

Tanumbirini 3H / Tanumbirini 3HST1

BASIC WELL COMPLETION REPORT

NORTHERN TERRITORY
MCARTHUR BASIN
EP161 / Northern Territory



Santos

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Abbreviations:

ABI	At Bit Inclination
ADR	Automated Drilling Rig
AHD	Australian Height Datum
API	American Petroleum Institute
ASCII	American Standard Code For Information Interchange
AZI	Azimuth
BBLs	Barrels (Unit Of Volume = 42 US Gallons)
BHA	Bottom Hole Assembly
BG	Background Gas
BOP	Blowout Preventer
BT	Broken Teeth
BU, B/U	Bottoms Up
C&S	Case And Suspend(ed)
CAL	Calliper
CAST	Circumferential Acoustic Scanning Tool
CBL	Cement Bond Log
CBU	Circulate Bottoms Up
CG	Connection Gas
CSG	Casing
CSV	Comma Separated Values ASCII File (*.csv)
CO2	Carbon Dioxide
CQ	Completion Quality
CT	Chipped Teeth
D&I	Direction And Inclination
DEN	Density
DDR	Daily Drilling Report
DE	Drilling Engineer
DLL	Dual Lateral Log
DLS	Dog Leg Severity
DMR	Daily Mud Report
DTF	Down-hole Tool Failure
ECD	Equivalent Circulating Density
EMW	Equivalent Mud Weight
ECD	Equivalent Circulating Density
EHS	Environment, Health And Safety
EP	Exploration Permit
FG	Formation Gas
FID	Flame Ionisation Detection
FIT	Formation Integrity Test
FTKLB	Foot Kilo Pounds (measurement of torque)
GEM	Gamma Elemental Minerology
GL	Ground Level
GPM	Gallons Per Minute
GR	Gamma Ray
HI-VIS	High Viscosity Mud Sweep
HRS	Hours
HSE	Health, Safety And Environment
ID	Internal Diameter
IL	In-Line
INCL	Inclination
KOP	Kick Off Point
LCM	Lost Circulation Material
LGDS	Low Gravity Drill Solids
LOT	Leak Off Test
LWD	Logging While Drilling

KCl	Potassium Chloride
KLBS	Kilo Pounds
MD	Measured Depth
MDRT	Measured Depth Rotary Table
MSFL	Micro Spherical Focused Log
MSL	Mean Sea Level (AMSL – Above Mean Sea Level)
MSS	Magnetic Single Shot
MW	Mud Weight
MWD	Measurement While Drilling
NaCl	Sodium Chloride
NB	New Bit
NEUT	Neutron
NP	Not Prognosed
NPT	Non Productive Time
NR	Non Rotating
PC	Production Casing
P&A	Plug(ged) And Abandon(ed)
PBTD	Plugged Back Total Depth
PDC	Polycrystalline Diamond Compact
PC	Production Casing
PDF	Portable Document Format
pH	Potential Hydrogen
PH	Production Hole
PHB	Pre-Hydrated Bentonite
PHPA	Partially-Hydrolysed Polyacrylamide
PJSM	Pre Job Safety Meeting
POOH	Pull Out Of Hole
PPG	Pounds Per Gallon
PPM	Parts Per Million
PSI	Pounds Per Square Inch
PTW	Permit To Work
PV	Plastic Viscosity
PWD	Pressure While Drilling
QGM	Quantitative Gas Measurement
QNT	Queensland / Northern Territory
RES	Resistivity
RC	Roller Cone
RIH	Run In Hole
ROP	Rate Of Penetration
RPM	Revolutions Per Minute
RQ	Reservoir Quality
RR	Re-Run
RSS	Rotary Steerable System
RT	Rotary Table
SDL	Surface Data Logging (Mudlogging)
SC	Surface Casing
SGR	Spectral Gamma Ray
SH	Surface Hole
SIDDP	Shut In Drill Pipe Pressure
SICP	Shut In Casing Pressure
SON	Sonic
SOV	Side Outlet Valve
SP	Spontaneous Potential
SPP	Stand Pipe Pressure
SRA	Source Rock Analysis
SS	Sub Sea
ST	Side Track(ed)
SWC	Sidewall Cores
TCI	Tungsten Carbide Insert

TD	Total Depth
TDS	Top Drive System
TG	Trip Gas
TOC	Top Of Cement
TOC	Total Organic Content
TQ	Torque
TRA	Tight Rock Analysis
TVD	Total Vertical Depth
TVT	Total Vertical Thickness
UBD	Underbalanced Drilling
VBR	Variable Bore Ram(s)
VIS	Viscosity
VSP	Vertical Seismic Profile
WBM	Water Based Mud
WOB	Weight On Bit
WSG	Wellsite Geologist
WT	Worn Teeth
XL	Cross-Line
XO, X/O	Cross Over
XLOT	Extended Leak Off Test
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence
XRFMI	Extended Range Micro Imager
YP	Yield Point

1 Introduction and Summary

Tanumbirini 3H / Tanumbirini 3HST1 was drilled by the Easternwell 106 rig in permit EP 161 onshore Northern Territory.

The EP 161 Velkerri prospect has been described as a Mesoproterozoic shale formation unconventional resource play that has been formally subdivided into three members: the Kyalla Member (oldest), the Amungee Member (middle) and the Wyworrie Member (youngest). Organic shale intervals within the Amungee Member have been informally subdivided into three reservoir units, the A Shale (oldest), the B Shale (middle) and the C Shale (youngest). All three shale intervals are deemed to be laterally extensive within the prospect area. The target B shale is assumed to have a relatively thick pay interval of 67m Total Vertical Thickness (TVT) based on Total Organic Content (TOC) >2% from offsets Tanumbirini 1 and Marmbulligan 1.

The EP 161 prospect area is currently defined by the western edge of the permit boundary and the estimated dry/wet gas window to the north, east and south (structural bounds) within the Beetaloo sub-basin. The permit area consists of 136 full and part graticular blocks, which are approximately 10,500km² (2.6 million acres), of which the assumed mid-case prospective area is 1,600km² (~400k ac). The gross interval of the Velkerri Formation located within the play fairway of EP 161 ranges from 1000mTVT to 1500mTVT ignoring the high variation and uncertainty on the eastern edge where faulting is prevalent.

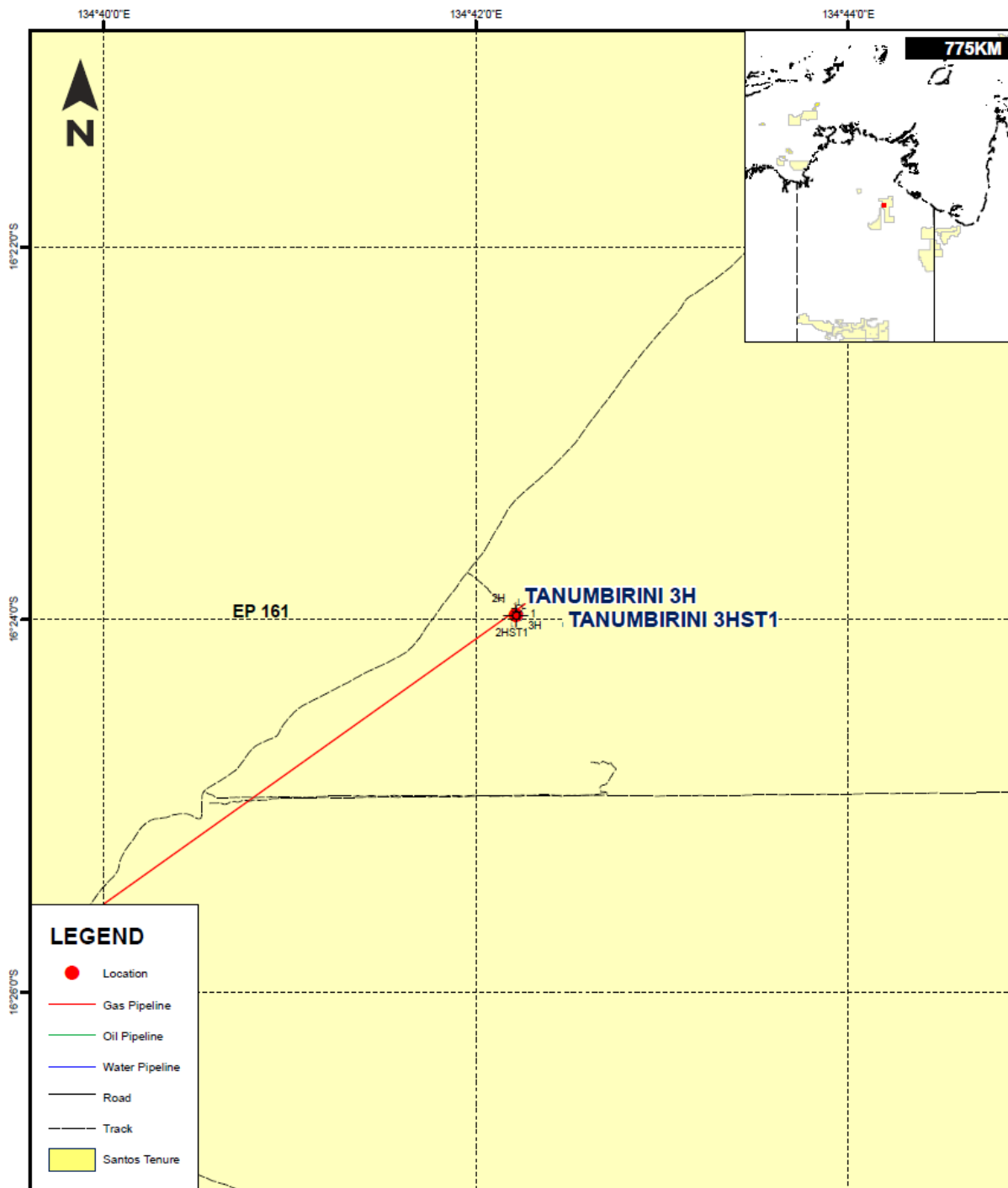
The Tanumbirini exploration program consisted of two ~1000m horizontal wells (Tanumbirini 2H and Tanumbirini 3H) planned to be drilled from a shared pad with a surface location approximately 75m SW of the Tanumbirini 1 well. Both wells targeted the thick Amungee Member B Shale with planned multi-stage fracture stimulation and flow testing to prove up gas deliverability.

The program is aligned with the near-term objectives to cost effectively and rapidly demonstrate the viability of shale gas production in the Beetaloo/McArthur basin by acquiring data to understand and better predict well performance.

The Velkerri Formation thickness at Tanumbirini 1 is approximately 1275mTVT, which represents the thickest Velkerri isochore data point in the Beetaloo sub-basin. The primary prospective reservoir unit is currently considered to be the B Shale.

Figure 1: Well Location Map

Figure 1. Tanumbirini 3H / Tanumbirini 3HST1 basic location map (1:50000)

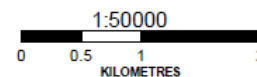


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TANUMBIRINI 3H

Figure 1. TANUMBIRINI 3H basic location map (1:50000)

Date: 2/11/2021



2 Well Summary Sheet

Well Name	Tanumbirini 3H / Tanumbirini 3HST1
Classification	Near Field Exploration
Permit	EP161 / Northern Territory
Well Path	Sidetracked Horizontal
Location (GDA94)	McArthur Basin / Northern Territory Latitude: 16° 23' 58.51" South Longitude: 134° 42' 12.78" East Northing: 8 186 841m Easting: 468 346m 100k Map: Tanumbirini 5865
Offset Well	Tanumbirini 1 located ~75m NE. Marmbulligan 1 located ~23km NE. Amungee NW 1 located ~ 99km W.
Seismic Control	MCSAN 19-01; IL MCSAN 19-01, XL MCSAN 13-05
Elevation	214.9m AHD (GL)
RT Elevation	223.6m
Kick off Depth	2674.0m MDRT
Side-track Depth	3377.0m MDRT
Total Depth Driller	3760.0m MDRT (Tanumbirini 3H)
Total Depth Logger	N/A (Tanumbirini 3H)
Total Depth Driller	4857.0m MDRT (Tanumbirini 3HST1)
Total Depth Logger	N/A (No wireline logging conducted)
Casing	Conductor 1: 20" at 31.0m MDRT Conductor 2: 13-3/8" at 233.2m MDRT Surface: 9-5/8" at 1079.6m MDRT Intermediate: 7" at 3717.2m MDRT Production: 4-1/2" at 4435.0m MDRT
Spud	04:30 hours on 23 rd August 2021
Side-tracked	Tanumbirini 3H: 08:45 hours on 27 th October 2021
Reached TD	03:45 hours on 7 th November 2021
Rig Released	Tanumbirini 3HST1: 14:00 hours on 19 th November 2021
Well Status	Cased and Suspended Gas Well
Suspended	14:00 hours on 19 th November 2021
PBTD	N/A
Permit Interests (Voting / Investment)	Santos QNT Pty Ltd 75.0 / 75.0% Tamboran Resources 25.0 / 25.0%
Rig Name/Type	Easternwell 106 / Land-Onshore
Drilling Contractor	Easternwell

3 Drilling

3.1 Summary of drilling and related operations

Tanumbirini 3H:

Tanumbirini 3H was spudded at 04:30hrs on 23rd August 2021 with the drilling rig Easternwell 106. The 17-1/2" conductor hole was drilled from 31mMD to section TD at 236mMD with 13-3/8" conductor casing (casing while drilling). The 13-3/8" conductor was cemented with the shoe set at 233.2mMD. A top up cement job was conducted from the back-side. A Formation Integrity Test (FIT) was performed to 22.1ppg EMW. The 12-1/4" surface hole was then drilled to section TD at 1083mMD. The 9-5/8" casing was ran and cemented with the shoe set at 1079.6mMD. The 8-1/2" intermediate hole was then drilled to section TD at 3759mMD with multiple bit runs while building inclination to 80.2°. A wiper trip was performed to 3245mMD and back to bottom. The BHA was back reamed and pulled out of the hole to surface. A string of 7" intermediate casing was ran with the hole packing off at 3735mMD. Circulated and cemented the 7" casing with the shoe set at 3717.2mMD. After drilling out the casing shoe and shoe track a Formation Integrity Test (FIT) was performed to 14.0ppg EMW. A cement stability plug was pumped 3759mMD to 3600mMD.

The cement plug was tagged and drilled out from 3693mMD to 3759mMD. The 6-1/8" production hole was drilled from 3759mMD to 3760mMD at which time the drill string became stuck. After attempting to free the string a blind backoff was conducted. A cement plug was set from 3533mMD to 3371mMD above the fish. After dressing the plug from 3371mMD to 3390mMD, a tri-mill and whipstock were ran in hole. The whipstock was set at 3373.7mMD inside the 7" casing, and a window was milled from 3367.4mMD to 3373.6mMD. A Formation Integrity Test (FIT) was performed to 14.0ppg EMW.

A 6-1/8" motor BHA was ran in hole. The hole was drilled ahead from 3373.6mMD to 3377mMD at which point 100% formation was observed. Tanumbirini 3H was side-tracked to Tanumbirini 3HST1 at 08:45hrs on 27th October 2021.

One oil fluorescence show was observed during drilling operations from 1615m to 1620m drillers depth in the Kyalla Formation. 20 to 30% of sandstone cuttings exhibited oil fluorescence with a gas peak of 42 Units (57/25/12/5/1%) and background gas of 10 Units.

Tanumbirini 3HST1:

Drilling of the 6-1/8" production hole proceeded from kick-off point at 3377mMD at 08:45hrs on 27th October 2021 to 3409mMD. After pulling out of hole the RSS and LWD tools were picked up. 6-1/8" production hole drilling resumed from 3409mMD to well TD at 4857mMD and was geosteered at high angle through the Amungee Member B Shale reservoir. Well TD was reached at 03:45hrs on 7th November 2021. Circulated the hole clean and back reamed / pulled out of hole to surface.

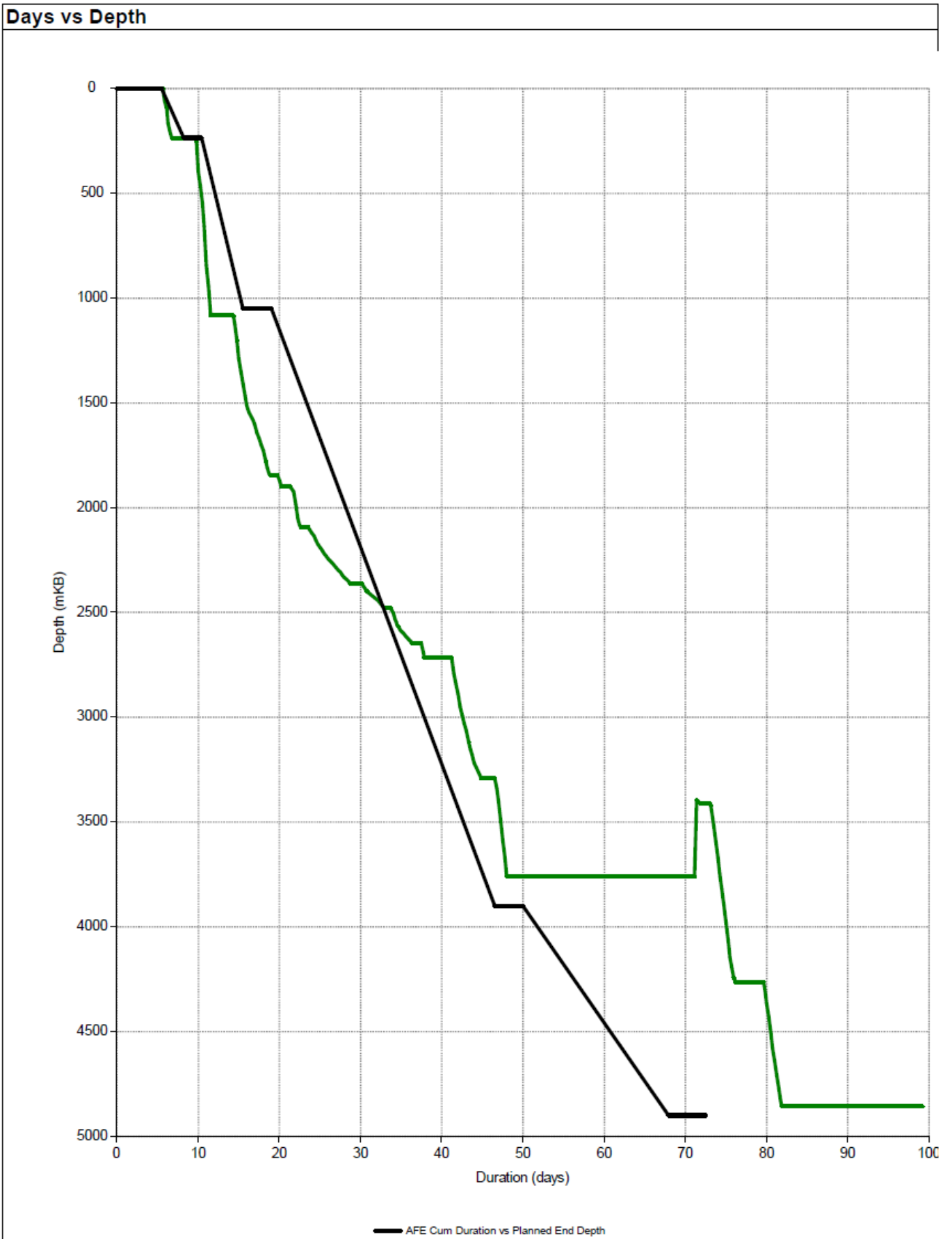
Ran 4-1/2" production casing, worked casing down to 4453mMD. At 4441mMD the casing string stalled out and a pressure increase was observed. Circulated and cleaned the hole from 4445mMD to 4433mMD. Cemented 4-1/2" production casing with the shoe set at 4435mMD.

While drilling Tanumbirini 3H / Tanumbirini 3HST1, measurement While Drilling (MWD) surveys were taken at regular intervals to ensure that the well stayed within the specified +/-50m lateral constraint from well design and within the vertical tolerance window of +/-10mTVD.

Several very poor to poor gas shows were observed in Tanumbirini 3HST1 in the Lower Kyalla and Wyworrie Member, with total gas peaks of up to 882 units over a background of 30 units (94/5/1Tr/Tr%). Several good gas shows were observed in Tanumbirini 3HST1 in the Amungee shales, with total gas peaks of up to 831 units over a background of 200 units (96/6/Tr/Tr/Tr%).

Tanumbirini 3HST1 has been cased and suspended for completion at a later date. The initial drilling phase objective in this well of successfully placing a horizontal well in the target shale, as well as casing and cementing the well has been met. The rig was released at 14:00 hours, 19th November 2021.

TVD Curve



3.2 Drilling equipment installed in or on the well

The drilling rig Easternwell 106 is an ADR 1500 type, top drive rig, with a cantilever triple mast.

Details of drilling equipment related to Easternwell 106 are enclosed in Appendix 1.

3.3 Casing and equipment installed in or on the well

The following table summarises casing sizes, depths and cementing details for Tanumbirini 3H and Tanumbirini 3HST1.

Table 1: Casing sizes, depths and cementing details

Bit Size (inch)	Depth (m)	Casing Size (inch)	Casing Depth (m)	Joints	Casing Type	Cement
17-1/2	236.0	13-3/8	233.2	20	68 lb/ft L80 SL-Boss	196.6 barrels of 11.8-15.8ppg Class 'G' cement plus additives 32.0bbls of 11ppg SentinelCem slurry top up cement job down the back side
12-1/4	1083.0	9-5/8	1079.6	93	53.5 lb/ft P110 SL-Boss	294.8 barrels of 11.5-15.6ppg Class 'G' cement plus additives
8-1/2	3759.0	7	3717.2	330	26 lb/ft P110 SL-APEX	336.3 barrels of 13.5-14.5ppg Lead and Tail plus additives
6-1/8	4857.0	4-1/2	4435.0	392	15.1 lb/ft Q125HY/Q125	236.6 barrels of 14.5ppg cement plus additives

3.4 Cementing operations carried out

Abandonment cement plugs were set on Tanumbirini 3H below the whipstock prior to side-track operations. Cement plug pumped: 80 bbls of 11.5ppg tuned spacer plus 20.2 bbls of 16.5ppg cement slurry. A further 29.6 bbls of 11.5 tuned spacer followed by 52 bbls of 10.4 ppg low rheology mud. The cement was then displaced with 18.3 bbls of 11.0ppg mud. Cement plug placed from 3532m and tagged at 3385m with 5klbs, top of plug was dressed down to 3390m in preparation for whipstock. Tanumbirini 3H wellbore abandonment plug 3532m to 3390m (142m).

Please refer to Table 1 for cementing details relating to casing strings.

3.5 Bit Records

The following table summarises bit run details for Tanumbirini 3H and Tanumbirini 3HST1. Bit details are also available in Appendix 1.

Table 2: Bit run details

Tanumbirini 3H

Bit #	Make	Type / Model		Size (inch)	Hours	Meters	Condition
1	Baker Bit Shoe	PDC	EZC506	17-1/2	15.4	205.0	In Hole (Casing Bit Shoe)
2	Baker	Tri Cone	VM-1	12-1/4	0.5	3.0	5-5-BT-S-3-I-WT-TD
3RR	Baker	Tri Cone	VM-1	12-1/4	0.0	0.0	5-5-BT-S-3-I-WT-BHA
4	Smith	PDC	MDSi616	12-1/4	30.3	844.0	1-1-CT-S-X-I-ER/RR-TD
5	Smith	PDC	Z716	8-1/2	98.5	762.0	5-4-RO-A-X-I-CT-PR
6	Ulterra	PDC	CF716	8-1/2	42.7	249.0	1-2-WT-S-X-I-NO-PR
7	Smith	PDC	MDSiR813	8-1/2	117.7	267.0	1-3-DL-S-X-I-CT-PR
8	Ulterra	PDC	U813M	8-1/2	64.3	117.0	1-1-WT-A-X-I-NO-PR
9	Baker	Hybrid	K5M425E	8-1/2	60.7	167.0	RCI: 3-6-BT-G-E-I-CT-PR PDC: 1-3- W T-T-X-I-NO-PR
10	Halliburton	PDC	GTi74DH	8-1/2	85.8	644.0	1-2-CT-G-X-I-BT-BHA
11	Halliburton	PDC	GTi74DH	8-1/2	30.5	470.0	1-3-BT-G-X-I-CT-TD
12	Hughes -1	TCI	STX	6-1/8	0.0	0.0	5-5-BT-A-4-I-ER-DP
13	Halliburton	PDC	GTi55WDDH	6-1/8	0.0	0.0	0-0-WT-A-X-I-RR-DTF
14RR	Halliburton	PDC	GTi55WDDH	6-1/8	0.3	1.0	Lost In Hole
15RR	Halliburton	PDC	GTE64C	6-1/8	0.0	0.0	-
16RR	Halliburton	PDC	GTE64C	6-1/8	0.0	0.0	-
17	WIS	Mill	Tri-Mill	6-1/8	7.7	6.2	2-2-WT-G-X-4-W-TD

Tanumbirini 3HST1

Bit #	Make	Type / Model		Size (inch)	Hours	Meters	Condition
18	WIS	Mill	Tri-Mill	6-1/8	0.0	0.0	2-2-WT-A-X-4-CT-TD
19	Smith	TCI	XRS20T	6-1/8	21.0	35.4	2-1-WT-M-E-I-CT-BHA
20	Halliburton	PDC	GTE64C	6-1/8	58.4	854.0	0-4-BT-S-X-I-CT-DTF
21	Halliburton	PDC	GTE64C	6-1/8	40.9	594.0	0-5-BT-S-X-I-CT-TD

3.6 Drilling Fluids

Table 3 summarises drilling fluids for Tanumbirini 3H.

Table 3: Drilling fluid details for Tanumbirini 3H

Hole/Bit Size		17-1/2"
Interval		31.0m – 236.0m
Drilling Fluid	Mud Type	KCL/Polymer
	Mud weight	8.7 – 8.8
	Funnel vis	118 - 126
	PV	26 -30
	YP	42 - 53
	pH	9.1 – 9.2
	API fluid loss	6.6 – 7.1
	Chlorides	26000 – 28000
	KCL %	5.2 – 6.0
Hole/Bit Size		12-1/4"
Interval		236.0m – 1083.0m
Drilling Fluid	Mud Type	KCL/Polymer
	Mud Weight	9.0 – 9.3
	Funnel vis	42 - 50
	PV	10 - 12
	YP	20 - 25
	pH	9.1 – 10.0
	API fluid loss	6.0 – 7.1
	Chlorides	38000 - 41000
	KCL %	9.0
Hole/Bit Size		8-1/2"
Interval		1083.0 – 3759.0m
Drilling Fluid	Mud Type	Performadril
	Mud Weight	10.0 – 10.9
	Funnel vis	46 - 60
	PV	14 - 24
	YP	27 - 49
	pH	9.1 – 9.8
	API fluid loss	3.6 – 4.9
	Chlorides	45000 - 99000
	KCL %	8.0 – 8.5

Hole/Bit Size		6-1/8"
Interval		3759.0 – 3760.0m
Drilling Fluid	Mud Type	BaraHib Plus
	Mud Weight	11.1
	Funnel vis	50 - 60
	PV	18 - 19
	YP	20 - 28
	pH	9.5 – 9.8
	API fluid loss	6.0 – 6.1
	Chlorides	95000 - 99000
	KCL %	8.4 – 8.5

The following table summarises drilling fluids for Tanumbirini 3HST1.

Table 4: Drilling fluid details for Tanumbirini 3HST1

Hole/Bit Size		6-1/8"
Interval		3377.0m – 4857.0m
Drilling Fluid	Mud Type	BaraHib Plus
	Mud weight	11.0 – 11.4
	Funnel vis	52 - 65
	PV	21 -29
	YP	30 - 44
	pH	9.1 – 9.7
	API fluid loss	4.7 – 5.7
	Chlorides	95000 - 105000
	KCL %	7.4 – 8.4

4 Geology

4.1 Formation Tops

The following table summarises formation tops for Tanumbirini 3HST1

Table 5: Formation tops

Formation	Formation Tops				
	Actual Top		High/Low	Prognosed Top	
	(m MDRT)	(m TVDSS)	Prognosis	(m MDRT)	(m TVDSS)
Tanumbirini 3HST1					
Surficial Deposits	8.7	214.9	0.1 H	8.7	215.0
Gum Ridge Formation	54.7	168.9	4.9 L	60.0	164.0
Inacumba Unit	201.5	22.1	0.9 H	201.0	23.0
Cox Formation	586.3	-362.6	3.6 L	585.0	-359.0
Bukalara Sandstone	1154.0	-930.4	1.6 H	1158.0	-932.0
Kyalla Formation	1302.1	-1078.5	0.5 H	1305.0	-1079.0
Lower Kyalla Sandstone	1826.9	-1602.0	3.0 H	1831.0	-1605.0
Moroak Sandstone	2069.3	-1845.7	4.3 H	2076.0	-1850.0
Wyworrie Member (VELK)	2642.4	-2418.8	0.8 H	2644.0	-2418.0
Amungee Member (VELK)	3174.8	-2951.2	34.2 L	3184.0	-2917.0
Total Depth	4857.0	-3222.1	0.9 H	4907.0	-3223.0

4.2 Reservoir and Prospective Horizons

The Tanumbirini prospect is defined as an unconventional shale play, the Amungee Member target formation is a 4-way syncline i.e., a basin, with no conventional up-dip traps apparent, therefore the low permeability source rock is the target and hydrocarbon migration, and trap geometry are not considered.

Prospects/plays defined as unconventional shale require reservoir parameters to be characterised using tight rock analysis (TRA) e.g., retort saturations, pulse-decay perm; geochemical analysis e.g., SRA, desorption, adsorption isotherms and organic petrology; and other supporting analyses such as mineralogy (XRD/XRF) and rock mechanics. The Amungee Mbr shale intervals or reservoir units are the most prospective target in EP 161. The B Shale ranks highest with similar thickness to the C Shale, but slightly better reservoir properties with respect to reservoir quality (RQ) and completion quality (CQ).

Although limited to a geosteering LWD tool string, the spectral gamma ray (SpecStar) data was used to estimate total organic content (TOCwt%) using a linear relationship based on existing source rock analysis and spectral gamma ray data that has been acquired in the Beetaloo Sub-basin. The B Shale target window was intersected at 3726mMD and the lateral section remained in the target window steering through TOC>2wt% for the complete section to TD at 4857mMD, and TOC>3wt% estimated to approximately 888m of the lateral section within the target window. Based on the formation evaluation data available, the B Shale remains the primary prospective interval in EP 161 and will be further assessed once production test data has been acquired.

5 Formation Sampling

5.1 Drill Cuttings

The following tables summarises drilling cuttings samples for Tanumbirini 3H and Tanumbirini 3HST1.

Table 6: Drilling cuttings samples for Tanumbirini 3H

Depth Interval (m)	Sampling Interval (m)	Remarks
31.0 – 1280.0	10.0	WBM drilling
1280 – 1655.0	5.0	WBM drilling
1655.0 – 1730.0	3.0	WBM drilling
1730.0 – 1810.0	5.0	WBM drilling
1810.0 – 1980.0	3.0	WBM drilling
1980.0 – 2075.0	5.0	WBM drilling
2075.0 – 3340.0	3.0	WBM drilling
3340.0 – 3760.0	5.0	WBM drilling

Table 7: Drilling cuttings samples for Tanumbirini 3HST1

Depth Interval (m)	Sampling Interval (m)	Remarks
3377.0 – 3560.0	3.0	WBM drilling
3560.0 – 4857.0	5.0	WBM drilling

Detailed drill cuttings lithological descriptions are enclosed in Appendix 2.

5.2 Mud gas

A total of 4 Iso-Tubes were collected on Tanumbirini 3H and 12 Iso-Tubes collected on Tanumbirini 3HST1. No onsite gas composition analysis was performed. A detailed summary of samples is enclosed in Appendix 3.

5.3 XRF Sampling

X-ray Fluorescence Spectroscopy (XRF) sampling was conducted from 2571m to 3759m on Tanumbirini 3H and from 3377m to 4857m on Tanumbirini 3HST1. A detailed summary of samples is enclosed in Appendix 3.

6 Formation Evaluation

6.1 Mudlogging

Halliburton provided mudlogging services for the drilling of Tanumbirini 3H / Tanumbirini 3HST1. This included conventional mudlogging, real time data monitoring, drilling analysis, and XRF sample analysis. Mudlogging data is enclosed in Appendix 4.

Mudlogging services were provided by Halliburton Unit 9900070 with the following parameters monitored:

1. Total Gas
2. Chromatographic Gas Breakdown (Chromatograph: C1-C5 in 60 seconds)
3. Hydrogen Sulphide Levels (3 sensors)
4. Depth/Rate of Penetration.
5. Pipe Speed/Block Position
6. Top drive RPM
7. Top drive Torque
8. Hook Load/Weight on Bit
9. Standpipe Pressure
10. Mud Pump Rate (2 pumps)
11. Mud Pit Levels (13 pits including 2 on the trip tank)
12. Mud flow paddle
13. CO2 detection

6.2 MWD/LWD Logging

Logging While Drilling (LWD) data was acquired by Halliburton. LWD services consisted of:

- Gamma Ray and Directional in the 12-1/4" hole section from 239m to 1083m,
- Gamma Ray, Directional and Pressure While Drilling in the 8-1/2" hole section from 1083m to 2645m,
- Gamma Ray, Azimuthal Gamma Ray, Directional, Sonic and Pressure While Drilling in the 8-1/2" hole from 2645m to 3759m,
- Gamma Ray, Azimuthal Gamma Ray, Directional, Sonic and Pressure While Drilling in the 6-1/8" hole from 3759m to 3760m,
- Directional in the Tanumbirini 3HST1 6-1/8" hole from 3377m to 3409m,
- Gamma Ray, Azimuthal Gamma Ray, Directional, Sonic, SpecStar and Pressure While Drilling in the Tanumbirini 3HST1 6-1/8" hole from 3409m to well total depth at 4857m.

Field data, log displays, and deviation surveys are enclosed in Appendix 5.

Table 8: MWD/LWD run details

Log (LWD)	Suite/Run	Interval (m MDRT)	Comments
Tanumbirini 3H			
LWD/MWD	4	239 - 1083	D&I-GR
LWD/MWD	5	1083 - 1845	D&I-GR-PWD
LWD/MWD	6	1845 - 2094	D&I-GR-PWD
LWD/MWD	7	2094 - 2361	D&I-GR-PWD
LWD/MWD	8	2361 - 2478	D&I-GR-PWD
LWD/MWD	9	2478 - 2645	D&I-GR-PWD
LWD/MWD	10	2645 - 3289	ABI-Azi GR-D&I-GR-PWD-Sonic

Log (LWD)	Suite/Run	Interval (m MDRT)	Comments
LWD/MWD	11	3289 - 3759	ABI-Azi GR-D&I-GR-PWD-Sonic
LWD/MWD	14	3759 - 3760	XBAT-Cal-PWD-Azi GR-SpecStar-D&I-GR-ABI-Vib
Tanumbirini 3HST1			
LWD/MWD	19	3377 - 3409	D&I
LWD/MWD	20	3409 - 4263	XBAT-Cal-PWD-Azi GR-SpecStar-D&I-GR-ABI-Vib
LWD/MWD	21	4263 - 4857	XBAT-Cal-PWD-Azi GR-SpecStar-D&I-GR-ABI-Vib

6.3 Wireline Logging

No wireline logging was conducted on Tanumbirini 3H / Tanumbirini 3HST1.

6.1 Hydrocarbon Indications

4.1 Gas detection whilst drilling

Gas levels were monitored from the surface to TD, using an FID total gas detector and FID chromatograph. Total gas was monitored in gas units (1unit = 200ppm methane equivalent in air) and the chromatograph was calibrated to measure ppm (parts per million) concentrations of the alkane gasses methane, ethane, propane, butane, and pentane.

A summary of Gas detection whilst drilling is enclosed in Appendix 6.



Appendices

1. Final Drilling Data Report
2. Drill Cuttings Lithological Descriptions
3. Sample Manifest Mud Gas Sampling Summary
4. Mudlogging Data
5. MWD-LWD Data
6. Gas Data Summary
7. Daily Geological Reports
8. Well Location Documents
9. Well Data Card