Independent Competent Person’s Report and Resource Estimation for Oil Shale Exploration Assets held by TomCo Energy plc

Report Prepared for

TomCo Energy plc

Report Prepared by

SRK Consulting (Australasia) Pty Ltd

TCO001

March 2019

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TomCo Energy plc

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Executive Summary

TomCo Energy plc (TomCo) requested SRK Consulting (Australasia) Pty Ltd (SRK) to undertake a Competent Persons Report of its oil shale exploration assets located in the Uinta Basin, Utah, USA. As part of this assessment, SRK was also requested to prepare a resource estimate conforming to the definitions and guidelines of the 2018 Petroleum Resources Management System (PRMS, 2018) sponsored by the SPE/AAPG/WPC/SPEE/SEG/EAGE/SPWLA.

TomCo holds five disparate land parcels related to two separate Mineral Leases, ML 49570 and ML 49571, respectively covering a combined area of 2,918.84 acres within the Uinta Basin of central eastern Utah. The leases are all underlain by shale units of the Green River Formation, which regionally hosts the largest known oil shale deposit in the world (**Figure ES-1**).

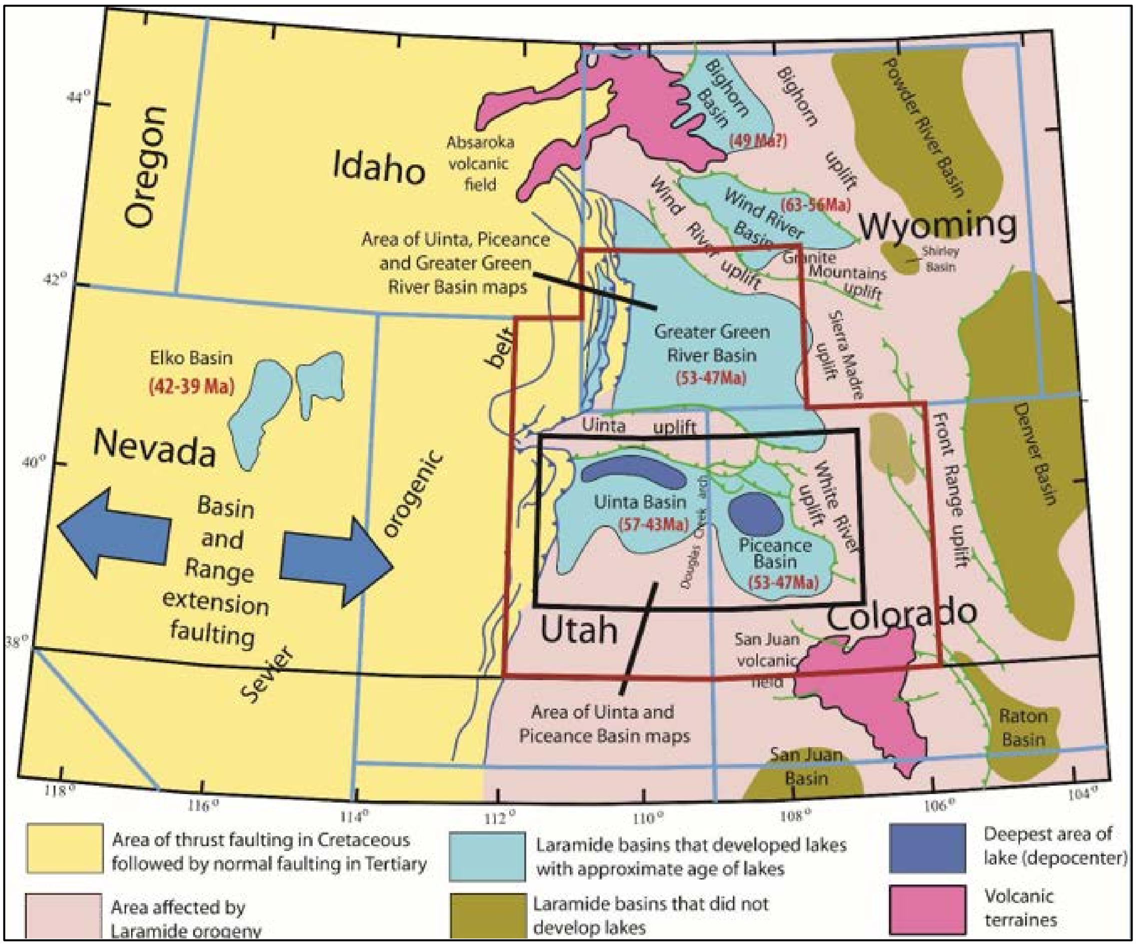

Figure ES-1: Location of the Uinta Basin, Utah
Source: USGS, 2010

ML 49571 forms part of an area termed the Holliday A block. The surrounding Mineral Leases in the Holliday Block and the other neighbouring Mineral Leases are held by Red Leaf Resources Inc. (Red Leaf).

The five blocks (held as ML 49570 and ML 49571) held by TomCo are referred to as Holliday A, Holliday B and Areas 1, 2 and 3 (**Figure ES-2**). Holliday Blocks A and B were assessed for their in situ petroleum Mineral Resource potential under the JORC Code (SRK, 2011).

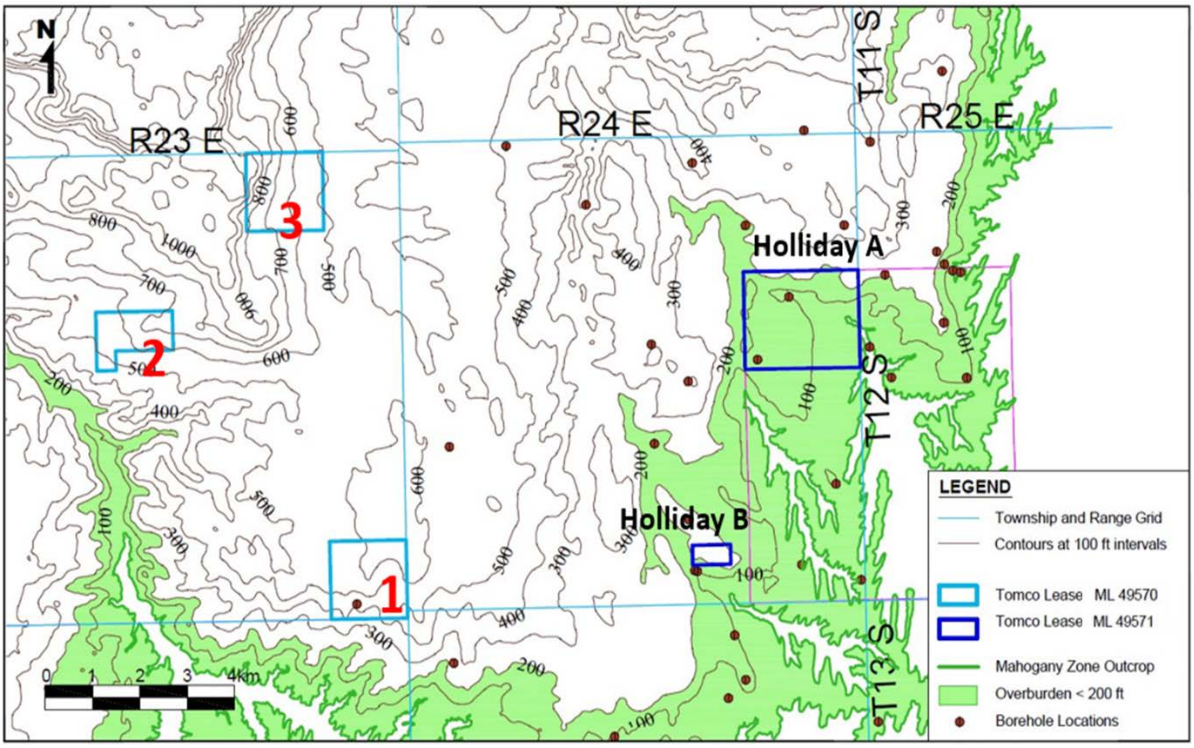

Figure ES-2: Location of Holliday A, Holliday B (ML 49571) and the area 1, 2 and 3 Blocks (ML 49570) in the Uinta Basin, Utah

Source: SRK, 2011

Based on its review and analysis, SRK has estimated the following Contingent Resources (**Table ES- 1**) and Prospective Resources (**Table ES-2**) for the various TomCo blocks. The Contingent Resources comprise the thick, high yield Mahogany shale section. The Prospective Resources comprise mainly the lower section of deeper, thinner oil shales. While Areas 2 and 3 are considered very likely to include the undrilled Mahogany section, this is not yet proven but their chance of development of the Prospective Resource is therefore higher.

Table ES-1: Estimated Contingent Resources for the TomCo Blocks in the Uinta Basin, Utah (recoverable, risked, as at 15 March 2019)

MM bbl	Gross			Net Attributable			Risk Factor		Operator
	Low (1C)	Best (2C)	High (3C)	Low (1C)	Best (2C)	High (3C)	Exploration	Dev'ment	
Holliday A	28.2	57.3	88.9	28.2	57.3	88.9	1.0	0.7	TomCo
Holliday B	1.8	4.6	8.2	1.8	4.6	8.2	1.0	0.7	TomCo
Area 1	29.1	69.4	169.9	29.1	69.4	169.9	1.0	0.7	TomCo
Area 2									TomCo
Area 3									TomCo
Total	**59.2**	**131.3**	**267.1**	**59.2**	**131.3**	**267.1**			

Table ES-2: Estimated Prospective Resources for the TomCo Blocks in the Uinta Basin, Utah (recoverable, unrisked, as at 15 March 2019)

MMbbl	Gross			Net Attributable			Risk Factor		Operator
	Low (1U)	Best (2U)	High (3U)	Low (1U)	Best (2U)	High (3U)	Exploration	Dev'ment	
Holliday A	41.7	84.7	131.5	41.7	84.7	131.5	0.95	0.4	TomCo
Holliday B	2.0	6.6	10.2	2.0	6.6	10.2	0.95	0.4	TomCo
Area 1	18.8	44.7	109.5	18.8	44.7	109.5	0.95	0.4	TomCo
Area 2	22.9	110.5	307.6	22.9	110.5	307.6	0.95	0.6	TomCo
Area 3	40.6	196.2	546.4	40.6	196.2	546.4	0.95	0.6	TomCo
Total	**126.0**	**442.8**	**1105.1**	**126.0**	**442.8**	**1105.1**			

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Disclaimer

The results presented in this Report are based on information supplied to SRK Consulting (Australasia) Pty Ltd (SRK) by TomCo Energy plc (TomCo) and other publicly available information.

SRK has exercised all due care in reviewing the supplied information. While SRK has compared key supplied data with expected values and independently verified as much information as possible, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Neither SRK nor any of the authors of this Report has any beneficial interest in the outcome of the technical assessment presented. SRK's fee for completing this Report is based on its normal professional daily rates plus reimbursement of incidental expenses. The payment of that professional fee is not contingent upon the outcome of the Report.

Limitations

The assessment of petroleum assets is subject to many uncertainties. It involves judgements on many variables that cannot be precisely determined, including reserves, future gas production rates, the costs associated with producing gas volumes, access to product markets, product prices and the potential impact of fiscal/regulatory changes.

Whilst every effort has been made to verify data, SRK does not accept any liability for its accuracy, nor do we warrant that our enquiries have revealed all matters that an extensive examination may disclose. SRK has not independently verified property title, encumbrances or regulations that apply to these assets. SRK has not reviewed all the development and exploration costs, past development costs or tax losses that may be relevant to an in-depth evaluation.

List of Abbreviations

Abbreviation	Meaning
AAPG	American Association of Petroleum Geologists
AFE	Application for Expenditure
ASTM	American Society for Testing and Materials
bbl	barrel
CBM	coal bed methane
cc/g	cubic centimetres per gram
EAGE	European Association of Geoscientists and Engineers
EUR	estimated ultimate recovery
ft	feet
g/cc	grams per cubic centimetre
G/T	gallons per tonne
HIP	hydrocarbons-in-place
kg	kilograms
km	kilometres
km^2	square kilometres
M	million
m	metres
ML	Mineral Lease
Mt	Million tonnes
OOIP	original oil-in-place
RF	radio frequency
PHIP	potential hydrocarbons-in-place
PRMS	Petroleum Resource Management System
SEG	Society of Exploration Geophysicists
SPE	Society of Petroleum Engineers
SPEE	Society of Petroleum Evaluation Engineers
SPWLA	Society of Petroleum Well Log Analysts
SRK	SRK Consulting (Australasia) Pty Ltd
SRV	stimulated rock volume
T	tonnes
TomCo	TomCo Energy plc
TVD	true vertical depth
USBM	United States Bureau of Mines
USGS	US Geological Survey
WPC	World Petroleum Council

PRMS Definitions and Guidelines - Summary

(Further details are provided in Appendix A)

RESERVES are those quantities of petroleum anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions. Reserves must further satisfy four criteria – they must be discovered, recoverable, commercial, and remaining (as of a given date) based on the development project(s) applied.

Proved Developed Reserves are assigned within the drilled spacing-unit and Proved Undeveloped Reserves are assigned to adjacent spacing-units where there is high confidence in continuity of productive reservoir. Probable and Possible Reserves are assigned in more remote areas indicating progressively less confidence.

- **Proved Reserves** are those quantities of petroleum, which, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under defined economic conditions, operating methods, and government regulations. If deterministic methods are used, the term reasonable certainty is intended to express a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least a 90% probability that the quantities actually recovered will equal or exceed the estimate.
- **Probable Reserves** are those additional Reserves which analysis of geoscience and engineering data indicate are less likely to be recovered than Proved Reserves but more certain to be recovered than Possible Reserves. It is equally likely that actual remaining quantities recovered will be greater than or less than the sum of the estimated Proved plus Probable Reserves (2P). In this context, when probabilistic methods are used, there should be at least a 50% probability that the actual quantities recovered will equal or exceed the 2P estimate.
- **Possible Reserves** are those additional reserves which analysis of geoscience and engineering data suggest are less likely to be recoverable than Probable Reserves. The total quantities ultimately recovered from the project have a low probability to exceed the sum of Proved plus Probable plus Possible (3P) Reserves, which is equivalent to the high estimate scenario. In this context, when probabilistic methods are used, there should be at least a 10% probability that the actual quantities recovered will equal or exceed the 3P estimate.

CONTINGENT RESOURCES are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations, but the applied project(s) are not yet considered mature enough for commercial development due to one or more contingencies. Contingent Resources may include, for example, projects for which there are currently no viable markets, or where commercial recovery is dependent on technology under development, or where evaluation of the accumulation is insufficient to clearly assess commerciality. Contingent Resources are further categorised in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterised by their economic status.

UNRECOVERABLE is that portion of Discovered or Undiscovered Petroleum Initially-in-Place quantities which is estimated, as of a given date, not to be recoverable by future development projects. A portion of these quantities may become recoverable in the future as commercial circumstances change or technological developments occur, the remaining portion may never be recovered due to physical/chemical constraints represented by subsurface interaction of fluids and reservoir rocks.

PRMS Guidelines 2011 state:

Contingent Resources may be assigned for projects that are dependent on “technology under development.”

It is recommended that the following guidelines be considered to distinguish these Contingent Resources from quantities that should be classified as Unrecoverable:

1. The technology has been demonstrated to be commercially viable in analogous reservoirs. Discovered recoverable quantities may be classified as Contingent Resources.
2 The technology has been demonstrated to be commercially viable in other reservoirs that are not analogous, and a pilot project will be necessary to demonstrate commerciality for this reservoir. If a pilot project is planned and budgeted, Discovered Recoverable quantities from the full project may be classified as Contingent Resources. If no pilot project is currently planned, all quantities should be classified as Unrecoverable.
3 The technology has not been demonstrated to be commercially viable but is currently under active development, and there is sufficient direct evidence (e.g., from a test project) to indicate that it may reasonably be expected to be available for commercial application within 5 years. Discovered Recoverable quantities from the full project may be classified as Contingent Resources.
4 The technology has not been demonstrated to be commercially viable and is not currently under active development, and/or there is not yet any direct evidence to indicate that it may reasonably be expected to be available for commercial application within 5 years. All such quantities should be classified as Unrecoverable.

Definition of Prospective Resources, P_{90}, P_{10}, P_{50}, P_{mean}

While there may be a significant risk that sub-commercial or undiscovered accumulations will not achieve commercial production, it is useful to consider the range of potentially recoverable volumes independently of such a risk.

Prospective Resources are those quantities of petroleum that are estimated to be potentially recoverable from undiscovered accumulations. These estimates are derived from volumetric estimates for the reservoir size, estimates of the reservoir characteristics (porosity, permeability, oil saturation). The basis of these estimates would be available geological and geophysical data, and the data from any existing wells in the given area.

Any estimation of resource quantities for an accumulation is subject to both technical and commercial uncertainties and consequently there will be a range of estimates that in general will be substantially greater for undiscovered accumulations than for discovered accumulations. In all cases, however, the actual range will be dependent on the amount and quality of data (both technical and commercial) which is available for that accumulation. As more data become available for a specific accumulation (for example wells and reservoir performance data), the range of uncertainty would be reduced.

Probabilistic methods are normally used to quantify the uncertainty in these estimated quantities and the results of the analysis are typically presented by stating resource quantities at the following levels of confidence:

- **P_{90} resource** reflects a volume estimate that, assuming the accumulation is developed, there is a 90% probability that the quantities actually recovered will equal or exceed the estimate. This is therefore a low estimate of resource.
- **P_{50} resource** reflects a volume estimate that, assuming the accumulation is developed, there is a 50% probability that the quantities actually recovered will equal or exceed the estimate. This is therefore a median estimate of resource or best estimate.

- **P_{10} resource** reflects a volume estimate that, assuming the accumulation is developed, there is a 10% probability that the quantities actually recovered will equal or exceed the estimate. This is therefore a high estimate of resource.
- **P_{mean}** is the mean of the probability distribution for the resource estimates. This is often not the same as P50 as the distribution can be skewed by high resource numbers with relatively low probabilities. P_{mean} data is not used in the current report as the current ASX Listing Rules do not allow it.

Statement of Competency

Dr Bruce Alan McConachie

Dr Bruce Alan McConachie is a geologist with extensive experience in economic resource evaluation and exploration. His career spans over 30 years and includes production, development and exploration experience in petroleum, coal, bauxite and various industrial minerals.

Work history includes:

- Comalco: 15 years (Rio Tinto-Alcan) - Chemist, Mine Geologist, Planning Engineer, Senior Geologist and Team Leader (Petroleum Group)
- Australian Geological Survey Organisation/ Bureau of Mineral Resources: 2.5 years (Geoscience Australia) - Senior Research Scientist (Petroleum Systems Petrel Sub-basin Project)
- Santos: 7 years - Senior Geologist, Team Leader and Chief Geologist – Indonesia
- BHP Billiton: 2.5 years - Global Bauxite Commodity Specialist and Manager Bulk Commodities
- SRK Consulting: 8 years – Principal Consultant.

Experience:

Extensive relevant experience covering petroleum exploration programs, joint venture management, farm-in and farm-out deals, onshore and offshore operations, field evaluation and development, oil and gas production and economic assessment, and relevant experience assessing petroleum resources under the PRMS code and mineral commodities under the JORC Code.

Industry Group Memberships:

- The Australasian Institute of Mining and Metallurgy (AusIMM) – 30 years
- American Association of Petroleum Geologists – 12 years
- Member of Petroleum Exploration Society (PESA)
- Member of Society of Petroleum Engineers (SPE).

Qualifications:

- Graduate degrees in geology and analytical chemistry
- Master of Applied Science by research and thesis on the coal geology of the Bowen Basin, Queensland
- Doctor of Philosophy by dissertation on foreland and fold belt basin analysis to characterise petroleum and mineral systems and deposits.

My qualifications and experience meet the requirements to act as a Competent Person to report petroleum reserves under PRMS (2007).

The data and interpretations presented in this document accurately reflect my view of TomCo Energy plc's oil shale assets that are the subject of the report.

srk consulting

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Dr Bruce Alan McConachie

1 Introduction

TomCo Energy plc (TomCo) requested SRK Consulting (UK) Ltd (SRK) to undertake a Competent Persons Report of its oil shale exploration assets located in the Uinta Basin, Utah, USA. As part of this assessment, SRK was also requested to prepare a Resource estimate in accordance with the definitions and guidelines of the 2018 Petroleum Resources Management System (PRMS, 2018) sponsored by the SPE/AAPG/WPC/SPEE/SEG/EAGE/SPWLA.

This report is based on review of technical data provided by TomCo and other publicly available data. It describes:

- A summary of the currently reportable Contingent Resources estimates for the Holliday Block divided into 1C, 2C, and 3C categories
- Prospective Resources for other permit areas.

1.1 Licences

TomCo holds a 100% interest in two Mineral Leases, ML 49570 and ML 49571 (the Leases), located in the Uinta Basin of Utah, approximately 150 km east-southeast of Salt Lake City (accessible by road).

The topography of TomCo's claims area comprises gently rolling hills dissected by deeply incised valleys with elevations ranging between 2,000 m and 2,200 m above sea level.

TomCo's Leases cover a combined area of 2,918.84 acres (**Figure 1-1**). The leases are not contiguous but occur in five separate parcels separated to a large extent by non-licensed Federal lands administered by the US Bureau of Land Management (BLM), and by leases held by other third-party companies, most notably Red Leaf. TomCo recently acquired interests in additional nearby leases.

SRK has been provided with copies of the Mineral Lease Assignment Forms, dated April 2006, which assigned the leases to TomCo, but SRK has not undertaken a legal due diligence study for the leases such as would be required to confirm that all statutory consents are in force and current. Notwithstanding this, SRK can confirm that the estimates of petroleum and quality provided later in this report relate to material within the Mineral Lease boundaries.

Figure 1-1 shows the locations of the parcels held by TomCo, as well as the topography across the area. This figure also highlights the five parcels for which SRK has reported hydrocarbon Resources within this Report and shows the limits of the focus Holliday Block area.

The annual rental for TomCo's Mineral Leases is some US$1 per acre. While there are no specific work commitments, exploitation of the leases must commence by 2024, if the leases are to remain in force beyond 2024.

As far as SRK is aware, TomCo's Mineral Leases are not currently subject to any known environmental liabilities.

The lease data is presented in **Table 1-1**. TomCo Energy plc consists of two subsidiary companies: The Oil Mining Company (100%) and TurboShale Inc. (80%). A State royalty of up to 12.5% is applicable to each Lease; however, there are exemptions for initial production cost recovery. Because the basis of any royalty payments is market price, SRK considers the net Resource attributable to TomCo is 100%.

Table 1-1: Licence data for ML 49570 and ML 49571

Asset	Operator	Interest	Status	Lease expiry date	Lease area	Comments
ML 49570 USA, UT, Uintah County Blocks T12S R23E – Sec2: All, Sec16:N1/2 NW1/4 SW1/4, Sec36: All	The Oil Mining Company Inc.	100%	Exploration	3 December 2024	1638.54 acres	
ML 49571 USA, UT, Uintah County Blocks T12S R24E – Sec11:S1/2 SE1/4, Sec12:S1/2 S1/2, Sec13: ALL, Sec14:E1/2, Sec34:NE1/4 SE1/4, Sec35:NW1/4 SW1/4	The Oil Mining Company Inc.	100%	Exploration	3 December 2024	1280 acres	LMO permit and Exploration permit

Source: TomCo

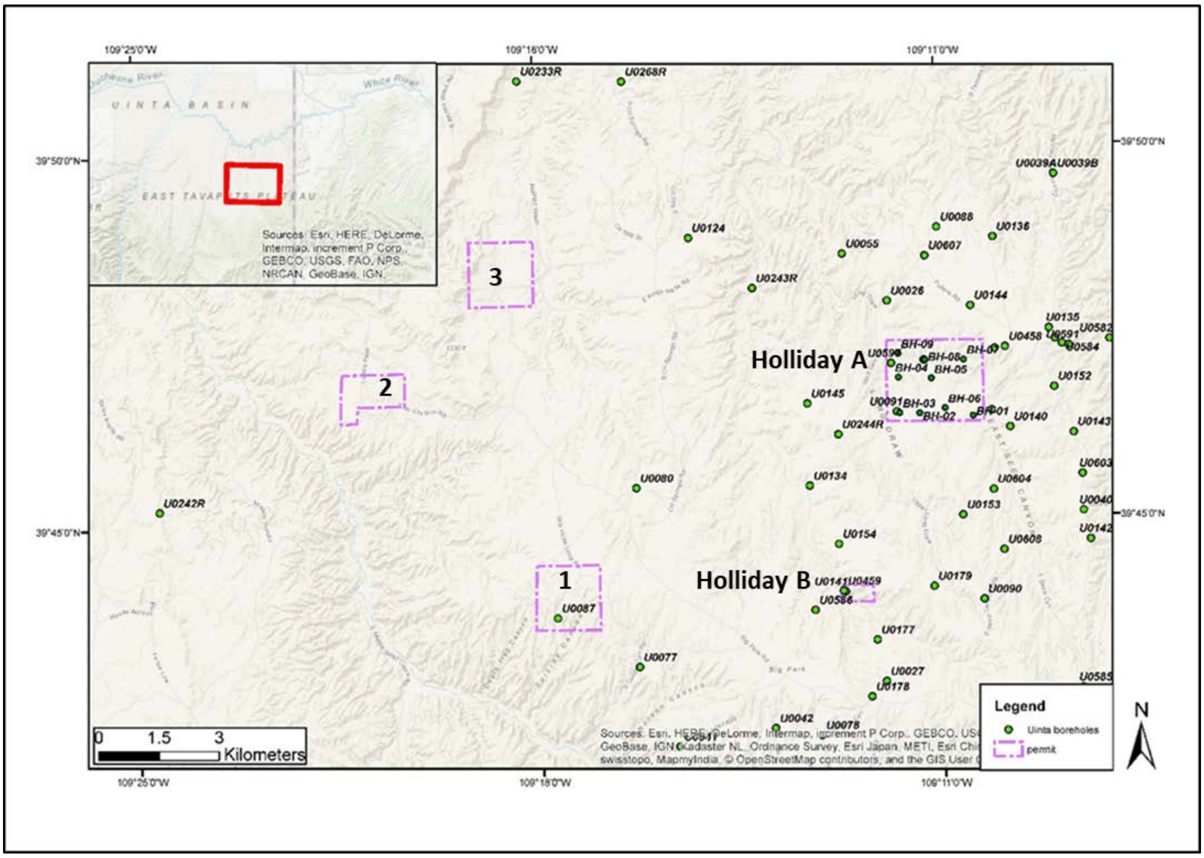

Figure 1-1: Location map of the Holliday A, Holliday B and Areas 1, 2 and 3
Source: SRK

1.2 Geology

TomCo's leases are located in the extreme eastern portion of the Uinta Basin of central Utah. The leases are characterised by rocks of the Eocene aged Green River Formation, which is known to host the largest oil shale deposit discovered in the world to date (but outside of TomCo's current leases and held by unrelated third parties).

The oil shale was first identified in the area in 1913, and the area has been studied by geologists since that time. The most definitive early public report on the area was the US Geological Survey's (USGS) Professional Paper 548 published in 1967 (Cashion, 1967).

The Green River Formation has been divided, in ascending order, into the Douglas Creek, Garden Gulch, Parachute Creek and Evacuation Creek members. The Douglas Creek Member is composed largely of sandstone, siltstone and limestone units, while the Garden Gulch, Parachute Creek and Evacuation Creek members are composed of marls, siltstone and oil shale interpreted to have been deposited in a lacustrine environment. The Parachute Creek Member contains the principal oil shale beds of the Green River Formation, with the richest being the Mahogany oil shale bed (also known as the Mahogany Zone).

Figure 1-2 presents the stratigraphy of the Parachute Creek Member and Garden Gulch Member of the Green River Formation.

Figure 1-3 shows the stratigraphy of the Parachute Creek Member of the upper Green River Formation illustrated by bulk density, sonic and oil yield plots from TomCo well U044.

Figure 1-4 and **Figure 1-5** show the stratigraphic well correlations for HB006-HB002-HB003 and HB004-HB005-HB008 with the high gamma shale units highlighted (black) on the gamma logs and density and oil yields for comparison. The mapped locations are shown in the **Figure 1-6** insert. The density logs best highlight the oil yield potential. A section flattened on the A Groove (poor oil zone) above the top Mahogany Shale is shown for the Holliday A block in **Figure 1-6.**

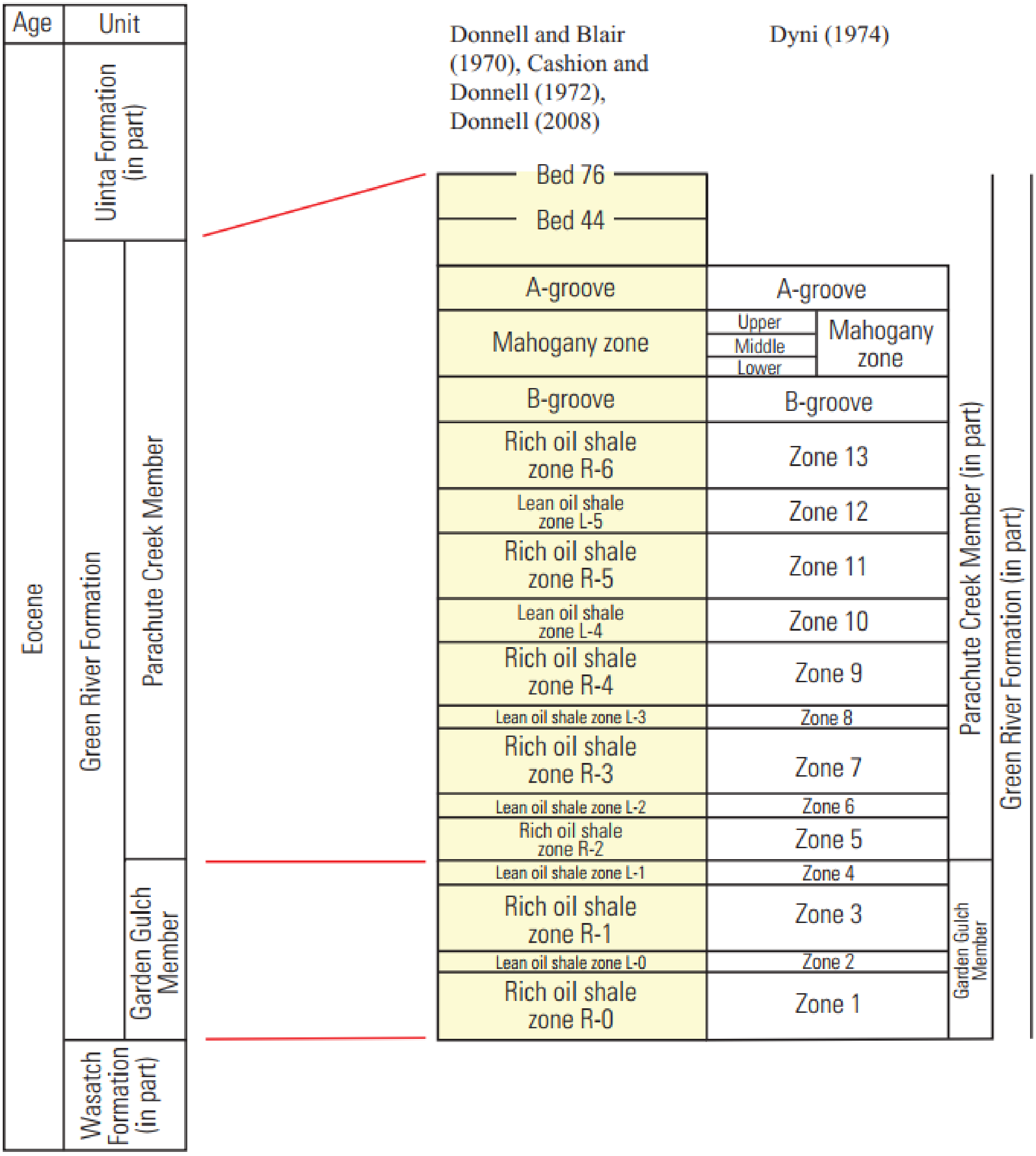

Figure 1-2: Stratigraphy and nomenclature for oil shale zones in the Green River Formation, Uinta Basin, Utah

Source: USGS, 2010

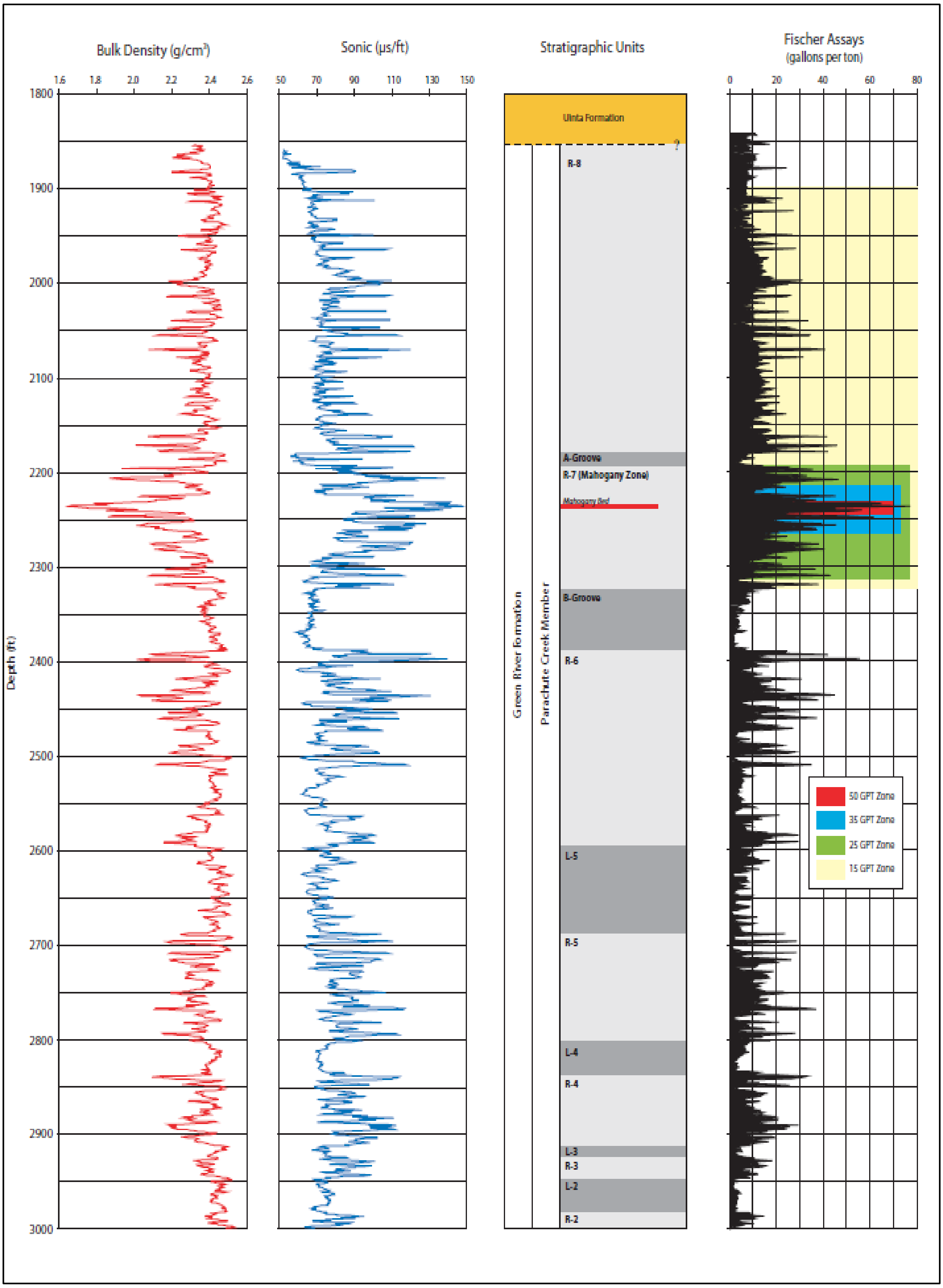

Figure 1-3: Stratigraphy of the Parachute Creek Member of the upper Green River Formation illustrated by bulk density, sonic, and oil-yield plots from well U044

Note: Section 22, T. 9 S., R. 23 E., SLBLM; north of the Holliday Block; Vanden Berg, 2008

Source: USGS, 2010

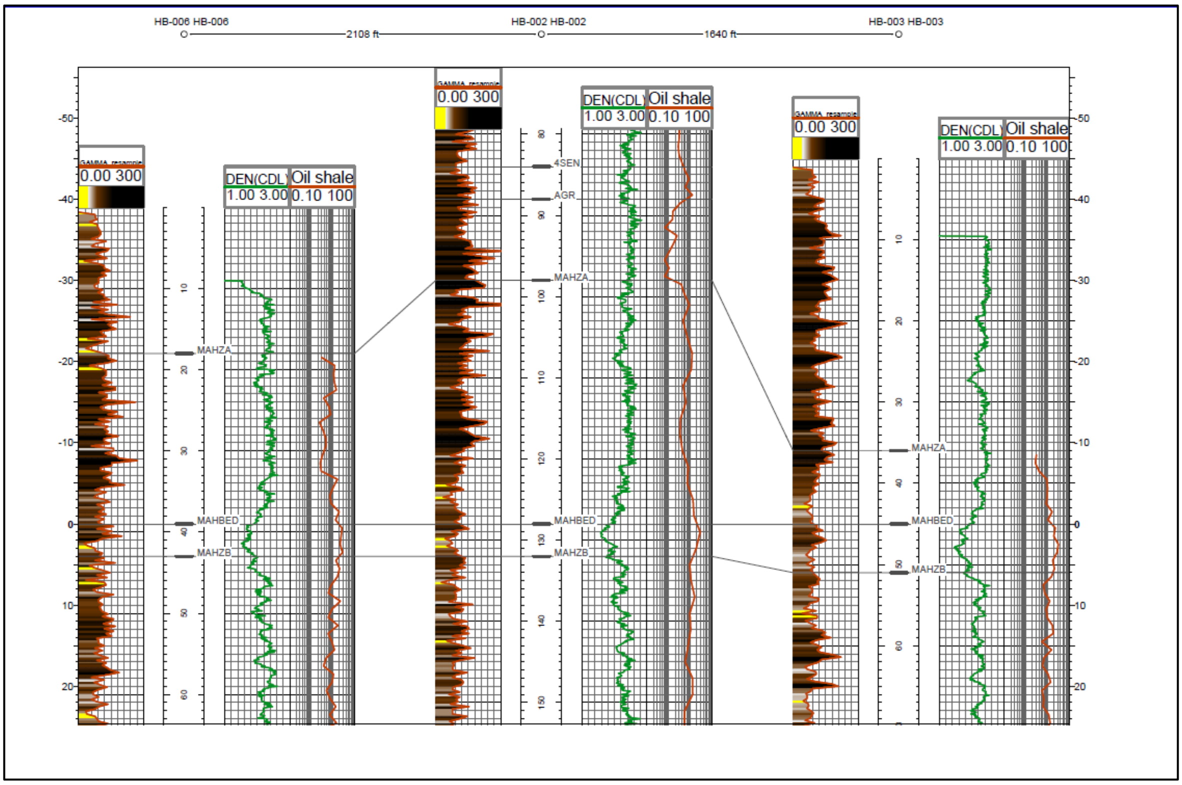

Figure 1-4: Well correlation and measured oil yield results across the HB006-HB002-HB003 wells

Source: SRK

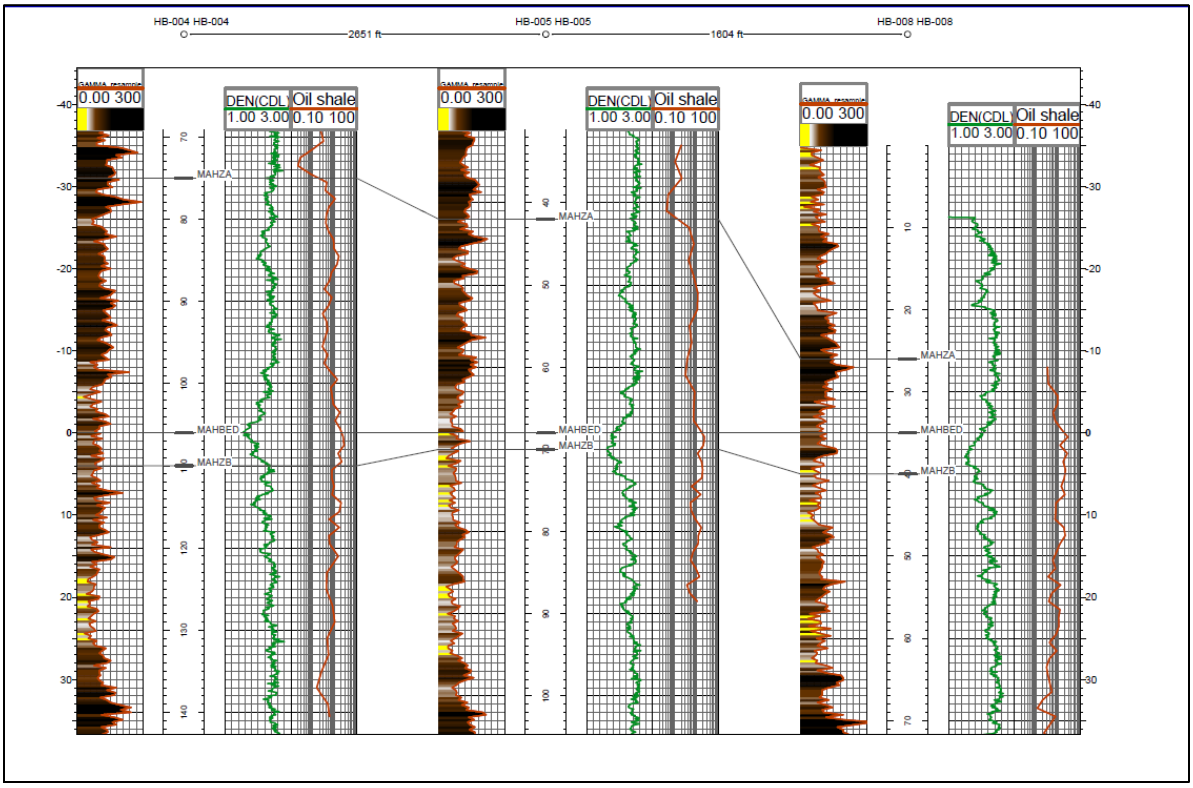

Figure 1-5: Well correlation and measured oil yield results across the HB004-HB005-HB008 wells

Source: SRK

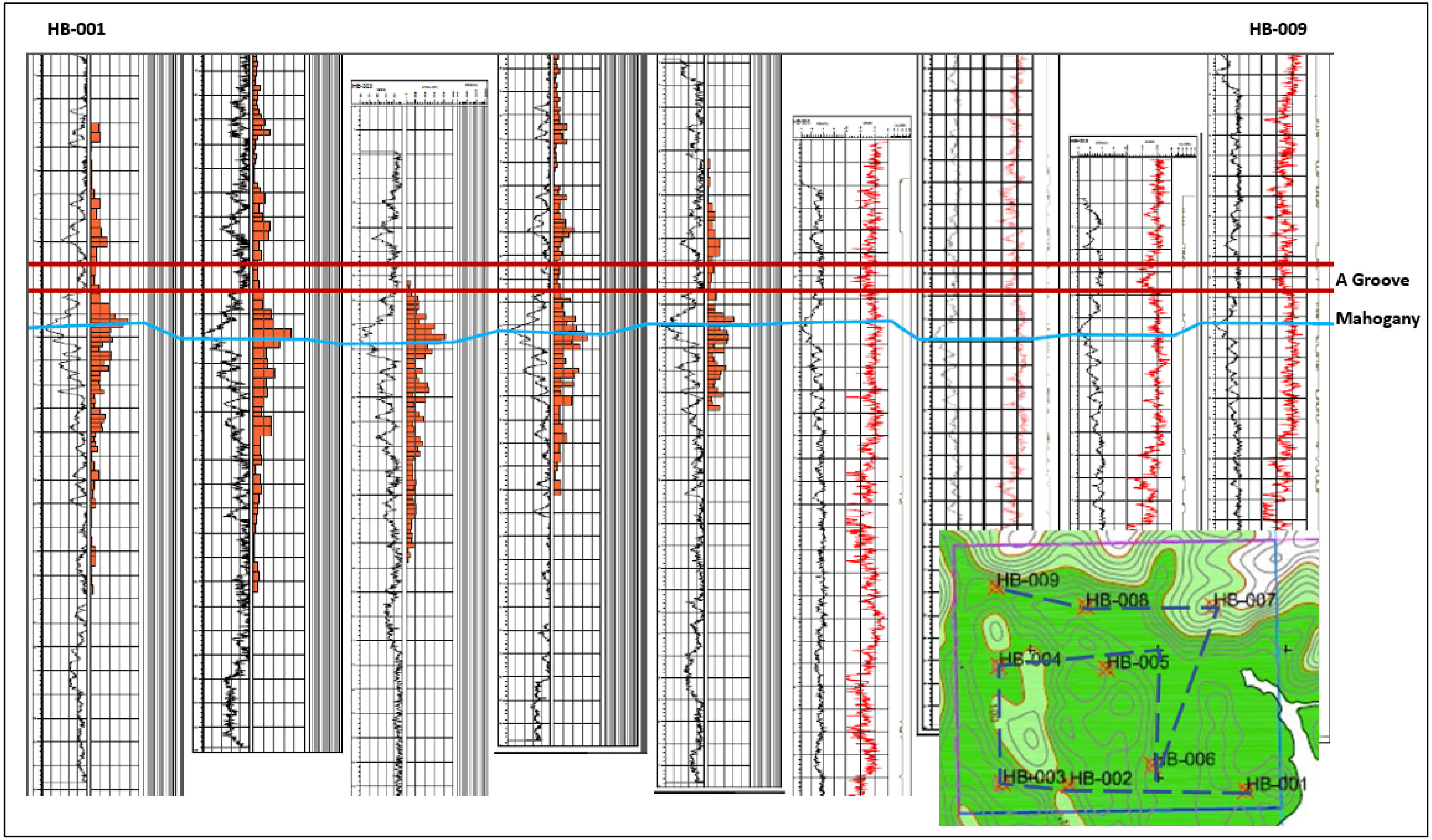

Figure 1-6: Holliday A block cross-section flattened on the A Groove above the top Mahogany Shale

Note: Density and Fischer assays G/T (gallons per tonne) shown on HB-001 to 005, density and gamma ray shown on HB-006-009.

Source: SRK

The Uinta Basin is a structurally asymmetric depression with the most steeply inclined rocks occurring along its northern flank. In TomCo's leases, the beds dip at shallow to moderate angles to the northwest. There is very little faulting in the area.

The Mahogany oil shales are composed of magnesian marlstone and have a high organic matter content. The predominant inorganic constituents are dolomite, calcite and clay, while clastic minerals such as quartz, sanidine, feldspar, muscovite, zircon and apatite all occur in small amounts and are partly of volcanic origin. Two types of organic matter are evident; one type is a structureless material, translucent and lemon-yellow to reddish-brown in colour, while the other comprises complete or fragments of organisms including algae, protozoa and insects and parts of higher plants including spores, pollen grains and minute pieces of tissue.

The oil shale beds are typically several metres thick where they outcrop to the east of the TomCo leases and extend in a continuous manner for several miles, suggesting that they were deposited in a very quiescent environment. They are also dark in colour where outcropping, visibly kerogen-bearing and tend to weather less than the associated beds and therefore stand out as resistant ledges. The degree of resistance to weathering and darkness of the colour of the rock in outcrop are in direct proportion to the content of organic matter. In the TomCo leases, the oil shale beds occur between the surface and several hundred metres below surface.

The bulk density of the oil shale is inversely proportional to the organic content and potential oil yield. For example, oil shale with an average bulk density of 2.38 t/m^3 yields approximately 15 gallons of oil per short tonne, while oil shale with an average bulk density of 1.40 t/m^3 yields approximately 100 gallons of oil per short tonne.

The highest shale oil yields occur within the Mahogany Zone which varies in thickness across the TomCo leases. The richest oil shale horizon, the Mahogany Bed, occurs approximately 23 ft from the top of the Mahogany Zone and is estimated to have average shale oil yields of 30–40 gallons per short tonne. The highest zones exceed 80 gallons per short tonne.

Overlying the Mahogany Zone, and separated by the A Groove Formation, is the 'R8' Zone, which outcrops at surface in the Holliday A Block and is also relatively rich in shale oil. Two sets of horizons, namely the Four Senators and Big Three, are present across the east of the lease area, where they occur between 30 ft and 60 ft from surface, have a thickness of between 2 ft and 9 ft and have estimated average yields of 18.5 gallons per short tonne. The petroleum Resource estimates undertaken in the current study include these units (about 20%) as well as the deeper units in the leases (about 40%).

Figure 1-7 maps the locations of geological sections in the basin near and throughout the TomCo leases. The stratigraphy intersected in the wells is described as Upper Mahogany, Mahogany and Mahogany Deep, depending on what was intersected in each well.

The regional depth of overburden of the Mahogany Zone is shown in **Figure 1-8** and shows the outcrop of the Mahogany Zone and overburden thickness and the TomCo Holliday A, Holliday B and Areas 1, 2 and 3 blocks. The Mahogany Zone thickness isopach (locally 60–86 ft thick) and the Mahogany Zone oil average oil yields (locally 20–25 G/T) are shown in **Figure 1-9** and **Figure 1-10**.

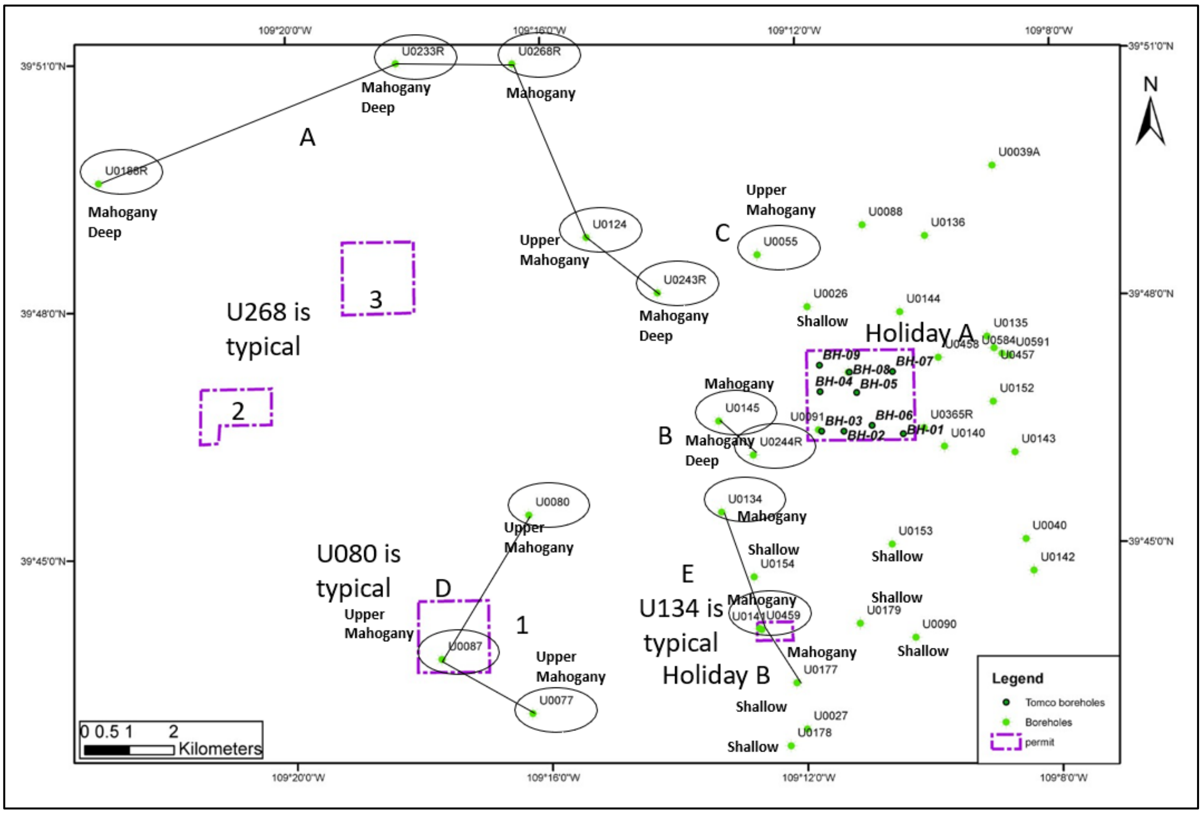

Figure 1-7: Stratigraphic sections drilled (Upper Mahogany, Mahogany and Mahogany Deep) and data assessed in relation to Holliday A, Holliday B, and Areas 1, 2 and 3 blocks

Source: SRK

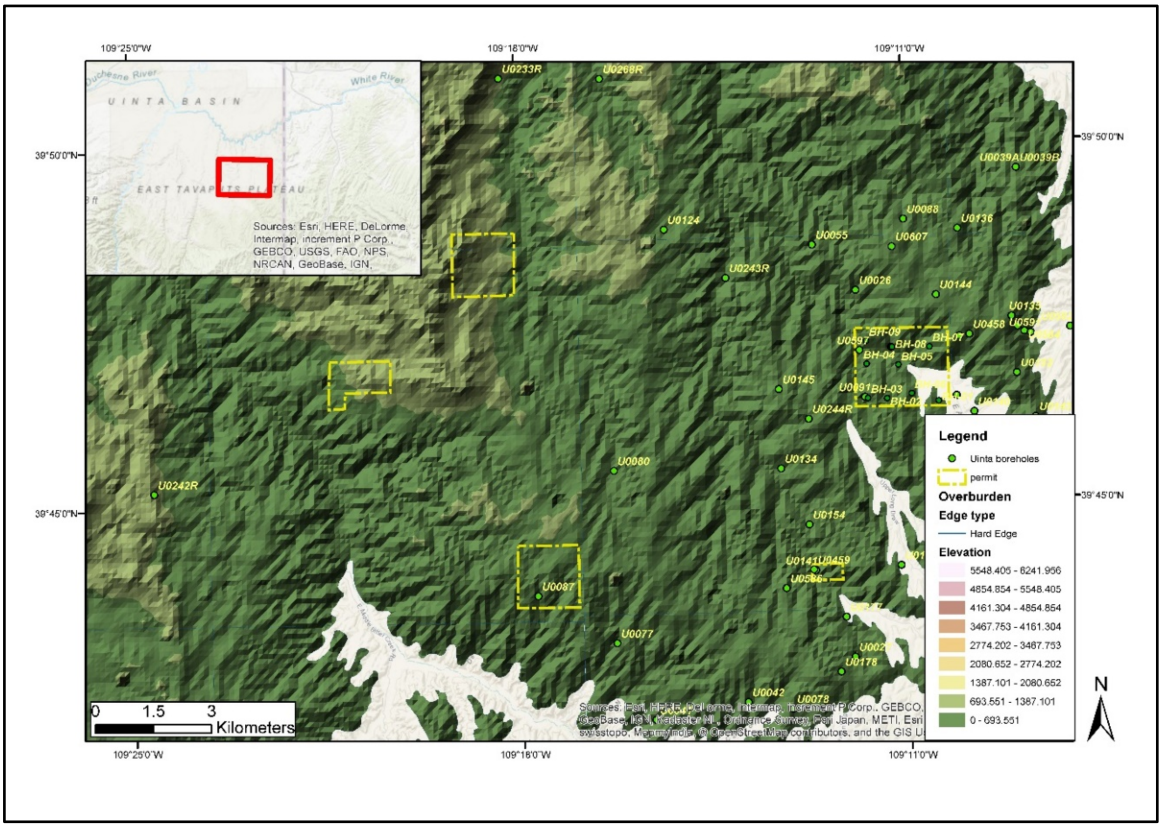

Figure 1-8: Mahogany Zone overburden

Source: USGS, 2010

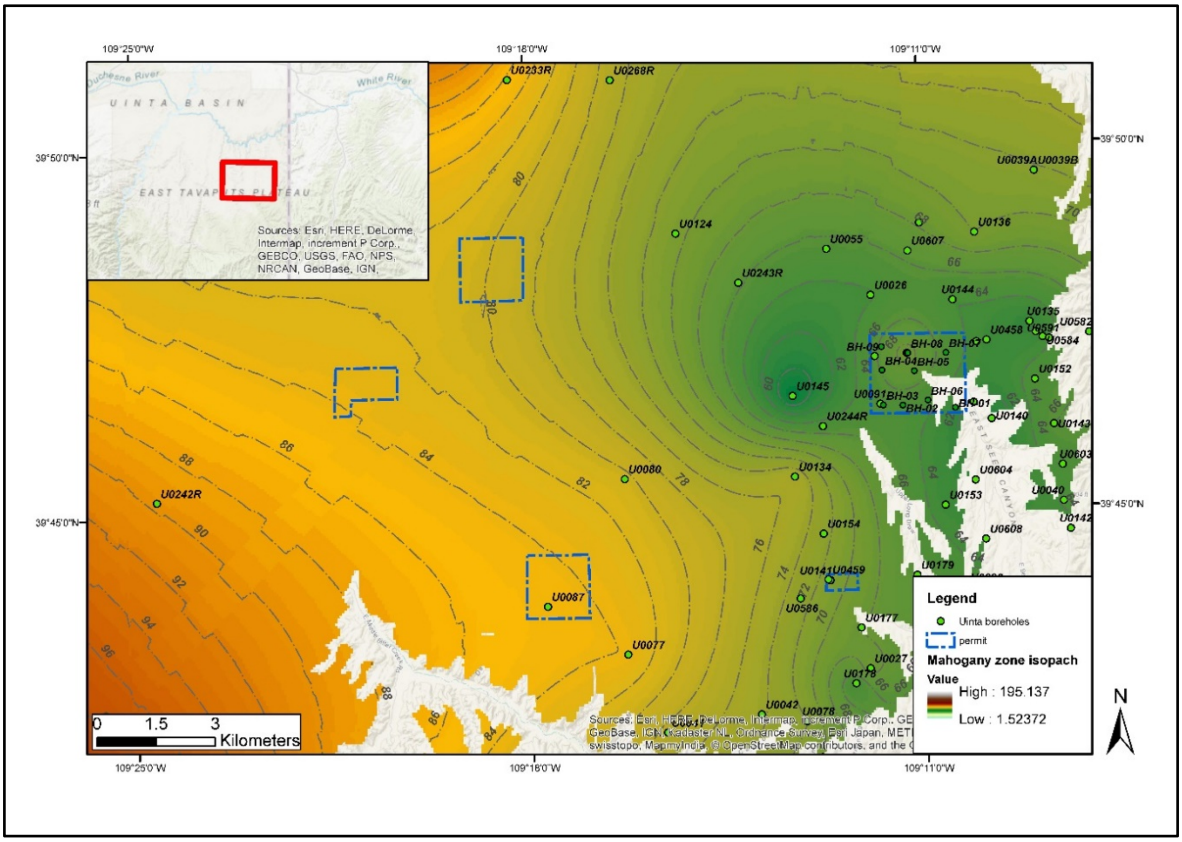

Figure 1-9: Mahogany Zone isopach

Source: USGS, 2010

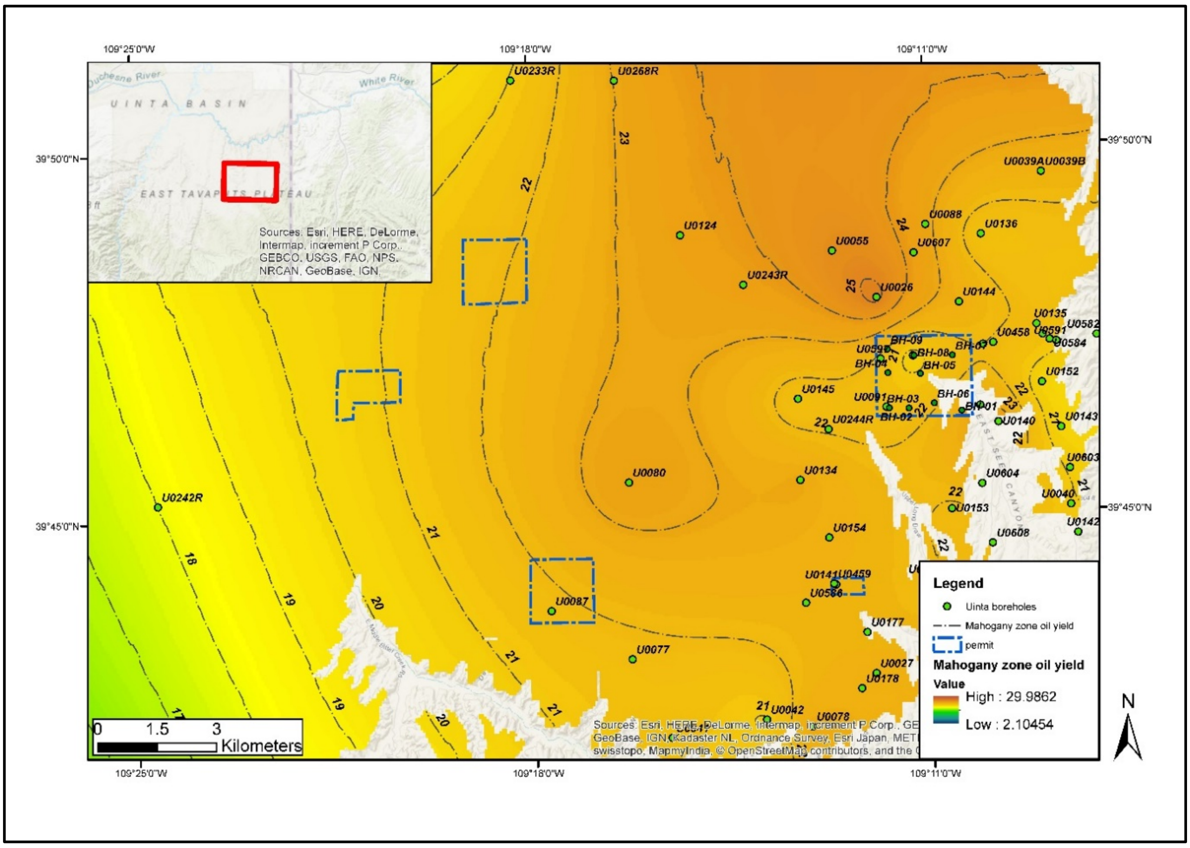

Figure 1-10: Mahogany Zone oil yield map

Source: USGS, 2010

2 Radio Frequency Technology and Resource Evaluation

2.1 Introduction

Kerogen is the parent material of oil and natural gas. Oil shale mainly comprises mineral matter and kerogen. Kerogen is insoluble in normal organic solvents and it does not have a specific chemical formula. By heating the oil shale formation, shale oil and gas can be extracted. This can be done either by mining the shale and retorting in a dedicated plant on surface, or by using an in situ retorting technique.

The development plan for TomCo's defined Resources in the Uinta Basin is focused on lowering the initial project capital costs and achieving the lowest possible oil recovery costs (Streeter et al., 1988; Bridges and Sresty, 1988). To achieve this, TomCo's development program will focus on in situ radio frequency (RF) microwave extraction.

2.2 Radio frequency technology

RF extraction is undertaken in a low-pressure environment by means of microwave heating that simulates a much deeper natural temperature setting where hydrocarbon expulsion would naturally occur. The technique is reported to be environmentally benign. Radio frequency/ critical fluid (RF/CF) is another technology that combines radio frequency heating and critical liquid driving (Pan et al., 2012); however, this is not currently being assessed by TomCo.

The RF process is unlike underground coal gasification, which is achieved by burning a coal seam in an uncontrolled manner in a restricted chamber at high pressures.

The RF technology is not widely used for current petroleum production, although trials have been undertaken over many years. SRK considers that recoveries should be similar to shale gas wells and has adopted this approach in combination with reported RF data to estimate the current recoverable petroleum Resources for TomCo's leases.

Table 2-1: Comparison of tight gas, shale gas and CBM parameters

	Tight Gas	Shale	CBM
Gas content (SCF/ton)	N/A	50-400	300-1,000
Storage mechanism	Pore Volume	Mixed	Adsorption
Ultimate Recovery	30% of OGIP	70% of OGIP	95+% of OGIP
Flow Method	Darcy	Channel	Channel
Permeability	10 µD-1 mD	<10 nD to 10 µD	<10 nD
Porosity	0.5-10%	0.1-4%	<0.1%
Response to low pressure	Minimal	Good	Excellent
Liquid Hydrocarbons	Some	Rare	None
Water production	Low	Variable	Variable
Water Quality	Tends to be poor	Variable	Variable
Price Environment to develop	$0.80/MCF	$6.84/MCF	$2.00/MCF

Source: Simpson, 2010

Note: CBM - coal bed methane

The need to understand the stimulated rock volume (SRV) and ideal well acre spacing is key to deriving the estimated recovery. The volumes derived from the application of Fischer analysis data are based on laboratory pyrolysis and extraction but serve as a guide to the in situ hydrocarbon generation potential. The full picture of recovery to surface depends on the understanding of SRV, production well spacing and design, and any secondary recovery systems such as solvent injection. The current TomCo program is designed to understand the extraction characteristics of the oil shale and how that may be eventually improved using typical unconventional lateral wells. An illustration of typical unconventional production from the Austin Chalk and Eagleford Formations (**Figure 2-1**) shows the production environment for a typical proposed TomCo lateral well.

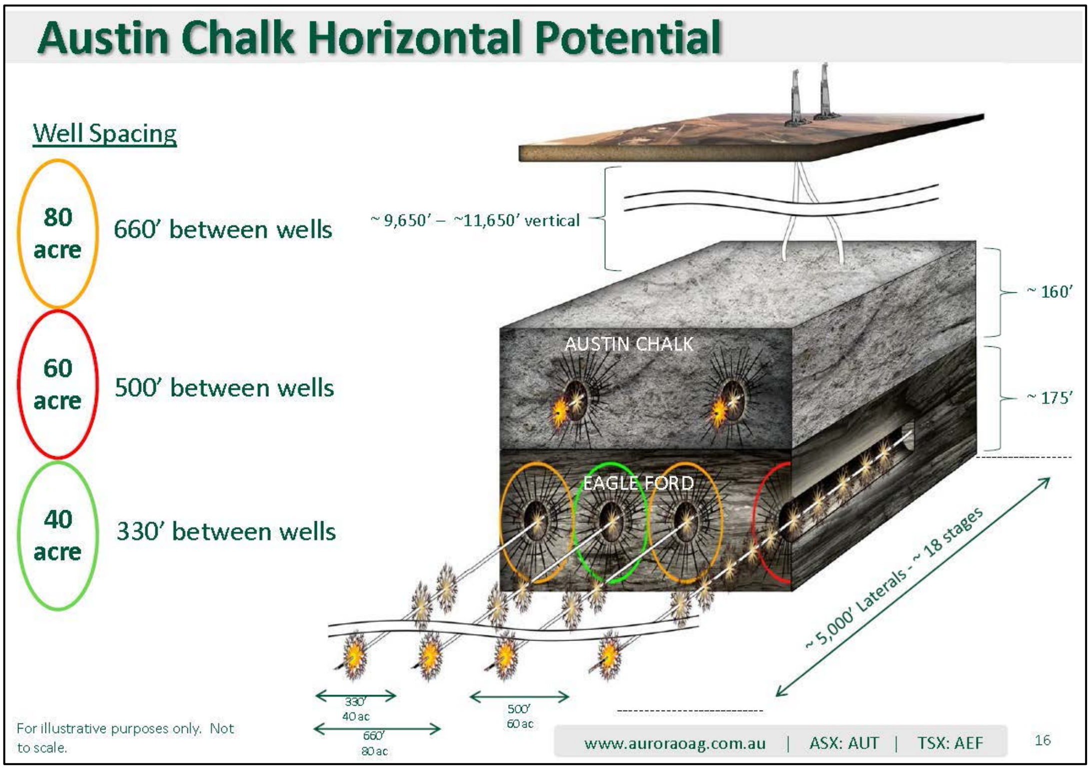

Figure 2-1: Typical unconventional production from the Austin Chalk and Eagleford Formations

Source: www.auroraoag.com.au

TomCo is currently undertaking trials to understand the best parameters to apply to in situ oil shale extraction. In simulation trials most like in situ RF processing, an increased heating rate came with a 25%–30% loss in oil yield, as shown in **Figure 2-2** (Burnham, 2003). Based on the gas chromatograms of shale oils produced under three different pyrolysis conditions, Burnham and Singleton (1983) concluded that slower heating rates and increased pressure generated more petroleum-like shale oil.

Similarly, expelled oil from hydrous pyrolysis experiments using shales of the Green River Formation is also much more like natural petroleum than conventional shale oil. Huizinga et al. (1988) reported 6.0 wt% oil yield from oil shale within the Green River Formation containing 10.6% organic carbon, which corresponds to 73% of Fischer assay. Slightly higher yields may be possible at lower temperatures and higher pressures, which would reduce oil cracking.

Bridges et al. (1978) described the net energy recoveries for the in situ dielectric heating of oil shale, and estimated **net energy recovery** factors of 0.3 to 0.5 for commercial RF in situ heating. Because energy is used to run the RF process, the net energy recovery factor must also be considered.

Based on all the available data, SRK has adopted a recovery range of 0.3 (low), 0.5 (best) and 0.7 (high) to capture the situation range from low recovery (where energy balance is considered), through to high recoveries (where liberated gas may potentially be used to power the most efficient recovery process).

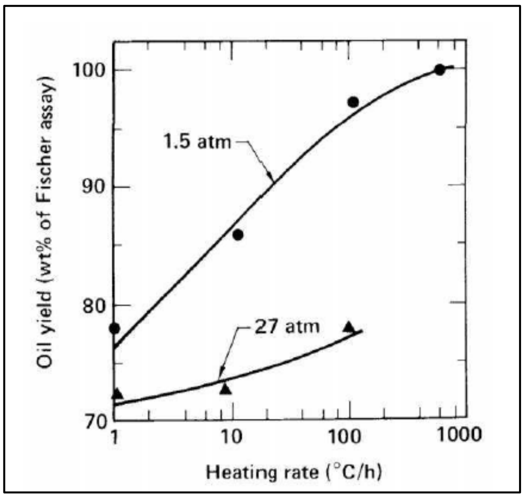

Figure 2-2: Effect of heating rate and pressure on oil yield
Source: Burnham, 2003

2.3 Fischer assays

Following the ASTM (American Society for Testing and Materials, 1980) procedure, the Fischer assay is a standardised laboratory test for determining the oil yield from oil shale to be expected from conventional shale oil extraction. It involves a 100 g oil shale sample being crushed to <2.38 mm and then heated in a small aluminium retort to 500°C (932°F) at a rate of 12°C/min (22°F/min) and held at that temperature for 40 minutes. The distilled vapours of oil, gas and water are passed through a condenser and cooled with ice water into a graduated centrifuge tube. The oil yields achieved by other technologies are often reported as a percentage of the Fischer assay oil yield.

The Fischer assay is the accepted standard for measuring oil yields from oil shale; however, the assay does not give a complete picture of the energy available in the organic fraction of the oil shale. For example, the method does not measure the composition of the gases released, but merely subtracts the sum of the weights of oil, water, and spent shale from 100% and reports this amount as "gas plus loss." Thus, "gas plus loss" accounts for all non-condensable gases released in the Fischer assay, including light hydrocarbons and carbon dioxide, plus analytical errors. Despite such shortcomings, the Fischer assay remains a useful tool for evaluating an oil shale resource.

Fischer assays made by different laboratories may not be strictly comparable because of slight differences in equipment and modifications of the analytical methods. Although most laboratories followed the ASTM-modified Fischer assay method, some differences were detected (Keighin, 1980). One laboratory, for example, was noted to yield consistently higher results, owing in part to the use of a more finely ground sample, whereas another laboratory gave consistently higher than expected results, but the reason is unclear. However, because most Fischer assays were made by the United States Bureau of Mines (USBM), the assays should give consistent results across boreholes.

Fischer assays of cuttings from rotary holes should be used with caution because they tend to mix and blend upon recovery from the borehole. They are particularly useful in identifying stratigraphic intervals that contain measurable oil. Fischer assays are not actually measurements of original oil in place, but are laboratory-extracted oil, so some recovery is incorporated into the analyses.

3 Resource Estimation

3.1.1 Introduction

This section presents an updated petroleum Resource estimate for the five parcels within TomCo's two Mineral Leases. This estimate has been produced by SRK based on the most up-to-date information available as at March 2019. This follows on from previous estimates produced by the USGS as part of a more general assessment of the Uinta Basin in the 1960s, and also by SRK in 2010 and 2011. The current Resource estimates are for Resources contained within TomCo's leases, ML 49570 and ML 49571, which are collectively referred to as Holliday A, Holliday B and Areas 1, 2 and 3.

3.2 Previous Resource estimates

3.2.1 Original USGS estimate

The USGS undertook an assessment of the oil shales in the Uinta Basin in the 1960s, publishing the results in Professional Paper 548 in 1967. This paper reports "Potential Reserves" based on yield assays prepared by the USBM from some 39 core holes in the area, as well as 20 exploratory wells and information from outcrops, using the accepted standard Fischer assay method. "Potential Reserves" for whole claim blocks were estimated, based on minimum oil shale seam thickness of 15 ft and a minimum yield of 30 G/T, and were classified as "Indicated" or "Inferred" based on proximity to the nearest drillhole.

The USGS estimates were reported for whole claim blocks only, whereas the TomCo leases cover sub-sections of these blocks. Notwithstanding this, applying the USGS analysis to the full and part blocks of the TomCo Leases provided the estimates shown in **Table 3-1**.

Table 3-1: USGS Resource Statement – Oil Shale – ML 49570 and ML 49571 (2,919 acres)

Potential Reserve Category	Tonnes (millions)	Minimum thickness (ft)	Minimum yield (G/T)	Barrels (millions)
Indicated	120	15	30	85
Inferred	150	15	30	110
Total	**270**	**15**	**30**	**195**

Source: SRK, 2010 and 2011

3.2.2 Previous SRK estimate (JORC Code 2004, updated 2012)

As part of its work in 2006, SRK independently estimated the potential oil content within the TomCo leases, using the same methodology as the USGS, but based on data from the four nearest drillholes to TomCo's leases only. Using this approach, SRK's comparable estimate was 390 Mt with a potential yield of 230 million barrels, contained in oil shales with an average thickness of some 68 ft and a mean yield of 25 G/T.

Because initially the proposed extraction of oil from the TomCo lease shale was to be based on surface mining and extraction using the Red Leaf Eco-Shale process, SRK reported its initial estimate using the terms and definitions and guidelines proposed in the 2004 edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC Code). Although this code is designed primarily for the reporting of hard rock mineral deposits, it is widely applied to sedimentary mineral resources such as coal. Given that the TomCo leases could be exploited at least in part by open pit mining, SRK considered the use of the JORC Code to be appropriate at the time.

SRK restricted its estimate to the eastern parcels covered by ML 49571 (Holliday A and B Blocks) within TomCo Mineral Leases. These parcels lie close to the outcrop of the oil shale, under relatively thin overburden cover (up to 200 ft) and are relatively close to the existing drillholes. SRK considered this area to be sufficiently well known to be reported as an Inferred Mineral Resource in accordance to the JORC Code (2012).

SRK's estimate in **Table 3-2** comprises some 200 Mt of oil shale containing a potential yield of 120 million barrels with an average yield of 25 G/T.

Table 3-2: SRK Mineral Resource Statement – Oil shale – ML 49571 (1,280 acres)

JORC Category	Tonnes (millions)	Mean thickness (ft)	Yield (G/T)	Barrels (millions)
Inferred Mineral Resource	200	68	25	120

Source: SRK, 2010 and 2011

SRK consider that because the oil shale within the three western parcels within ML 49571 occurs in areas of thicker overburden (300–700 ft) this may limit exploitation to in situ methods and that while it is almost certain that the shale units of the Green River Formation is present within ML 49571, the exact thickness and yield of the oil shale remains uncertain as there is only limited nearby drillhole data. SRK noted at that time that further drilling would have the potential to significantly increase the Inferred Mineral Resource shown in **Table 3-2**.

The updated Mineral Resource estimate prepared by SRK in 2011 was based on information obtained from the nine diamond drillholes that TomCo drilled in November 2011 and 15 drillholes from the Utah Oil Shale Database, Open-File Report 469 (Vanden Berg et al., 2006) and the report covered ML 49571 from a JORC Code mining perspective.

SRK has reviewed the lithological and geophysical logs for the nine new drillholes and reconciled the depths to lithological horizons against the Fischer assays and geophysical traces. The drillholes from the Utah Oil Shale Database were reinterpreted from Fischer assay data and geophysical logs, where available.

SRK did not consider it appropriate to simply report that tonnage of oil shale modelled within the TomCo leases as a Mineral Resource as defined by the JORC Code (2012). Rather, SRK restricted the Resource to material that had the potential to be exploited through the Red Leaf EcoShale™ process. Specifically, this comprises oil shale within the two easternmost parcels of land held by TomCo (Holliday Blocks A and B) and to material within 300 ft of surface.

In addition, SRK has excluded the weathered zone which has an average thickness of 17 ft across the Leases. The resulting SRK Mineral Resource estimate is presented in **Table 3-3** and is 100% attributable to TomCo.

Table 3-3: SRK Updated Mineral Resource Statement – Oil Shale – ML 49571 (1,280 acres)

Location	Horizon	Tonnes (millions)	Mean thickness (ft)	Yield (G/T)	Barrels (millions)
Inside Holliday Block Area	Big Three	4	2	18.6	2
	Four Senators	11	5	19.5	6
	Upper Mahogany	77	27	19.3	41
	Mahogany Bed	9	4	60.2	13
	Lower Mahogany	101	34	21.9	61
Subtotal		**202**	**72**	**22.3**	**123**
Outside Holliday Block Area	Mahogany Zone	15	75	23.1	10
Total		**217**	**72**	**22.4**	**133**

Source: SRK, 2010 and 2011

As was the case previously, SRK reported this updated estimate using the terms and guidelines of the JORC Code (2012) and considered all material contained in the Holliday A Block to be sufficiently defined to be reported as an Indicated Mineral Resource as defined by the JORC Code and the material outside of this to be reported as an Inferred Mineral Resource.

In summary, SRK derived an Indicated Mineral Resource of 202 Mt with a mean yield of 22.3 G/T for 123 million barrels and an Inferred Mineral Resource of 15 Mt with a mean yield of 23.1 G/T for 10 million barrels. Dr Mike Armitage was the Competent Person, as defined by the JORC Code, responsible for SRK's 2011 estimate.

SRK noted that some 158 Mt of the 2011 Mineral Resource (estimated to contain some 98 million barrels of shale oil) that occurs within the single parcel located within the Holliday A Block area is overlain by 100 ft of overburden or less and could be mined at a stripping ratio in the order of 1.3:1 (waste tonnes: ore tonnes), assuming a slope angle of ~35°.

SRK considered that if the weathered material could be processed, the resource across the Holliday A Block licence could increase by around 7%. As was also previously the case, SRK considered there was potential for the presence of additional Mineral Resources within the three westernmost parcels to be demonstrated, although the thicker overburden in this area (between 300 ft and 1,000 ft) would likely limit exploitation to in situ methods. While it is almost certain that the shale units of the Green River Formation are present in these blocks, the exact thickness and yield of the oil shale remains uncertain as there is no nearby drillhole data. Notwithstanding this, SRK (2011) considered that further drilling would enable a Mineral Resource to be reported for these areas in ML 49571 and this would have the potential to more than double the Mineral Resource presented in Table 3-3.

3.2.3 Estimation of Prospective and Contingent Resources (PRMS, 2018)

In view of the acquisition by TomCo of access to the TurboShale™ RF in situ retorting technology, SRK considers it appropriate to quantify the Company's oil shale resources under the guidelines of the Petroleum Resource Management System (PRMS).

Under PRMS (2018), Prospective Resources are defined as those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective Resources have both an associated chance of geologic discovery and a chance of development. Prospective Resources are further categorised in accordance with the range of uncertainty associated with recoverable estimates, assuming discovery and development, and may be sub-classified based on project maturity.

Contingent Resources are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations, by the application of development project(s) not currently considered to be commercial owing to one or more contingencies. Contingent Resources have an associated chance of development. Contingent Resources may include, for example, projects for which there are currently no viable markets, or where commercial recovery is dependent on technology under development, or where evaluation of the accumulation is insufficient to clearly assess commerciality. Contingent Resources are further categorised in accordance with the range of uncertainty associated with the estimates and should be sub-classified based on project maturity and/ or economic status.

A description of Prospective and Contingent Resources is provided in Appendix A and a Glossary of terms is provided in Appendix B. The P_{50} estimations were based on the best deterministic average data from wells associated with or near each block assessed. The ranges to define the P_{10} and P_{90} were estimated from the leanest and richest wells. The basis for the estimated recoveries were described in Section 2.2 above.

PRMS (2018) is best suited to estimation of in situ recovery of hydrocarbons from either conventional or unconventional accumulations, particularly where probabilistic estimates are required, and the economic focus is on netback returns from individual wells. The JORC Code (2012) is best suited to estimate mined ores, where volumes and grades are principally based on deterministic estimations and the project economics are focused on mining and extractive processing.

SRK reviewed the data available for the TomCo leases and the surrounding data for the Uinta Basin. SRK used deterministic assessments to derive the high, low and best in situ Resource volumes and then applied a recovery factor distribution to assess the recoverable Resources.

Prospective Resources were defined where mapping of the oil shale stratigraphy from nearby surrounding wells into the TomCo leases demonstrated that the shale units were likely to be present; however, these shales were not intersected in the existing drilling undertaken in the blocks. Contingent Resources were estimated for those parts of the stratigraphy where the oil shales were directly intersected within the TomCo blocks (labelled 2 and 3 in **Figure 1-7**). The focus of drilling and assessment to date has been the high oil yield Mahogany Shale Member between the A Groove and the B Groove formations; this sequence hosted most of the Contingent Resources.

The updated petroleum Resource estimate presented in this Report is based on information obtained from the nine diamond drillholes completed by TomCo in November 2011, and 15 drillholes from the Utah Oil Shale Database, Open-File Report 469 (Vanden Berg et al., 2006) and covers the Leases comprising ML 49571 and ML 49570.

SRK reviewed the lithology and geophysical logs for the nine drillholes and reconciled the depths to lithological horizons against the Fischer assays and geophysical traces. The drillholes from the Utah Oil Shale Database were reinterpreted from Fischer assay data and geophysical logs where available.

SRK has estimated the petroleum modelled within the TomCo leases as Prospective and Contingent Resources as these are defined by PRMS (2018). SRK has excluded the weathered zone which is an average depth of 17 ft across the Leases.

SRK's resultant Prospective Resource petroleum estimates (oil in place and recoverable oil) are presented in **Table 3-4** and are 100% attributable to TomCo as at 15 March 2019. SRK's Contingent Resource petroleum estimates (kerogen in place and recoverable oil) 100% attributable to TomCo as at 15 March 2019 are also shown in **Table 3-4**.

The Contingent and Prospective petroleum estimations attributable to the two TomCo Leases as at 15 March 2019 are summarised in **Table 3-5**.

The Prospective Resources are considered to carry a risk factor of 0.95 indicating that the probability of their occurrence is very high but remains unproven. The exploration risk and chance of development are presented for each Resource category and each block. The chance of development is based on an assessment of the likely potential to convert the Resources to economic Reserves within a 5-year timeframe based on successful field trails. The lowest risk is attributable to the Mahogany section, where pilot production trial work has begun, and the highest risk is attributable to the deeper and thinner Prospective Resources.

Under PRMS (2018), a Contingent Resource comprises proved hydrocarbons the same as a Reserve; however, there is insufficient economic information to demonstrate the capacity for commercial production. The Prospective Resource in Area 1comprises only deeper oil shales and the Mahogany Zone is categorised as a Contingent Resource. In Area 2 and Area 3 (ML 49570), there is likely both Mahogany Zone and deeper oil shales; therefore, the potential for development is considered greater than for the deep shales alone.

Table 3-4: Potential hydrocarbon in place, Contingent and Prospective Resources petroleum estimations 100% attributable to the TomCo Leases in the Uinta Basin, Utah as at 15 March 2019

Holliday A

MM bbl		Low	Best Est	High
Potential HIP	Mahogany	94.1	114.7	127.1
	Sub-Mahog	139.0	169.5	187.8
Recovery Factor		30%	50%	70%
Oil Resource	Contingent	28.2	57.3	88.9
	Prospective	41.7	84.7	131.5

Holliday B

MM bbl		Low	Best Est	High
Potential HIP	Mahogany	6.1	9.1	11.8
	Sub-Mahog	6.6	13.3	14.6
Recovery Factor		30%	50%	70%
Oil Resource	Contingent	1.8	4.6	8.2
	Prospective	2.0	6.6	10.2

Area 1

MM bbl		Low	Best Est	High
Potential HIP	Mahogany	97.2	138.8	242.7
	Sub-Mahog	62.6	89.4	156.4
Recovery Factor		30%	50%	70%
Oil Resource	Contingent	29.1	69.4	169.9
	Prospective	18.8	44.7	109.5

Area 2

MM bbl		Low	Best Est	High
Potential HIP	Mahogany / Sub-Mahog	76.3	221.0	439.4
Recovery Factor		30%	50%	70%
Oil Resource	Contingent	0	0	0
	Prospective	22.9	110.5	307.6

Area 3

MM bbl		Low	Best Est	High
Potential HIP	Mahogany / Sub-Mahog	135.5	392.5	780.5
Recovery Factor		30%	50%	70%
Oil Resource	Contingent	0	0	0
	Prospective	40.6	196.2	546.4

Source: SRK analysis

Table 3-5: Contingent and Prospective petroleum estimations 100% attributable to the TomCo leases in the Uinta Basin, Utah as at 15 March 2019

	Contingent Resources			Net Attributable			Risk Factor		Operator
Recoverable Oil MMBbls	1C (low)	2C (best)	3C (high)	Low (1C)	Best (2C)	High (3C)	Exploration	Dev'ment	
Area 1	29.1	69.4	169.9	29.1	69.4	169.9	1.00	0.7	TomCo
Area 2							1.00		TomCo
Area 3							1.00		TomCo
Holliday A	28.2	57.3	88.9	28.2	57.3	88.9	1.00	0.7	TomCo
Holliday B	1.8	4.6	8.2	1.8	4.6	8.2	1.00	0.7	TomCo
Total Bbls	59.2	131.3	267.1	59.2	131.3	267.1			

	Prospective Resources			Net Attributable			Risk Factor		Operator
Recoverable Oil MMBbls	1U (low)	2U (best)	3U (high)	Low (1C)	Best (2C)	High (3C)	Exploration	Dev'ment	
Area 1	18.8	44.7	109.5	18.8	44.7	109.5	0.95	0.4	TomCo
Area 2	22.9	110.5	307.6	22.9	110.5	307.6	0.95	0.6	TomCo
Area 3	40.6	196.2	546.4	40.6	196.2	546.4	0.95	0.6	TomCo
Holliday A	41.7	84.7	131.5	41.7	84.7	131.5	0.95	0.4	TomCo
Holliday B	2.0	6.6	10.2	2.0	6.6	10.2	0.95	0.4	TomCo
Total Bbls	126.0	442.8	1,105.1	126.0	442.8	1,105.1			

SRK notes:

The Contingent Resources are based on Fischer extractions from the high-quality Mahogany section oil shales.

Fischer analyses assess laboratory-extracted oil derived from the kerogen in the shale, so some recovery is incorporated into these analyses.

Contingent Resources for Area 1 and Holliday B are based on historical data. Modern drilling and new analyses are required to confirm the estimated P_{50}; however, the P_{50} estimate is the most likely outcome based on the information currently available.

Historical data for the Holliday A Block closely aligns with the modern drilling and analyses undertaken by TomCo.

The Prospective Resources (Holliday A and B and Area 1) are based on additional potential from the lower section below the Mahogany B Groove.

The Prospective Resources (Areas 2 and 3) are based on full section potential.

Additional SRK notes:

Estimated Reserves require a positive economic outcome and will be focused initially on the main Mahogany section.

Estimated Reserves will focus on netback returns for individual wells and each well will require sufficient SRV to achieve the necessary return.

Estimated Reserves will initially be applicable to the main oil shale zones. Both pilot well recovery factors, oil shale quality and depth related costs will likely impact the estimated volumes from deeper zones.

4 Planned Appraisal and Development

TomCo has commenced a pilot field trial aimed at determining the technical and economic viability and optimised economic conditions for RF extraction of the petroleum Resources described in this Report. The work is planned for 2019. The initial field trial was focused on the RF heating technology rather than extraction and production to surface. The full assessment of production characteristics and will be an important step to the estimation of Reserves.

SRK recommends acquisition of any available magnetic geophysical surveys and any available seismic geophysical data control to allow more accurate mapping of the oil shale structure. Mapping with control will enable more accurate placement of long-reach horizontal wells to extract the petroleum. A small program of check assaying at a second laboratory and the detailed outcrop mapping of the Mahogany Zone within the lease area is also recommended to understand the range of outcomes and standard conditions used for Fischer assays.

SRK is confident that the potential for project development is significant and additional work in conjunction with the ongoing pilot studies will assist to maximise the potential Reserves available for development.

5 Conclusions

SRK has estimated the potential hydrocarbons in place plus the Contingent and Prospective Petroleum Resources in the five TomCo blocks in the Uinta Basin in Utah. Large Resources are available for potential development in the current Leases and TomCo will increase their land position in the near future.

With the development of the pilot study, SRK expects that it will be possible to estimate Petroleum Reserves once SRVs and petroleum recoveries are more accurately defined to allow netback economic returns for individual wells to be determined. A full economic model based on oil price and all the associated production and development assumptions will then enable the potential Reserves to be estimated.

Recoveries and economics are key to understanding the development potential of the large available petroleum Resources available for potential development in the Uinta Basin, Utah.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A: Category Definitions of 1P, 2P and 3P (1C, 2C and 3C)

(PRMS, 2018) For further details on the definitions and guidelines, please see PRMS (2018)

Figure A-1 presents the 1P 2P and 3P category definitions and provides guidelines designed to promote consistency in resource assessments. The following summarises the definitions for each Reserves category in terms of both the deterministic incremental approach and scenario approach and also provides the probability criteria if probabilistic methods are applied.

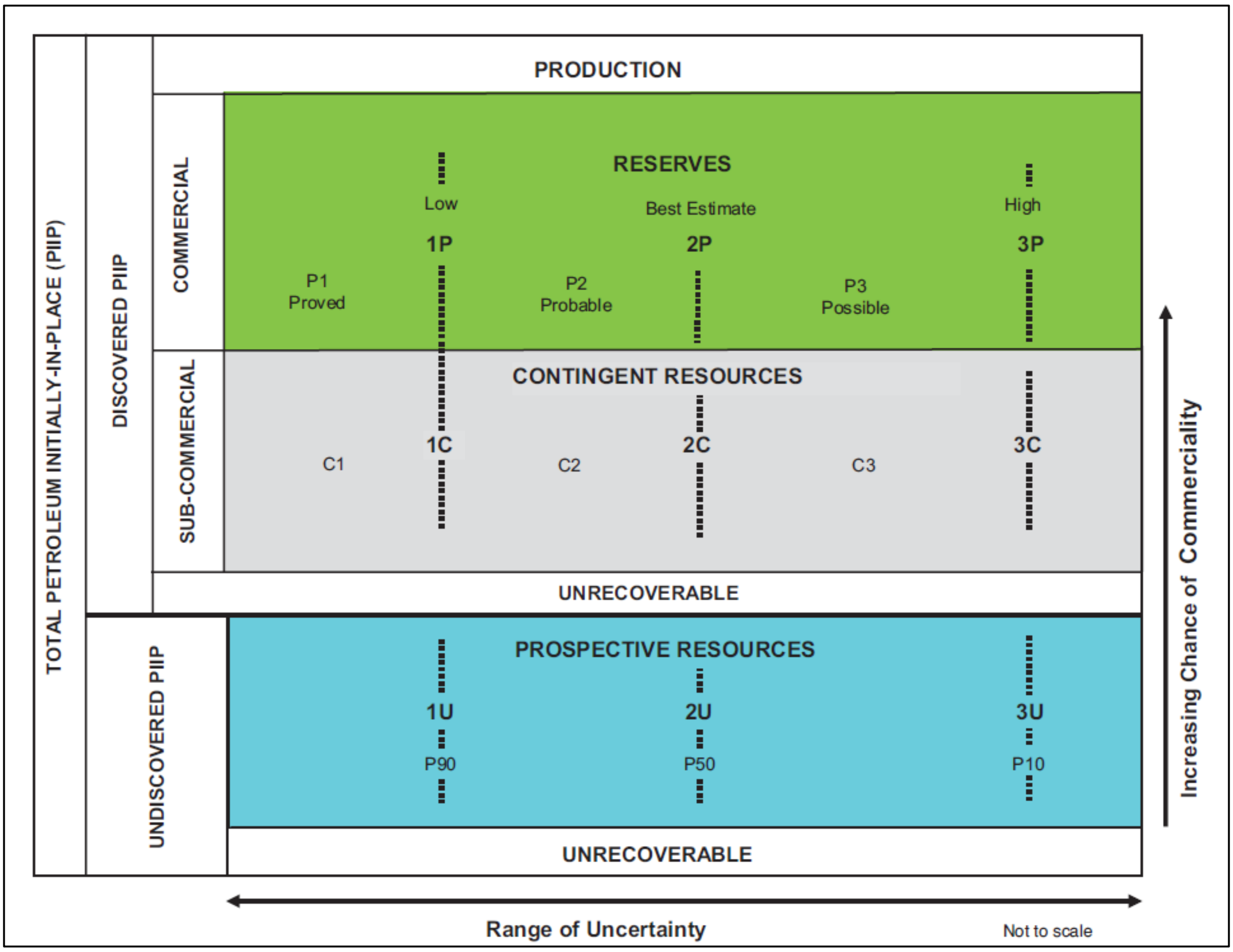

Figure A-1: Resources classification framework

- **Proved Reserves** are those quantities of petroleum, which, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under defined economic conditions, operating methods, and government regulations. If deterministic methods are used, the term reasonable certainty is intended to express a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least a 90% probability that the quantities actually recovered will equal or exceed the estimate.
- **Probable Reserves** are those additional Reserves which analysis of geoscience and engineering data indicate are less likely to be recovered than Proved Reserves but more certain to be recovered than Possible Reserves. It is equally likely that actual remaining quantities recovered will be greater than or less than the sum of the estimated Proved plus Probable Reserves (2P). In this context, when probabilistic methods are used, there should be at least a 50% probability that the actual quantities recovered will equal or exceed the 2P estimate.

- **Possible Reserves** are those additional reserves which analysis of geoscience and engineering data suggest are less likely to be recoverable than Probable Reserves. The total quantities ultimately recovered from the project have a low probability to exceed the sum of Proved plus Probable plus Possible (3P) Reserves, which is equivalent to the high estimate scenario. In this context, when probabilistic methods are used, there should be at least a 10% probability that the actual quantities recovered will equal or exceed the 3P estimate.

The “Range of Uncertainty” reflects a range of estimated quantities potentially recoverable from an accumulation by a project, while the vertical axis represents the “Chance of Commerciality”, that is, the chance that the project that will be developed and reach commercial producing status.

The following definitions apply to the major subdivisions within the resources classification:

TOTAL PETROLEUM INITIALLY-IN-PLACE is that quantity of petroleum that is estimated to exist originally in naturally occurring accumulations. It includes that quantity of petroleum that is estimated, as of a given date, to be contained in known accumulations prior to production plus those estimated quantities in accumulations yet to be discovered (equivalent to “total resources”).

DISCOVERED PETROLEUM INITIALLY-IN-PLACE is that quantity of petroleum that is estimated, as of a given date, to be contained in known accumulations prior to production.

PRODUCTION is the cumulative quantity of petroleum that has been recovered at a given date. While all recoverable resources are estimated and production is measured in terms of the sales product specifications, raw production (sales plus non-sales) quantities are also measured and required to support engineering analyses based on reservoir voidage.

Multiple development projects may be applied to each known accumulation, and each project will recover an estimated portion of the initially-in-place quantities. The projects shall be subdivided into Commercial and Sub-Commercial, with the estimated recoverable quantities being classified as Reserves and Contingent Resources respectively, as defined below.

RESERVES are those quantities of petroleum anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions. Reserves must further satisfy four criteria’s: they must be discovered, recoverable, commercial, and remaining (as of the evaluation date) based on the development project(s) applied. Reserves are further categorised in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterised by development and production status.

CONTINGENT RESOURCES are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations, but the applied project(s) are not yet considered mature enough for commercial development due to one or more contingencies. Contingent Resources may include, for example, projects for which there are currently no viable markets, or where commercial recovery is dependent on technology under development, or where evaluation of the accumulation is insufficient to clearly assess commerciality. Contingent Resources are further categorised in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterised by their economic status.

UNDISCOVERED PETROLEUM INITIALLY-IN-PLACE is that quantity of petroleum estimated, as of a given date, to be contained within accumulations yet to be discovered.

PROSPECTIVE RESOURCES are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective Resources have both an associated chance of discovery and a chance of development. Prospective Resources are further subdivided in accordance with the level of certainty associated with recoverable estimates assuming their discovery and development and may be sub-classified based on project maturity.

UNRECOVERABLE is that portion of Discovered or Undiscovered Petroleum Initially-in-Place quantities which is estimated, as of a given date, not to be recoverable by future development projects. A portion of these quantities may become recoverable in the future as commercial circumstances change or technological developments occur, the remaining portion may never be recovered due to physical/chemical constraints represented by subsurface interaction of fluids and reservoir rocks.

Estimated Ultimate Recovery (EUR) is not a resources category, but a term that may be applied to any accumulation or group of accumulations (discovered or undiscovered) to define those quantities of petroleum estimated, as of a given date, to be potentially recoverable under defined technical and commercial conditions plus those quantities already produced (total of recoverable resources).

In specialised areas, such as basin potential studies, alternative terminology has been used, the total resources may be referred to as Total Resource Base or Hydrocarbon Endowment. Total recoverable or EUR may be termed Basin Potential. The sum of Reserves, Contingent Resources and Prospective Resources may be referred to as “remaining recoverable resources.” When such terms are used, it is important that each classification component of the summation also be provided. Moreover, these quantities should not be aggregated without due consideration of the varying degrees of technical and commercial risk involved with their classification.

Project-Based Resources Evaluations

The resources evaluation process consists of identifying a recovery project, or projects, associated with a petroleum accumulation(s), estimating the quantities of Petroleum Initially-in-Place, estimating that portion of those in-place quantities that can be recovered by each project, and classifying the project(s) based on its maturity status or chance of commerciality.

This concept of a project-based classification system is further clarified by examining the primary data sources contributing to an evaluation of net recoverable resources (**Figure A-2**) that may be described as follows:

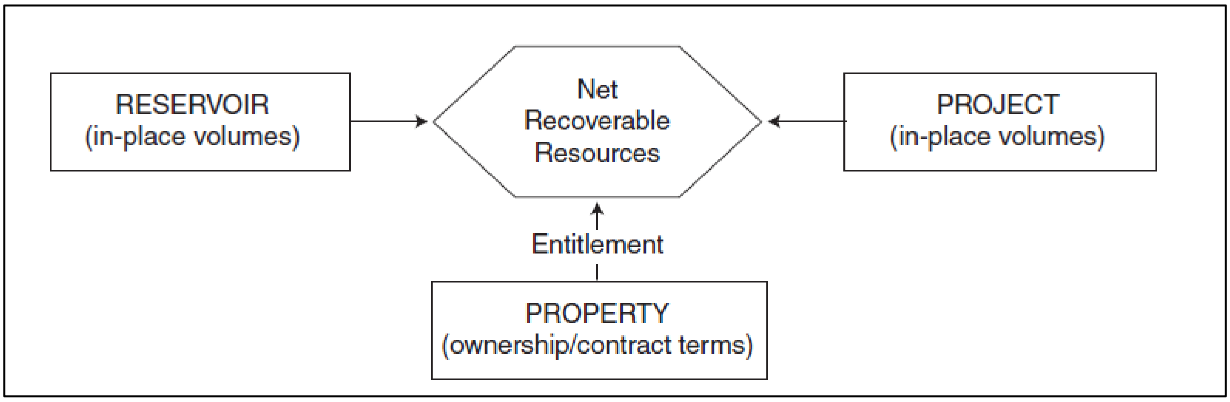

Figure A-2: Resources evaluation data sources

Resources Classification

The basic classification requires establishment of criteria for a petroleum discovery and thereafter the distinction between commercial and sub-commercial projects in known accumulations (and hence between Reserves and Contingent Resources).

Determination of Discovery Status

A discovery is one petroleum accumulation, or several petroleum accumulations collectively, for which one or several exploratory wells have established through testing, sampling, and/or logging the existence of a significant quantity of potentially moveable hydrocarbons.

In this context, "significant" implies that there is evidence of a sufficient quantity of petroleum to justify estimating the in-place volume demonstrated by the well(s) and for evaluating the potential for economic recovery. Estimated recoverable quantities within such a discovered (known) accumulation(s) shall initially be classified as Contingent Resources pending definition of projects with sufficient chance of commercial development to reclassify all, or a portion, as Reserves.

Where in-place hydrocarbons are identified, but are not considered currently recoverable, such quantities may be classified as Discovered Unrecoverable, if considered appropriate for resource management purposes, a portion of these quantities may become recoverable resources in the future as commercial circumstances change or technological developments occur.

Determination of Commerciality

Discovered recoverable volumes (Contingent Resources) may be considered commercially producible, and thus Reserves, if the entity claiming commerciality has demonstrated firm intention to proceed with development and such intention is based upon all of the following criteria:

- Evidence to support a reasonable timetable for development.
- A reasonable assessment of the future economics of such development projects meeting defined investment and operating criteria.
- A reasonable expectation that there will be a market for all or at least the expected sales quantities of production required to justify development.
- Evidence that the necessary production and transportation facilities are available or can be made available.
- Evidence that legal, contractual, environmental and other social and economic concerns will allow for the actual implementation of the recovery project being evaluated.

To be included in the Reserves class, a project must be sufficiently defined to establish its commercial viability. There must be a reasonable expectation that all required internal and external approvals will be forthcoming, and there is evidence of firm intention to proceed with development within a reasonable time frame. A reasonable time frame for the initiation of development depends on the specific circumstances and varies according to the scope of the project. While 5 years is recommended as a benchmark, a longer time frame could be applied where, for example, development of economic projects are deferred at the option of the producer for, among other things, market-related reasons, or to meet contractual or strategic objectives. In all cases, the justification for classification as Reserves should be clearly documented.

To be included in the Reserves class, there must be a high confidence in the commercial producibility of the reservoir as supported by actual production or formation tests. In certain cases, Reserves may be assigned on the basis of well logs and/or core analysis that indicate that the subject reservoir is hydrocarbon-bearing and is analogous to reservoirs in the same area that are producing or have demonstrated the ability to produce on formation tests.

Project Status and Commercial Risk

Evaluators have the option to establish a more detailed resources classification reporting system that can also provide the basis for portfolio management by subdividing the chance of commerciality axis according to project maturity. Such sub-classes may be characterised by standard project maturity level descriptions (qualitative) and/or by their associated chance of reaching producing status (quantitative).

As a project moves to a higher level of maturity, there will be an increasing chance that the accumulation will be commercially developed. For Contingent and Prospective Resources, this can further be expressed as a quantitative chance estimate that incorporates two key underlying risk components:

- The chance that the potential accumulation will result in the discovery of petroleum. This is referred to as the "chance of discovery".
- Once discovered, the chance that the accumulation will be commercially developed is referred to as the "chance of development."

Thus, for an undiscovered accumulation, the "chance of commerciality" is the product of these two risk components. For a discovered accumulation where the "chance of discovery" is 100%, the "chance of commerciality" becomes equivalent to the "chance of development."

Project Maturity Sub-classes

As illustrated in **Figure A-3**, development projects (and their associated recoverable quantities) may be sub-classified according to project maturity levels and the associated actions (business decisions) required to move a project toward commercial production.

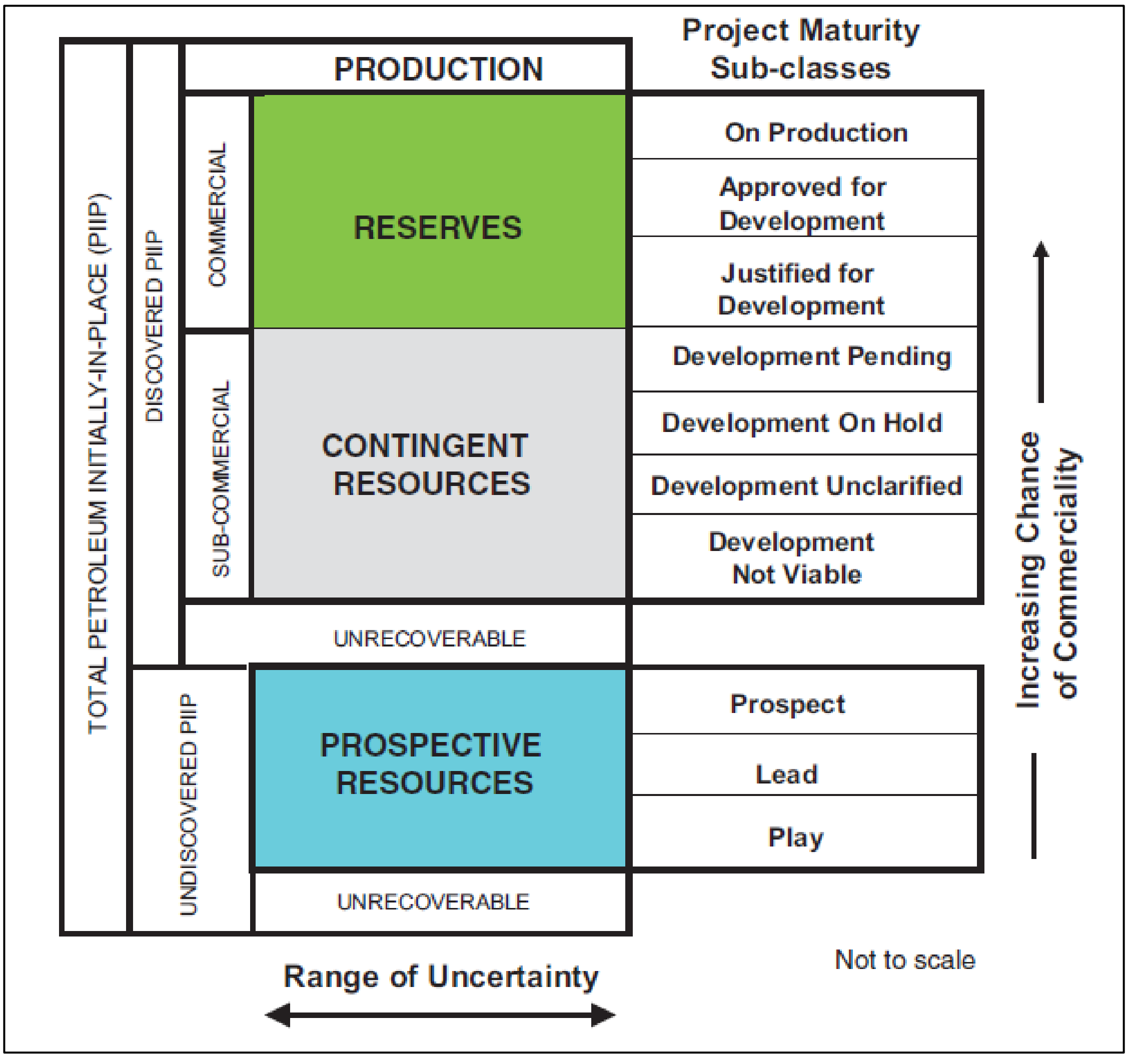

Figure A-3: Project maturity sub-classes

Project Maturity terminology and definitions have been modified from the example provided in the 2001 Supplemental Guidelines, Chapter 2. Detailed definitions and guidelines for each Project maturity sub-class are provided in **Figure A-3**. This approach supports managing portfolios of opportunities at various stages of exploration and development and may be supplemented by associated quantitative estimates of chance of commerciality. The boundaries between different levels of project maturity may be referred to as "decision gates."

Decisions within the Reserves class are based on those actions that progress a project through final approvals to implementation and initiation of production and product sales. For Contingent Resources, supporting analysis should focus on gathering data and performing analyses to clarify and then mitigate those key conditions, or contingencies, that prevent commercial development.

For Prospective Resources, these potential accumulations are evaluated according to their chance of discovery and, assuming a discovery, the estimated quantities that would be recoverable under appropriate development projects. The decision at each phase is to undertake further data acquisition and/or studies designed to move the project to a level of technical and commercial maturity where a decision can be made to proceed with exploration drilling.

Evaluators may adopt alternative sub-classes and project maturity modifiers, but the concept of increasing chance of commerciality should be a key enabler in applying the overall classification system and supporting portfolio management.

Reserves Status

Once projects satisfy commercial risk criteria, the associated quantities are classified as Reserves. These quantities may be allocated to the following subdivisions based on the funding and operational status of wells and associated facilities within the reservoir development plan:

- Developed Reserves are expected quantities to be recovered from existing wells and facilities.
- Developed Producing Reserves are expected to be recovered from completion intervals that are open and producing at the time of the estimate.
- Developed Non-Producing Reserves include shut-in and behind-pipe Reserves.
- Undeveloped Reserves are quantities expected to be recovered through future investments.

Where Reserves remain undeveloped beyond a reasonable timeframe, or have remained undeveloped due to repeated postponements, evaluations should be critically reviewed to document reasons for the delay in initiating development and justify retaining these quantities within the Reserves class. While there are specific circumstances where a longer delay (see Determination of Commerciality, section 2.1.2) is justified, a reasonable time frame is generally considered to be less than 5 years.

Development and production status are of significant importance for project management. While Reserves Status has traditionally only been applied to Proved Reserves, the same concept of Developed and Undeveloped Status based on the funding and operational status of wells and producing facilities within the development project are applicable throughout the full range of Reserves uncertainty categories (Proved, Probable and Possible).

Quantities may be subdivided by Reserves Status independent of sub-classification by Project Maturity. If applied in combination, Developed and/or Undeveloped Reserves quantities may be identified separately within each Reserves sub-class (On Production, Approved for Development, and Justified for Development).

Economic Status

Projects may be further characterised by their Economic Status. All projects classified as Reserves must be economic under defined conditions.

Based on assumptions regarding future conditions and their impact on ultimate economic viability, projects currently classified as Contingent Resources may be broadly divided into two groups:

- Marginal Contingent Resources are those quantities associated with technically feasible projects that are either currently economic or projected to be economic under reasonably forecasted improvements in commercial conditions but are not committed for development because of one or more contingencies.
- Sub-Marginal Contingent Resources are those quantities associated with discoveries for which analysis indicates that technically feasible development projects would not be economic and/or other contingencies would not be satisfied under current or reasonably forecasted improvements in commercial conditions. These projects nonetheless should be retained in the inventory of discovered resources pending unforeseen major changes in commercial conditions.

Where evaluations are incomplete such that it is premature to clearly define ultimate chance of commerciality, it is acceptable to note that project economic status is "undetermined." Additional economic status modifiers may be applied to further characterise recoverable quantities; for example, non-sales (lease fuel, flare, and losses) may be separately identified and documented in addition to sales quantities for both production and recoverable resource estimates. Those discovered in-place volumes for which a feasible development project cannot be defined using current or reasonably forecast improvements in technology are classified as Unrecoverable.

Economic Status may be identified independently of, or applied in combination with, Project Maturity sub-classification to more completely describe the project and its associated resources.

Appendix B: Glossary of Terms

Adsorption - The property of some solids and liquids to attract a liquid or a gas to their surfaces. For coal, it is the property of the coal matrix to attract natural gas to the coal surface.

As-Received (Basis) - Represents an analysis of a sample as received at a laboratory.

Assessment - The geosciences, engineering, and associated studies conducted on a petroleum exploration, development, or producing project resulting in estimates of the quantities that can be recovered and sold and the associated cash flow under defined forward conditions. Projects are classified and estimates of derived quantities are categorised according to applicable guidelines.

Best Estimate - This is considered to be the best estimate of the quantity that will actually be recovered from the accumulation by the project. It is the most realistic assessment of recoverable quantities if only a single result were reported. If probabilistic methods are used, there should be at least a 50% probability (P50) that the quantities actually recovered will equal or exceed the best estimate. For prospective resources estimates, this estimate is dependent on a discovery being made. For contingent resources, this estimate is dependent on economic contingencies being successfully addressed.

Capital Costs - Monies spent in drilling and completing a well that cannot be deducted under federal income tax law. The monies are recovered by the slower and less desirable depletion or depreciation methods. Capital expenditures also include geological and geophysical costs, equipment costs, and lease bonuses.

Cleating - A series of tight, closely spaced, small fractures in the coal bed caused by geologic stress. Cleating, and coal permeability, may be enhanced in areas of faulting, fracturing, or structural stress.

Coal Seam - A strata of coal that is thick enough to be mapped over an area or mined.

Coal Thickness - The true perpendicular thickness of a coal strata. Gross coal thickness is normally the distance between the top and base of the coal seam. Net coal thickness is normally determined by excluding coal sections with densities above 1.75 g/cc.

Coal Bed Methane (CBM) - Natural gas contained in coal deposits, whether or not stored in gaseous phase. Coal bed gas, although usually mostly methane, may be produced with variable amounts of inert or even non-inert gases.

Commerciality - When a project is commercial, this implies that the essential social, environmental, and economic conditions are met, including political, legal, regulatory, and contractual conditions. In addition, a project is commercial if the degree of commitment is such that the accumulation is expected to be developed and placed on production within a reasonable time-frame.

Contingent Resources - Those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations by application of development projects but which are not currently considered to be commercially recoverable due to one or more commercial contingencies.

Core Hole - A well drilled with a slim-hole rig. The wellbore is 6¼ in. in diameter or less. Well logs are run in a core hole, although a core is not necessarily taken.

Density - Mass per unit of volume. Density is typically reported in g/cc (for example, rocks) or pounds per barrel (drilling mud) in the oil field.

Desorption - The release of gas from the coal matrix as the pressure is lowered and the adsorption capacity of the coal is subsequently lowered.

Estimated Ultimate Recovery - Those quantities of petroleum, which are estimated, on a given date, to be potentially recoverable from an accumulation, plus those quantities already produced there.

Exploration Well - A well drilled in order to locate an undiscovered petroleum reservoir, either by discovering a new field or a new shallower or deeper reservoir in a previously discovered field.

Fair Market Value - The amount of money (or the cash equivalent of some other consideration) determined by the expert in accordance with the provisions of the VALMIN Code for which the mineral or petroleum asset or security should change hands on the valuation date in an open and unrestricted market between a willing buyer and a willing seller in an "arm's length" transaction, with each party acting knowledgeably, prudently and without compulsion. Value is usually comprised of two components, the underlying or 'technical value' of the mineral or petroleum asset or security and a premium or discount relating to market, strategic, or other considerations. Value should be selected as the most likely figure from within a range after taking account of risk and the possible variation in ore grade, metallurgical recovery, capital and operating costs, commodity prices, exchange rates and the like.

Formation - A strata of rock that is sufficiently distinctive and continuous that it can be mapped.

Gas Content - For coalbed methane evaluations, this is the amount of gas adsorbed onto the coal matrix surfaces, usually expressed as cubic meters or standard cubic feet per tonne of coal.

High Estimate - This is considered to be an optimistic estimate of the quantity that will actually be recovered from an accumulation by a project. If probabilistic methods are used, there should be at least a 10% probability (P10) that the quantities actually recovered will equal or exceed the high estimate. For prospective resources estimates, this estimate is dependent on a discovery being made. For contingent resources, this estimate is dependent on contingencies being successfully addressed.

Horizontal Well - A well that is drilled by deviation drilling and tracks the dip of a subsurface reservoir. A horizontal well traditionally consists of a vertical section and a lateral horizontal section, which penetrates the target reservoir.

Langmuir Equation - Relates the coverage or adsorption of molecules on a solid surface to gas pressure or concentration of a medium above the solid surface at a fixed temperature. The equation was developed by Irving Langmuir in 1916.

Low Estimate - This is considered to be a conservative estimate of the quantity that will actually be recovered from the accumulation by a project. If probabilistic methods are used, there should be at least a 90% probability (P90) that the quantities actually recovered will equal or exceed the low estimate. For prospective resources estimates, this estimate is dependent on a discovery being made. For contingent resources, this estimate is dependent on contingencies being successfully addressed.

Net Coal Thickness - The net thickness of the coal bed. Net coal thickness is normally the distance between the top and base of the coal seam once the coal sections with densities above 1.75 g/cc are excluded.

Operating Costs - The direct operating costs plus district overhead plus employee benefits for a specific producing property.

Original Gas-in-Place (OGIP) - The total quantity of natural gas that is estimated to exist originally in naturally occurring reservoirs.

Overburden Thickness - The thickness of the overburden rock above top of the coal seam. The distance between ground level and the top of the coal seam.

Permeability - The measurement of a rock's ability to transmit fluids, typically measured in darcies or millidarcies.

Pilot - A small development project to validate the petroleum engineering estimates of recovery, rates, and spacing before the operator commits to commercial development.

Probabilistic Methods - The method of estimation of resources is called probabilistic when the known geoscience, engineering, and economic data are used to generate a continuous range of estimates and their associated probabilities.

Probability - The extent to which an event is likely to occur, measured by the ratio of the favourable cases to the whole number of cases possible. SPE convention is to quote cumulative probability of exceeding or equalling a quantity where P90 is the small estimate and P10 is the large estimate.

Production Sharing Contract (PSC) - An agreement between the parties to a well and a host country regarding the percentage of production each party will receive after the participating parties have recovered a specified amount of costs and expenses.

Prospect - A project associated with a potential accumulation that is sufficiently well defined to present a viable drilling target.

Prospective Resources - Those quantities of petroleum that are estimated, as of a given date, to be potentially recoverable from undiscovered accumulations.

Rat hole - Extra hole drilled at the end of the well (beyond the last zone of interest) to ensure that the zone of interest can be fully evaluated or a sump to enable dewatering.

Recovery Factor - A numeric expression of that portion of inplace quantities of petroleum estimated to be recoverable by specific processes or projects, most often represented as a percentage.

Reserves - Those quantities of petroleum anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions. Reserves must further satisfy four criteria: They must be discovered, recoverable, commercial, and remaining (as of a given date) based on the development project(s) applied.

Risk - The probability of loss or failure.

Risk Factor - The chance of success.

Structure - A geological feature produced by deformation of the Earth's crust, such as a fold or a fault; a feature within a rock, such as a fracture or bedding surface; or, more generally, the spatial arrangement of rocks.

Vertical Well - A well drilled vertically into the subsurface.

Volumetric Estimate - An estimate of the volume of gas-inplace or resources/reserves using generally accepted petroleum engineering equations.

Uncertainty - The range of possible outcomes in a series of estimates. For recoverable resources assessments, the range of uncertainty reflects a reasonable range of estimated potentially recoverable quantities for an individual accumulation or a project.

SRK Report Client Distribution Record

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Date Issued: 15 March 2019

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John Potter	TomCo Energy plc

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