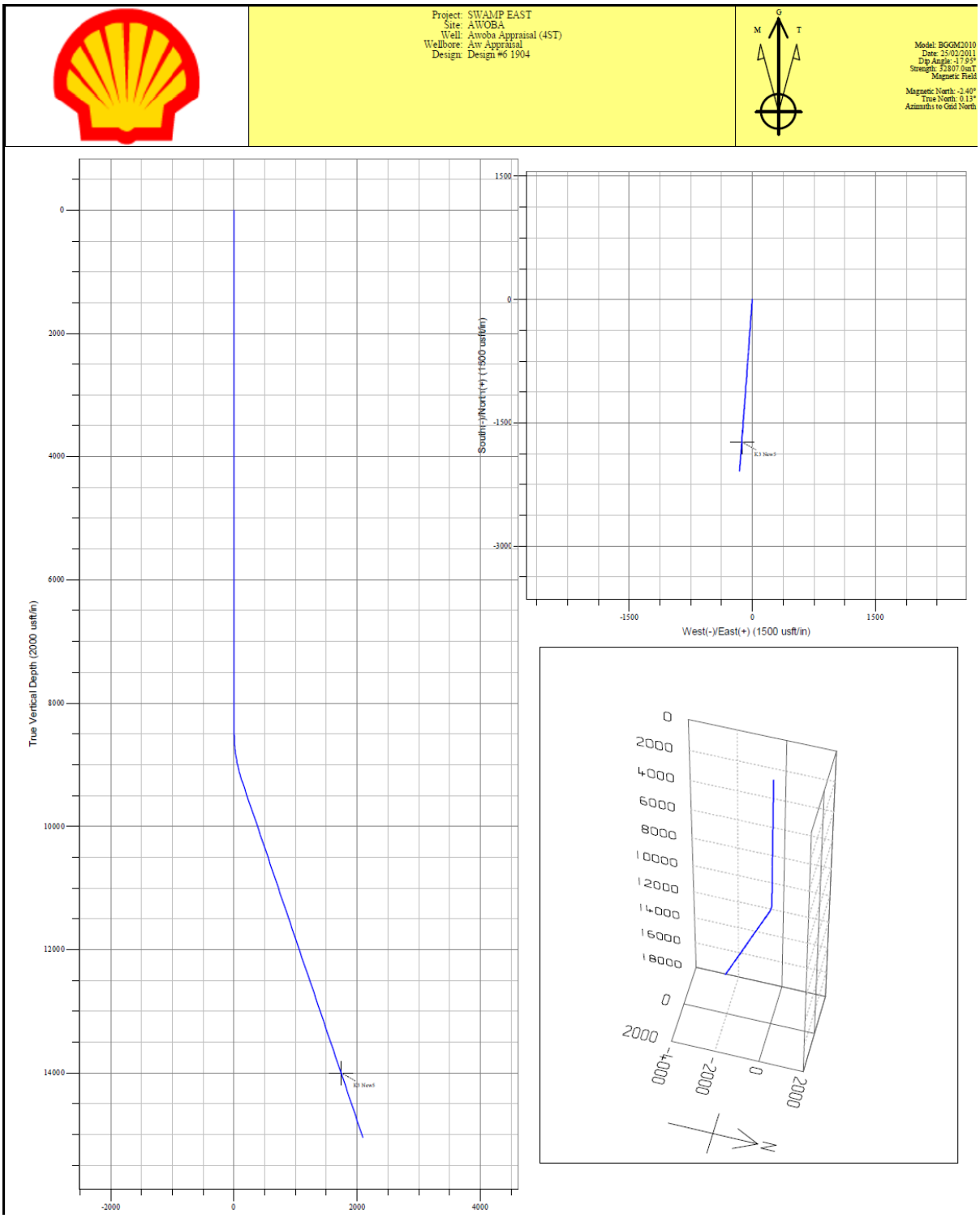
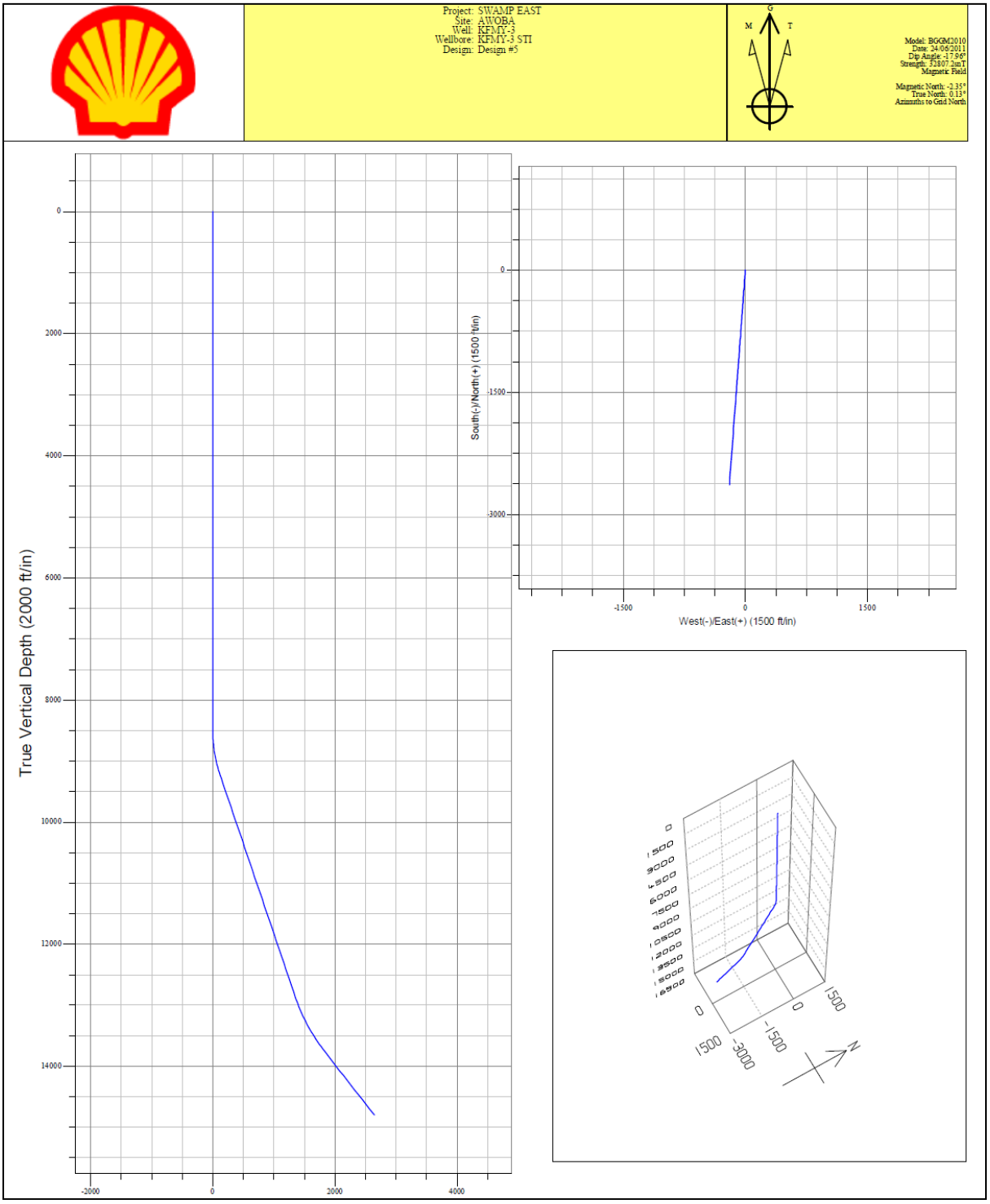


Figure A4.2 KFMY-3 side track hole trajectory (Plan and section view)



TableA4.1: Awoba KFMY-3 Deviation Data table

MD	Incl	Azi	TVD	+N/-S (ft)	+E/-W (ft)	Northing m	Easting m
0	0	0	0	0	0	59,453.00	488,201.00
100	0	0	100	0	0	59,453.00	488,201.00
200	0	0	200	0	0	59,453.00	488,201.00
300	0	0	300	0	0	59,453.00	488,201.00
400	0	0	400	0	0	59,453.00	488,201.00
500	0	0	500	0	0	59,453.00	488,201.00
600	0	0	600	0	0	59,453.00	488,201.00
700	0	0	700	0	0	59,453.00	488,201.00
800	0	0	800	0	0	59,453.00	488,201.00
900	0	0	900	0	0	59,453.00	488,201.00
1000	0	0	1000	0	0	59,453.00	488,201.00
1100	0	0	1100	0	0	59,453.00	488,201.00
1200	0	0	1200	0	0	59,453.00	488,201.00
1300	0	0	1300	0	0	59,453.00	488,201.00
1400	0	0	1400	0	0	59,453.00	488,201.00
1500	0	0	1500	0	0	59,453.00	488,201.00
1600	0	0	1600	0	0	59,453.00	488,201.00
1700	0	0	1700	0	0	59,453.00	488,201.00
1800	0	0	1800	0	0	59,453.00	488,201.00
1900	0	0	1900	0	0	59,453.00	488,201.00
2000	0	0	2000	0	0	59,453.00	488,201.00
2100	0	0	2100	0	0	59,453.00	488,201.00
2200	0	0	2200	0	0	59,453.00	488,201.00
2300	0	0	2300	0	0	59,453.00	488,201.00
2400	0	0	2400	0	0	59,453.00	488,201.00
2500	0	0	2500	0	0	59,453.00	488,201.00
2600	0	0	2600	0	0	59,453.00	488,201.00
2700	0	0	2700	0	0	59,453.00	488,201.00
2800	0	0	2800	0	0	59,453.00	488,201.00
2900	0	0	2900	0	0	59,453.00	488,201.00
3000	0	0	3000	0	0	59,453.00	488,201.00
3100	0	0	3100	0	0	59,453.00	488,201.00
3200	0	0	3200	0	0	59,453.00	488,201.00
3300	0	0	3300	0	0	59,453.00	488,201.00
3400	0	0	3400	0	0	59,453.00	488,201.00
3500	0	0	3500	0	0	59,453.00	488,201.00
3600	0	0	3600	0	0	59,453.00	488,201.00
3700	0	0	3700	0	0	59,453.00	488,201.00
3800	0	0	3800	0	0	59,453.00	488,201.00
3900	0	0	3900	0	0	59,453.00	488,201.00
4000	0	0	4000	0	0	59,453.00	488,201.00
4100	0	0	4100	0	0	59,453.00	488,201.00
4200	0	0	4200	0	0	59,453.00	488,201.00
4300	0	0	4300	0	0	59,453.00	488,201.00
4400	0	0	4400	0	0	59,453.00	488,201.00
4500	0	0	4500	0	0	59,453.00	488,201.00
4600	0	0	4600	0	0	59,453.00	488,201.00
4700	0	0	4700	0	0	59,453.00	488,201.00
4800	0	0	4800	0	0	59,453.00	488,201.00
4900	0	0	4900	0	0	59,453.00	488,201.00
5000	0	0	5000	0	0	59,453.00	488,201.00

5100	0	0	5100	0	0	59,453.00	488,201.00
5200	0	0	5200	0	0	59,453.00	488,201.00
5300	0	0	5300	0	0	59,453.00	488,201.00
5400	0	0	5400	0	0	59,453.00	488,201.00
5500	0	0	5500	0	0	59,453.00	488,201.00
5600	0	0	5600	0	0	59,453.00	488,201.00
5700	0	0	5700	0	0	59,453.00	488,201.00
5800	0	0	5800	0	0	59,453.00	488,201.00
5900	0	0	5900	0	0	59,453.00	488,201.00
6000	0	0	6000	0	0	59,453.00	488,201.00
6100	0	0	6100	0	0	59,453.00	488,201.00
6200	0	0	6200	0	0	59,453.00	488,201.00
6300	0	0	6300	0	0	59,453.00	488,201.00
6400	0	0	6400	0	0	59,453.00	488,201.00
6500	0	0	6500	0	0	59,453.00	488,201.00
6600	0	0	6600	0	0	59,453.00	488,201.00
6700	0	0	6700	0	0	59,453.00	488,201.00
6800	0	0	6800	0	0	59,453.00	488,201.00
6900	0	0	6900	0	0	59,453.00	488,201.00
7000	0	0	7000	0	0	59,453.00	488,201.00
7100	0	0	7100	0	0	59,453.00	488,201.00
7200	0	0	7200	0	0	59,453.00	488,201.00
7300	0	0	7300	0	0	59,453.00	488,201.00
7400	0	0	7400	0	0	59,453.00	488,201.00
7500	0	0	7500	0	0	59,453.00	488,201.00
7600	0	0	7600	0	0	59,453.00	488,201.00
7700	0	0	7700	0	0	59,453.00	488,201.00
7800	0	0	7800	0	0	59,453.00	488,201.00
7900	0	0	7900	0	0	59,453.00	488,201.00
8000	0	0	8000	0	0	59,453.00	488,201.00
8100	0	0	8100	0	0	59,453.00	488,201.00
8200	0	0	8200	0	0	59,453.00	488,201.00
8300	0	0	8300	0	0	59,453.00	488,201.00
8400	0	0	8400	0	0	59,453.00	488,201.00
8500	0	0	8500	0	0	59,453.00	488,201.00
8600	2.5	184.22	8600	-2.2	-0.2	59,452.34	488,200.95
8700	5	184.22	8699.7	-8.7	-0.6	59,450.35	488,200.81
8800	7.5	184.22	8799.1	-19.6	-1.4	59,447.04	488,200.56
8900	10	184.22	8898	-34.7	-2.6	59,442.42	488,200.22
9000	12.5	184.22	8996	-54.2	-4	59,436.49	488,199.78
9100	15	184.22	9093.2	-77.9	-5.8	59,429.26	488,199.25
9200	17.5	184.22	9189.2	-105.8	-7.8	59,420.76	488,198.62
9249.7	18.74	184.22	9236.4	-121.2	-9	59,416.06	488,198.27
9300	18.74	184.22	9284	-137.3	-10.1	59,411.15	488,197.91
9400	18.74	184.22	9378.7	-169.4	-12.5	59,401.38	488,197.19
9500	18.74	184.22	9473.4	-201.4	-14.9	59,391.61	488,196.47
9600	18.74	184.22	9568.1	-233.5	-17.2	59,381.85	488,195.75
9700	18.74	184.22	9662.8	-265.5	-19.6	59,372.08	488,195.02
9800	18.74	184.22	9757.5	-297.5	-22	59,362.31	488,194.30
9900	18.74	184.22	9852.2	-329.6	-24.3	59,352.54	488,193.58
10000	18.74	184.22	9946.9	-361.6	-26.7	59,342.78	488,192.86
10100	18.74	184.22	10041.6	-393.7	-29.1	59,333.01	488,192.14
10200	18.74	184.22	10136.3	-425.7	-31.4	59,323.24	488,191.42
10300	18.74	184.22	10231	-457.8	-33.8	59,313.48	488,190.70
10400	18.74	184.22	10325.7	-489.8	-36.2	59,303.71	488,189.97
10500	18.74	184.22	10420.4	-521.8	-38.5	59,293.94	488,189.25
10600	18.74	184.22	10515.1	-553.9	-40.9	59,284.18	488,188.53
10700	18.74	184.22	10609.8	-585.9	-43.3	59,274.41	488,187.81

10800	18.74	184.22	10704.5	-618	-45.6	59,264.64	488,187.09
10900	18.74	184.22	10799.2	-650	-48	59,254.87	488,186.37
11000	18.74	184.22	10893.9	-682.1	-50.4	59,245.11	488,185.65
11100	18.74	184.22	10988.6	-714.1	-52.7	59,235.34	488,184.92
11200	18.74	184.22	11083.3	-746.2	-55.1	59,225.57	488,184.20
11300	18.74	184.22	11178	-778.2	-57.5	59,215.81	488,183.48
11400	18.74	184.22	11272.7	-810.2	-59.8	59,206.04	488,182.76
11500	18.74	184.22	11367.4	-842.3	-62.2	59,196.27	488,182.04
11600	18.74	184.22	11462.1	-874.3	-64.6	59,186.51	488,181.32
11700	18.74	184.22	11556.8	-906.4	-66.9	59,176.74	488,180.60
11800	18.74	184.22	11651.5	-938.4	-69.3	59,166.97	488,179.87
11900	18.74	184.22	11746.2	-970.5	-71.7	59,157.20	488,179.15
12000	18.74	184.22	11840.9	-1,002.50	-74	59,147.44	488,178.43
12100	18.74	184.22	11935.6	-1,034.50	-76.4	59,137.67	488,177.71
12200	18.74	184.22	12030.3	-1,066.60	-78.8	59,127.90	488,176.99
12300	18.74	184.22	12125	-1,098.60	-81.1	59,118.14	488,176.27
12400	18.74	184.22	12219.7	-1,130.70	-83.5	59,108.37	488,175.55
12500	18.74	184.22	12314.3	-1,162.70	-85.9	59,098.60	488,174.82
12600	18.74	184.22	12409	-1,194.80	-88.2	59,088.84	488,174.10
12700	18.74	184.22	12503.7	-1,226.80	-90.6	59,079.07	488,173.38
12800	18.74	184.22	12598.4	-1,258.90	-93	59,069.30	488,172.66
12900	18.74	184.22	12693.1	-1,290.90	-95.4	59,059.54	488,171.94
13000	18.74	184.22	12787.8	-1,322.90	-97.7	59,049.77	488,171.22
13100	18.74	184.22	12882.5	-1,355.00	-100.1	59,040.00	488,170.50
13200	18.74	184.22	12977.2	-1,387.00	-102.5	59,030.23	488,169.77
13300	18.74	184.22	13071.9	-1,419.10	-104.8	59,020.47	488,169.05
13400	18.74	184.22	13166.6	-1,451.10	-107.2	59,010.70	488,168.33
13500	18.74	184.22	13261.3	-1,483.20	-109.6	59,000.93	488,167.61
13600	18.74	184.22	13356	-1,515.20	-111.9	58,991.17	488,166.89
13700	18.74	184.22	13450.7	-1,547.30	-114.3	58,981.40	488,166.17
13800	18.74	184.22	13545.4	-1,579.30	-116.7	58,971.63	488,165.45
13900	18.74	184.22	13640.1	-1,611.30	-119	58,961.87	488,164.72
14000	18.74	184.22	13734.8	-1,643.40	-121.4	58,952.10	488,164.00
14100	18.74	184.22	13829.5	-1,675.40	-123.8	58,942.33	488,163.28
14200	18.74	184.22	13924.2	-1,707.50	-126.1	58,932.56	488,162.56
14277.4	18.74	184.22	13997.5	-1,732.30	-128	58,925.00	488,162.00
14319.5	18.74	184.22	14037.4	-1,745.80	-128.9	58,920.89	488,161.70
14400	18.74	184.22	14113.6	-1,771.60	-130.9	58,913.03	488,161.12
14500	18.74	184.22	14208.3	-1,803.60	-133.2	58,903.26	488,160.40
14600	18.74	184.22	14303	-1,835.60	-135.6	58,893.50	488,159.67
14700	18.74	184.22	14397.7	-1,867.70	-138	58,883.73	488,158.95
14800	18.74	184.22	14492.4	-1,899.70	-140.3	58,873.96	488,158.23
14900	18.74	184.22	14587.1	-1,931.80	-142.7	58,864.20	488,157.51
15000	18.74	184.22	14681.8	-1,963.80	-145.1	58,854.43	488,156.79
15100	18.74	184.22	14776.5	-1,995.90	-147.4	58,844.66	488,156.07
15172.4	18.74	184.22	14845	-2,019.10	-149.1	58,837.59	488,155.54
15200	18.74	184.22	14871.2	-2,027.90	-149.8	58,834.89	488,155.35
15300	18.74	184.22	14965.9	-2,060.00	-152.2	58,825.13	488,154.62
15383.6	18.74	184.22	15045	-2,086.70	-154.1	58,816.97	488,154.02

TableA4.1: *Awoba KFMY-03* Side Track Hole Deviation Data table

MD	Incl	Azi	TVD	+N/-S	+E/-W	Northing	Easting
				(ft)	(ft)	m	m
13100	18.74	184.2	12882.5	-1,355.00	-100.1	59,040.00	488,170.50
13200	20.67	184.2	12976.7	-1,388.60	-102.6	59,029.75	488,169.74
13300	22.59	184.2	13069.6	-1,425.40	-105.3	59,018.55	488,168.91
13400	24.52	184.2	13161.3	-1,465.20	-108.2	59,006.40	488,168.01
13500	26.45	184.2	13251.6	-1,508.10	-111.4	58,993.32	488,167.05
13600	28.37	184.2	13340.3	-1,554.00	-114.8	58,979.33	488,166.02
13700	30.3	184.2	13427.5	-1,602.90	-118.4	58,964.44	488,164.92
13800	32.22	184.2	13513	-1,654.60	-122.2	58,948.67	488,163.75
13900	34.15	184.2	13596.7	-1,709.20	-126.2	58,932.03	488,162.52
14000	36.07	184.2	13678.5	-1,766.60	-130.5	58,914.55	488,161.23
14100	38	184.2	13758.3	-1,826.70	-134.9	58,896.24	488,159.88
14200	38	184.2	13837.1	-1,888.10	-139.4	58,877.52	488,158.50
14300	38	184.2	13915.9	-1,949.50	-144	58,858.81	488,157.12
14301	38	184.2	13916.6	-1,950.00	-144	58,858.63	488,157.11
14500	38	184.2	14073.5	-2,072.20	-153	58,821.38	488,154.36
14600	38	184.2	14152.3	-2,133.60	-157.6	58,802.67	488,152.98
14700	38	184.2	14231.1	-2,195.00	-162.1	58,783.95	488,151.60
14800	38	184.2	14309.9	-2,256.40	-166.6	58,765.24	488,150.22
14900	38	184.2	14388.7	-2,317.80	-171.1	58,746.52	488,148.84
15000	38	184.2	14467.5	-2,379.20	-175.7	58,727.81	488,147.46
15100	38	184.2	14546.3	-2,440.60	-180.2	58,709.09	488,146.07
15200	38	184.2	14625.1	-2,502.00	-184.7	58,690.38	488,144.69
15300	38	184.2	14703.9	-2,563.40	-189.3	58,671.66	488,143.31
15400	38	184.2	14782.7	-2,624.80	-193.8	58,652.95	488,141.93
15422	38	184.2	14800	-2,638.30	-194.8	58,648.84	488,141.63

Appendix 5 Well Cost Estimate

Table A5.1: Time and Cost estimate for well Awoba KFMY-3

Well Name: **KFMY-3 with sidetrack**

(A) GENERAL INFORMATION

Date of Cost Estimate	13-Jun-11
Drilling Rig	Swamp Rig-1 (PASSION)
Rig Move Distance (km)	30
Terrain	Swamp
Operation Type 1	Initial Drilling
FIELD DATA	Swamp
Well Type	Appraisal
Well Trajectory	Deviated
Completion Objective	Oil Producer
Completion Type	SSS
Tubing Size (Select)	3-1/2" 9.3ppf L80 13% Cr H563 R2
Well Test Mode?	Test With Rig On Site
Maximum Depth (ftahd)	15,422
Total Footage (ft)	17,805

(B) PHASE SUMMARY (USD)

PHASES		DAYS	COST (USD)
RM & PREP		6.0	1,823,298
17-1/2"/16"		9.6	3,835,264
12-1/4" MAIN		21.2	8,978,541
8-1/2" PILOT 1		18.1	5,793,240
8-1/2" MAIN		18.0	5,542,643
COMPLETION		6.4	3,664,254
Well Lift Only _ Test With Rig On Site		3.5	1,182,946
TOTAL FOR YEAR	0	82.77	30,820,187

(C.) WORK ORDER SUMMARY

	DESCRIPTION	RM, PREP & DRILL	COMPL / RE-COMPL	Well Lift Only _ Test With Rig On Site	TOTAL
11	Mob/Demob, Lumpsum Move, Day Rate	6,999,551	607,664	329,333	7,936,549
12	Tools on Rental	384,269	33,715	18,273	436,257
13	MarineSpread/Boat/Barge/HouseBoat	1,630,010	143,016	77,510	1,850,535
14	Air&Land Helicopters & Vehicles	676,979	59,398	32,191	768,568
15	Additional Catering & Water	527,734	48,036	26,034	601,804
16	Add.Logistic/Onne/KI/Ogunu/Movabl	66,923	6,396	3,467	76,786
17	IT Communications, DataComs, RTOC	170,229	14,936	8,095	193,259
18	Diesel	867,839	76,143	41,267	985,250
19	Bits	316,213	-	-	316,213
20	DD, MWD, GYRO	3,410,329	-	-	3,410,329
21	Whole Mud/Chemicals/Rental&Servic	1,439,467	193,580	10,105	1,643,152
22	ST.Pipes/CSGs/Access/Runng Servic	2,754,487	-	-	2,754,487
23	Cement/Chemicals/Rentals & Servic	662,958	11,807	6,399	681,164
24	Petro Logs/Wireline/FEWD/Testrack	1,154,573	13,376	7,249	1,175,198
25	Coring & Coring Analysis	-	-	-	-
26	Special Drilling Tools	-			-
27	Sand Control/Chemicals/Acc&Servic	-	-	-	-
28	Tubing & Other Completions Servic	-	1,549,524	-	1,549,524
29	Wellhead/Xmas Trees & Servic	335,225	456,833	-	792,058
30	Well Clean Up, Lifting / Testing	-	-	436,118	436,118
31	Special Completion Tools	-	-	-	-
32	Waste Management & Environment	898,581	29,007	15,721	943,309
33	Security	652,192	57,223	31,013	740,427
34	Community Assistance	132,574	11,632	6,304	150,510
35	Staff Salaries	1,052,722	92,365	50,059	1,195,145
DIRECT / INDIRECT COST TOTAL =		**24,132,856**	**3,404,649**	**1,099,137**	**28,636,643**
SCD (%) =	2.5%	603,321	85,116	27,478	715,916
BASE COST =		24,736,178	3,489,765	1,126,616	29,352,559
Contingency (%)=	0.0%	-	-	-	-
VAT=	5.0%	1,236,809	174,488	56,331	1,467,628
50/50 (TM) Cost Estimate For 2011 (Year of Estimation)		25,972,987	3,664,254	1,182,946	30,820,187
MOD For Year 2012 (Proposed Year of Execution)		**28,050,826**	**3,957,394**	**1,277,582**	**33,285,802**

Table A5.2: Time and Cost estimate for well Awoba KFMY-3 (NAPIMS format)

Exchange Rate @ 1.0 USD= 150

	Activities	Unit	Qty	Rate	Source (NGN) 40%	Source (USD) 60%	Functional (USD)	Comments
	Mob/Demob/ Move							
1	Rig Cost (Mobilization)	L/sum	1.0	0	-	-	-	
1.1	Rig Move (Lumpsum)	L/sum	1.0	641,850	38,511,000	385,110	641,850	
	Rig Rate	Day	0.0	95,000	-	-	-	
	Total (Mob/Move/Demob)=				**38,511,000**	**385,110**	**641,850**	
	2.0 Conduct/ Preparation							
2.1	Additional Rig Equipment	Day	6.0	5,271	1,891,217	18,912	31,520	
2.1B	Marine Spread	Day	6.0	22,359	8,022,251	80,223	133,704	
2.1C	Add Acc/ Cat/ Air & Land Transp.	Day	-1.0	16,445	4,356,711	43,567	72,612	
2.1D	Portable Water	Day	6.0	1,350	484,495	4,845	8,075	
2.2	Cost Of Conductor Pipe	ft	400.0	281	6,736,445	67,364	112,274	
2.3	Stovepipe Piling & Welding	Job	1.0		3,742,260	37,423	62,371	
2.4	Rentals - 1 (Tel/ Data/RTOC)	Day	6.0	2,335	837,798	8,378	13,963	
2.4B	Fishing/Bit/Mud/Cmt/DD/EWL	Job	1.0		2,009,981	20,100	33,500	
2.4C	Tbg/Whd/Sand Cont/ Well Serv	Job			20,113,500	201,135	335,225	
2.6	Fuel And Lubricants	Day	6.0	11,904	4,271,155	42,712	71,186	
2.5	W.Eng Staff Salaries	Day	6.0	14,440	5,181,072	51,811	86,351	
2.7	Special Drilling Tools	Unit	0.0	0			-	
	Total (Cond/ Prep)=				**57,646,885**	**576,469**	**960,781**	
	3.0 17-1/2" Ofh 13-3/8" Casing							
3.1	Rig Rate	Day	9.6	95,000	54,913,637	549,136	915,227	
3.1B	Additional Rig Equipment	Day	9.6	5,271	3,046,811	30,468	50,780	
3.1C	Marine Spread	Day	9.6	22,359	12,924,104	129,241	215,402	
3.1D	Add Acc/ Cat/ Air & Land Transp.	Day	9.6	16,445	9,506,100	95,061	158,435	
3.1E	Portable Water	Day	9.6	1,350	780,537	7,805	13,009	
3.2	Casing + Accessories	Job	1		35,759,271	357,593	595,988	
3.3	Casing Running	Job	1		7,780,482	77,805	129,675	
3.4	Coring	Job	1		-	-	-	
3.5	Mud Material & Engineering	Job	1		10,810,681	108,107	180,178	
3.6	Cement, Additives And Services	Job	1		12,269,788	122,698	204,496	
3.7	Mud Logging/Adt	Job	0		-	-	-	
3.8	W.Eng Staff Salaries	Day	9.6	14,440	8,346,873	83,469	139,115	
3.9	Wireline Logging	Job	1		1,208,732	12,087	20,146	
3.10	Rock Bits + Nozzles	no.	2		5,283,314	52,833	88,055	
3.11	Fuel And Lubricants	Day	9.6	11,904	6,880,968	68,810	114,683	
3.12	Tubing + Sand Ctrl+W-Test)	Job	0	0	-	-	-	
3.13	DD/MWD/GYRO Services	Job	1		31,368,182	313,682	522,803	
3.14	Well Head	Job	0		-	-	-	
3.15	Rentals - 1 (Tel/ Data/RTOC)	Day	9.6	2,335	1,349,719	13,497	22,495	
3.16	Special Drilling Tools	Unit	0.0	0			-	
	Total 18" (+) Hole Section=				**202,229,199**	**2,022,292**	**3,370,487**	
	4.0 12-1/4" Pilot & Main/ 9-5/8" Csg							
4.1	Rig Rate	Day	21.2	95,000	120,889,125	1,208,891	2,014,819	
4.1B	Additional Rig Equipment	Day	21.2	5,271	6,707,374	67,074	111,790	
4.1C	Marine Spread	Day	21.2	22,359	28,451,650	284,517	474,194	
4.1D	Add Acc/ Cat/ Air & Land Transp.	Day	21.2	16,445	20,927,116	209,271	348,785	
4.1E	Portable Water	Day	21.2	1,350	1,718,305	17,183	28,638	
4.2	Casing + Accessories	Job	1		76,185,335	761,853	1,269,756	
4.3	Casing Running	Job	1		9,120,340	91,203	152,006	
4.4	Coring	Job	0		-	-	-	
4.5	Mud Material & Engineering	Job	1		64,198,069	641,981	1,069,968	
4.6	Cement, Additives And Services	Job	1		9,125,138	91,251	152,086	
4.7	Mud Logging/Adt	Job	1		2,278,302	22,783	37,972	
4.8	W.Eng Staff Salaries	Day	21.2	14,440	18,375,147	183,751	306,252	
4.9	Wireline Logging	Job	1		7,851,417	78,514	130,857	
4.10	Rock Bits + Nozzles	no.	4		8,542,828	85,428	142,380	
4.11	Fuel And Lubricants	Day	21.2	11,904	15,148,044	151,480	252,467	
4.12	Tubing + Sand Ctrl+W-Test)	Job	0	0	-	-	-	
4.13	DD/MWD/GYRO Services	Job	1		73,102,821	731,028	1,218,380	
4.14	Well Head	Job	0		-	-	-	
4.15	Rentals - 1 (Tel/ Data/RTOC)	Day	21.2	2,335	2,971,327	29,713	49,522	
4.16	Special Drilling Tools	Unit	0.0	0			-	
	Total 12-1/4" Hole Section=				**465,592,338**	**4,655,923**	**7,759,872**	
	5.0 8.5" Pilot & Main Ofh 7" Liner							
5.1	Rig Rate	Day	36.1	95,000	205,659,318	2,056,593	3,427,655	
5.1B	Additional Rig Equipment	Day	36.1	5,271	11,410,737	114,107	190,179	
5.1C	Marine Spread	Day	36.1	22,359	48,402,592	484,026	806,710	
5.1D	Add Acc/ Cat/ Air & Land Transp.	Day	36.1	16,445	35,601,685	356,017	593,361	
5.1E	Portable Water	Day	36.1	1,350	2,923,220	29,232	48,720	
5.2	Casing + Accessories	Job	1		16,455,042	164,550	274,251	
5.3	Casing Running	Job	1		9,490,060	94,901	158,168	
5.4	Coring	Job	0		-	-	-	
5.5	Mud Material & Engineering	Job	1		10,761,884	107,619	179,365	
5.6	Cement, Additives And Services	Job	1		17,720,287	177,203	295,338	
5.7	Mud Logging/Adt	Job	1		3,640,548	36,405	60,676	
5.8	W.Eng Staff Salaries	Day	36.1	14,440	31,260,216	312,602	521,004	
5.9	Wireline Logging	Job	1		53,545,122	535,451	892,419	
5.10	Rock Bits + Nozzles	no.	4		5,146,608	51,466	85,777	
5.11	Fuel And Lubricants	Day	36.1	11,904	25,770,195	257,702	429,503	
5.12	Tubing + Sand Ctrl+W-Test)	Job	0	0	-	-	-	
5.13	DD/MWD/GYRO Services	Job	1		100,148,735	1,001,487	1,669,146	
5.14	Well Head	Job	0		-	-	-	
5.15	Rentals - 1 (Tel/ Data/RTOC)	Day	36.1	2,335	5,054,890	50,549	84,248	
5.16	Special Drilling Tools	Unit	0.0	0			-	
	Total 8-1/2" Hole Section=				**582,991,138**	**5,829,911**	**9,716,519**	
	6.0 6" Ofh 4-1/2" Liner							
6.1	Rig Rate	Day	0.0	95,000	-	-	-	
6.1B	Additional Rig Equipment	Day	0.0	5,271	-	-	-	
6.1C	Marine Spread	Day	0.0	22,359	-	-	-	
6.1D	Add Acc/ Cat/ Air & Land Transp.	Day	0.0	16,445	-	-	-	
6.1E	Portable Water	Day	0.0	1,350	-	-	-	
6.2	Casing + Accessories	Job	0.0		-	-	0	
6.3	Casing Running	Job	0.0		-	-	0	
6.4	Coring	Job	0.0		-	-	0	
6.5	Mud Material & Engineering	Job	0.0		-	-	-	
6.6	Cement, Additives And Services	Job	0.0		-	-	-	
6.7	Mud Logging/Adt	Job	0.0		-	-	-	
6.8	W.Eng Staff Salaries	Day	0.0	14,440	-	-	-	
6.9	Wireline Logging	Job	0.0		-	-	-	
6.10	Rock Bits + Nozzles	no.	0.0		-	-	-	
6.11	Fuel And Lubricants	Day	0.0	11,904	-	-	-	
6.12	Tubing + Sand Ctrl+W-Test)	Job	0.0	0	-	-	-	
6.13	DD/MWD/GYRO Services	Job	0.0		-	-	-	
6.14	Well Head	Job	0.0		-	-	-	
6.15	Rentals - 1 (Tel/ Data/RTOC)	Day	0.0	2,335	-	-	-	
6.16	Special Drilling Tools	Unit	0.0	0			-	
	Total 6" Hole Section=				-	-	-	
	OTHERS							
7.0	Community Relations		72.9		7,954,433	79,544	132,574	
8.0	Miscellaneous Charges				-	-	-	
9.0	Transportation (Land)				-	-	-	
10.0	Waste Management		72.9		53,914,881	539,149	898,581	
11.0	Warehouse				-	-		
12.0	Catering Services				-	-	-	
13.0	Personal Protective Equipment (Ppe)							
14.0	Security		72.9		39,131,507	391,315	652,192	
	Total (Waste Mgt/ Comm/ Security/ Others)=				**101,000,821**	**1,010,008**	**1,683,347**	
	SUBTOTAL=				1,447,971,381	14,479,714	24,132,856	
	SCD (%) =			2.5%	**36,199,285**	**361,993**	**603,321**	
	BASE COST =				**1,484,170,665**	**14,841,707**	**24,736,178**	
	Contingency (%)=			0.0%	-	-	-	
	VAT=			5.0%	**74,208,533**	**742,085**	**1,236,809**	
	DRILLING GRAND TOTAL (50/50 EST)=				**1,558,379,199**	**15,583,792**	**25,972,987**	50/50 (TM) Cost Estimate For 2011 (Year of Estimation)

(TM) Today's Money_OK.