COAL ASSESSMENT REPORT TITLE PAGE AND SUMMARY

TITLE OF REPORT:
Coal Assessment Report for the EB Trend coal licences, Mt. Spieker area, British Columbia

TOTAL COST: $66,840.72

AUTHOR(S): **C.G. Cathyl-Huhn P.Geo. and P. Singh M.A.Sc.**
SIGNATURE(S):

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S):**CX-9-7**

YEAR OF WORK: **2013**

PROPERTY NAME: **EB Trend (Mt. Spieker)**

COAL LICENSE(S) AND/OR LEASES ON WHICH PHYSICAL WORK WAS DONE: **381711; non-physical work only on 379597, 379598 and 379600**

MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN: **93P 015**

MINING DIVISION: **Liard (Peace region)**
NTS / BCGS: **NTS 93P/3 BCGS 093P.004**
LATITUDE: **55° 04' 58.80"**
LONGITUDE: **121° 20' 20.24"** (at centre of work)
UTM Zone: **10N** EASTING: **603594 to 608465** NORTHING: **6103425 to 6107150**

OWNER(S): **Walter Canadian Coal Partnership**

MAILING ADDRESS: **800-688 West Hastings Street, Vancouver, B.C. V6B 1P1**

OPERATOR(S) [who paid for the work]: **Wolverine Coal Partnership**

MAILING ADDRESS: **800-688 West Hastings Street, Vancouver, B.C. V6B 1P1**

REPORT KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralisation, size and attitude. Do not use abbreviations or codes)
Coal, sandstone, siltstone, mudstone, Early Cretaceous, Aptian, Albian, Bullhead Group, Gething Formation, Gaylard Member, Bluesky Member, Bullmoose Member, Chamberlain Member, Moosebar Formation, Cowmoose Member, Spieker Member, thrust faults, folds, displacement transfer zones, décollement tectonics, bedding-plane detachment zones, northeast vergence, Bullmoose Thrust, East Bullmoose Thrust, Headwaters Thrust, Spieker Syncline, East Bullmoose Anticline, Jones Syncline, glauconite
REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS:
Coal Assessment Reports 552, 553, 555, 556, 606, 901; **Petroleum Assessment Report 863**.

SUMMARY OF TYPES OF WORK IN THIS REPORT		EXTENT OF WORK (in metric units)	ON WHICH TENURES
GEOLOGICAL (scale, area)			
	Ground, mapping	**none**	
	Photo interpretation **1:10,000 1,197 hectares**	**1,197 hectares**	**379597, 379598, 379599, 381711**
GEOPHYSICAL (line-kilometres)			
	Ground (Specify types)	**none**	
		none	
	Airborne	**none**	
	(Specify types)	**none**	
	Borehole – **in 2 out of 2 boreholes**		**381711**
	Gamma, Resistivity	**303.28 metres**	**381711**
	Resistivity	**303.28 metres**	**381711**
	Caliper	**303.28 metres**	**381711**
	Deviation	**294.25 metres**	**381711**
	Dip	**none**	**381711**
	Others (specify) **Density (with gamma, resistivity and caliper)** **Neutron (with gamma)**	 **303.28 metres** **303.18 metres**	**381711**
	Core	**none**	
	Non-core	**304.00 metres**	
SAMPLING AND ANALYSES			
Total # of Samples		**none**	
	Proximate	**none**	
	Ultimate	**none**	
	Petrographic	**none**	
	Vitrinite reflectance	**none**	
	Coking	**none**	
	Wash tests	**none**	
PROSPECTING (scale/area)		**none**	
PREPARATORY/PHYSICAL		**none**	
Line/grid (km)		**none**	
Trench (number, metres)		**none**	
Bulk sample(s)		**none**	

1 Table of contents

Serial and section title *(continued)* *Page*

1.1 List of tables

Serial and title *Page*

1.2 List of maps

2 Objectives, situation, and details of work

This report presents a synthesis of the surface and subsurface geology of the EB Trend coal licences (comprising provincial mineral tenures 379597, 379598, 379600 and 381711), as performed by Wolverine Coal Partnership on behalf of Walter Canadian Coal Partnership during the year 2013. In general terms, the present study is intended to summarise and review historic exploratory work conducted by various parties – as referenced in this report's bibliography – as far back as the year 1975, and to present an updated geological map (**Map 2-3**) based upon modern concepts of regional coalfield geology.

Results of the year-2013 geological study are intended to guide Walter Canadian Coal Partnership's ongoing exploratory work.

2.1 Location, access, and tenure

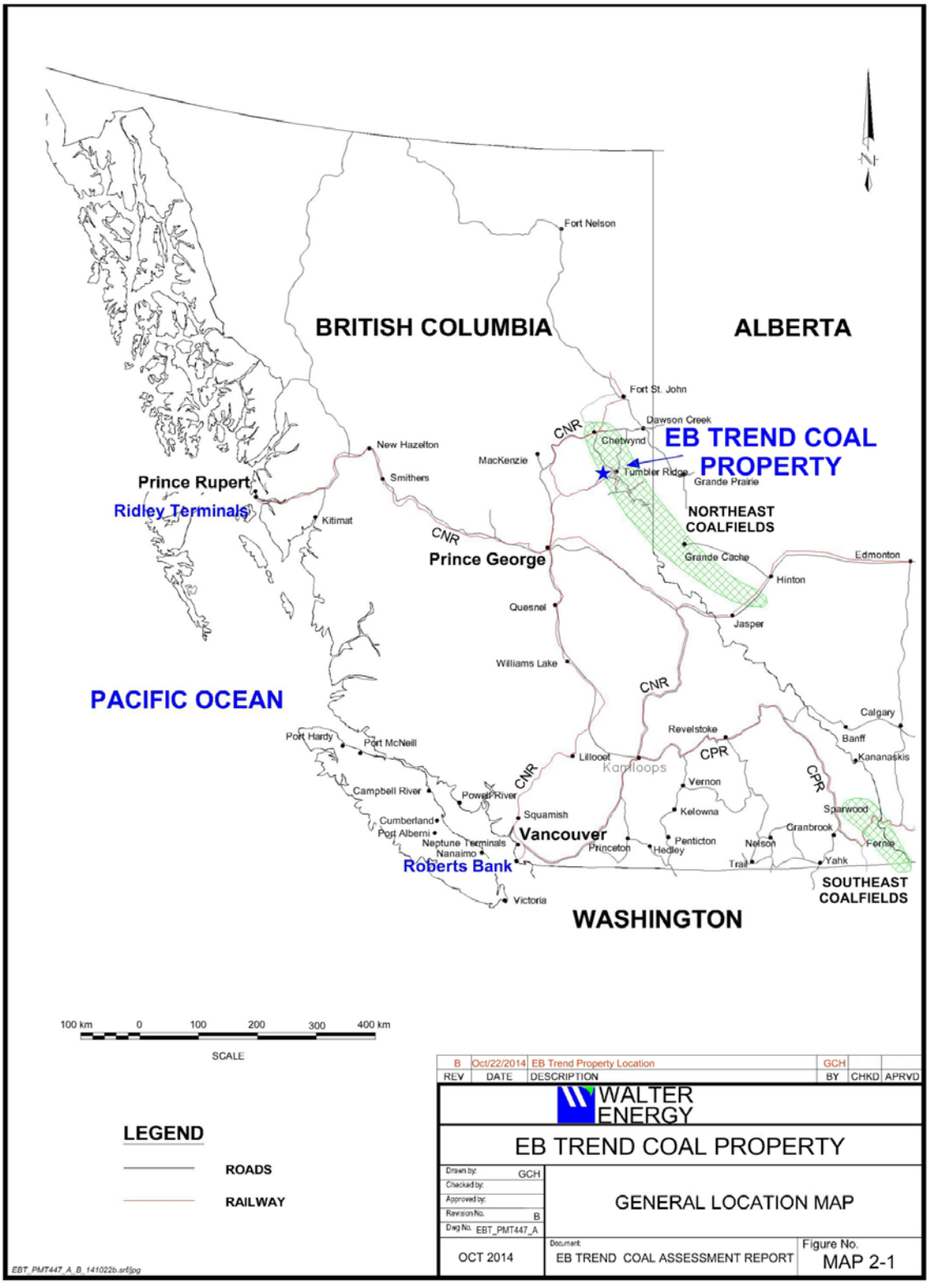
General location of the property, within northeastern British Columbia, is depicted as **Map 2-1**, and coal land tenure (**Table 2-1**) is depicted in relation to the local topographic setting of the EB Trend coal property as **Map 2-2**.

The EB Trend coal property is located approximately 100 kilometres south of the town of Chetwynd, and 30 kilometres west of the town of Tumbler Ridge, within the western half of map-area 93 P/03 of Canada's National Topographic System. Road access to EB Trend is via paved provincial highway BC-29, southeastward from Chetwynd or northwestward from Tumbler Ridge, and thence twelve kilometres southwestward along the gravelled Wolverine Forest Service Road, to its junction with the gravelled, non-status Perry Creek Road. EB Trend is located a further eight kilometres to the northwest along Perry Creek Road. Several former logging-roads and coal-exploration trails, some of them now repurposed as natural-gas wellsite service roads, branch from Perry Creek Road and thus provide vehicular access to the northwestern portion of the EB Trend coal property.

The southeastern portion of the property contains no constructed routes other than seismic lines, and it is therefore more difficult to access other than by foot. Downed timber prevents the ready use of all-terrain vehicles on seismic lines, although with some effort they could be cleared for such usage.

Landing-sites for helicopters are available along exposed ridge-crests in the southwestern portion of the property, but walking eastward from these alpine areas is rendered more difficult by dense, scrubby forest cover.

Crushed sandstone and conglomerate from colluvial deposits are the only sources of good-quality rock for construction aggregate and road-building. Locally-quarried siltstone and mudstone (mostly from the Moosebar Formation) have been used for construction of natural-gas drilling-rig roads. These fine-grained materials pack down acceptably to make smooth roads, although roads thus constructed become muddy in wet weather and dusty in dry weather.


BRITISH COLUMBIA
ALBERTA
Fort Nelson
Fort St. John
Dawson Creek
Chetwynd
EB TREND COAL PROPERTY
Tumbler Ridge
Grande Prairie
NORTHEAST COALFIELDS
Grande Cache
Edmonton
Hinton
Jasper
New Hazelton
MacKenzie
Smithers
Prince Rupert
Ridley Terminals
Kitimat
CNR
Prince George
Quesnel
Williams Lake
PACIFIC OCEAN
Port Hardy
Port McNeill
Campbell River
Cumberland
Port Alberni
Neptune Terminals
Nanaimo
Roberts Bank
Victoria
Powell River
Squamish
Vancouver
Lillooet
Kamloops
Revelstoke
CPR
Vernon
Kelowna
Penticton
Princeton
Hedley
Calgary
Banff
Kananaskis
Sparwood
Cranbrook
Fernie
Nelson
Trail
Yahk
SOUTHEAST COALFIELDS
WASHINGTON
100 km 0 100 200 300 400 km
SCALE
LEGEND
ROADS
RAILWAY
B Oct/22/2014 EB Trend Property Location GCH
REV DATE DESCRIPTION BY CHKD APRVD
WALTER ENERGY
EB TREND COAL PROPERTY
Drawn by: GCH
Checked by:
Approved by:
Revision No. B
Dwg No. EBT_PMT447_A
GENERAL LOCATION MAP
OCT 2014
Document: EB TREND COAL ASSESSMENT REPORT
Figure No. MAP 2-1
EBT_PMT447_A_B_141022b.srf/jpg

Surface access for drilling and other exploratory works is regulated by the provincial government, subject to the *Coal Act Regulations* and the *Mines Act*. The EB Trend coal property is situated within the Wapiti PSYU (Public Sustained Yield Unit), and timber cutting is subject to the terms of a Free Use Permit issued by the Ministry of Forests. Area-based stumpage fees are in effect.

2.2 Property description

The EB Trend coal property consists of four coal licences (as depicted in **Map 2-2**), originally acquired in year-2000 by Western Canadian Coal Corporation (WCCC), subsequently passed onward to the reorganised Western Coal Corporation (WCC) and, following WCC's acquisition by Walter Energy, transferred onward to Walter Canadian Coal Partnership (WCCP). One of the licences (381711) covers ground previously held by Brameda Resources Limited, whereas the other three licences cover ground previously held by Denison Mines Limited.

Coal licences grant to their holder the exclusive right to explore for coal, subject to consultation with local First Nations, coordination of access with other tenure-holders (such as oil and gas firms, other mineral-tenure holders, and timber companies), and the successful submission of an exploratory work plan. Coal licences do not, in and of themselves, confer the ownership of coal upon their holder (as the coal remains the property of the Crown via the province of British Columbia), but they can under appropriate circumstances be converted into coal leases, upon which a scheme of mining may be established. Holders of coal licences are obliged to make annual reports to the Crown, as concerns exploratory work done on their respective tenures. Prior to 1986, the Crown required that a certain minimal amount of assessable exploratory work be done each year, in order to retain the tenure in good standing. Since 1986 there have been no such requirements for annual work commitments.

The term of coal licences is one year, which may normally be extended upon the payment of an area-based annual rental fee as prescribed by the provincial Coal Act Regulation. EB Trend is now approaching the end of its third five-year span of increased rental fees, at $15/hectare. In August and October of 2015, however, the fourth five-year span will commence, and rental fees will increase to $20/hectare).

As of the writing of this report, annual rentals for the EB Trend coal licences have been paid, but the tenures themselves will not be advanced in good standing until such time as the present report is accepted by the Mineral Titles Branch on behalf of the Crown. **Table 2-1** presents details of the coal tenures at EB Trend, whose aggregate area is 1,197 hectares (approximately 2,913 acres) and whose annual rental cost is $17,955.

Table 2-1: Coal tenures at EB Trend

Tenure Numbers		Land description		Area	Dates		Annual rental
Current	Historic	Blocks	Units		Issued on	Renew by	at $15/ha
379597	CL 3401	93P/03 Blk. C	89, 90, 99, 100	300 ha	Aug. 11, 2000	Aug. 11, 2014	$4500
379598	CL 3400	93P/03 Blk. C	87, 88, 97, 98	300 ha	Aug. 11, 2000	Aug. 11, 2014	$4500
379600	CL 3399	93P/03 Blk. C	85, 86, 95, 96	300 ha	Aug. 11, 2000	Aug. 11, 2014	$4500
381711	CL 3059	93P/03 Blk. F	9, 10, 19, 20	297 ha	Oct. 30, 2000	Oct.30, 2014	$4455
Totals		4 coal licences / 16 units		1197 ha			$17,955

2.3 Infrastructure

Electrical power is potentially available from B.C. Hydro's Bullmoose Mine substation, served by 230-KV transmission line 2L322, although ten to fifteen kilometres of newly-built power line would be required to serve the EB Trend property. Telecommunications are available via satellite telephone systems. Satellite access is excellent in upland areas, but unreliable in the heavily-wooded hillsides. Cellular telephone coverage is unlikely to be available at EB Trend, owing to distance from transmitters, and issues of line-of-sight in mountainous country.

2.4 Base-maps, imagery, and surveys

Base-mapping for EB Trend is freely available from the provincial government's Base Map Online Store, which affords a facility for downloading shaded-relief topographic maps at 1:20,000 scale. Hardcopy British Columbia Geographic System (BCGS) and digital Terrain Resource Information Management (TRIM) maps 093P.004 cover the property. Canada's national Army Survey Establishment (ASE) has also for several decades maintained a series of topographic maps at 1:50,000 scale, as part of the National Topographic System (NTS). MTS map-sheet 92P/3 covers the EB Trend property. Depending on their vintage, these maps are referred to the North American Datums of 1927 (NAD27) or that of 1983 (NAD83). UTM NAD83 grid references are used exclusively within the current report.

Detailed base-maps of the original Mt. Spieker coal property were produced in the late 1970s: copies of these maps are included in various of the historic Coal Assessment Reports, although they are generally marked-up and their depicted coordinate systems are clearly not UTM NAD83.

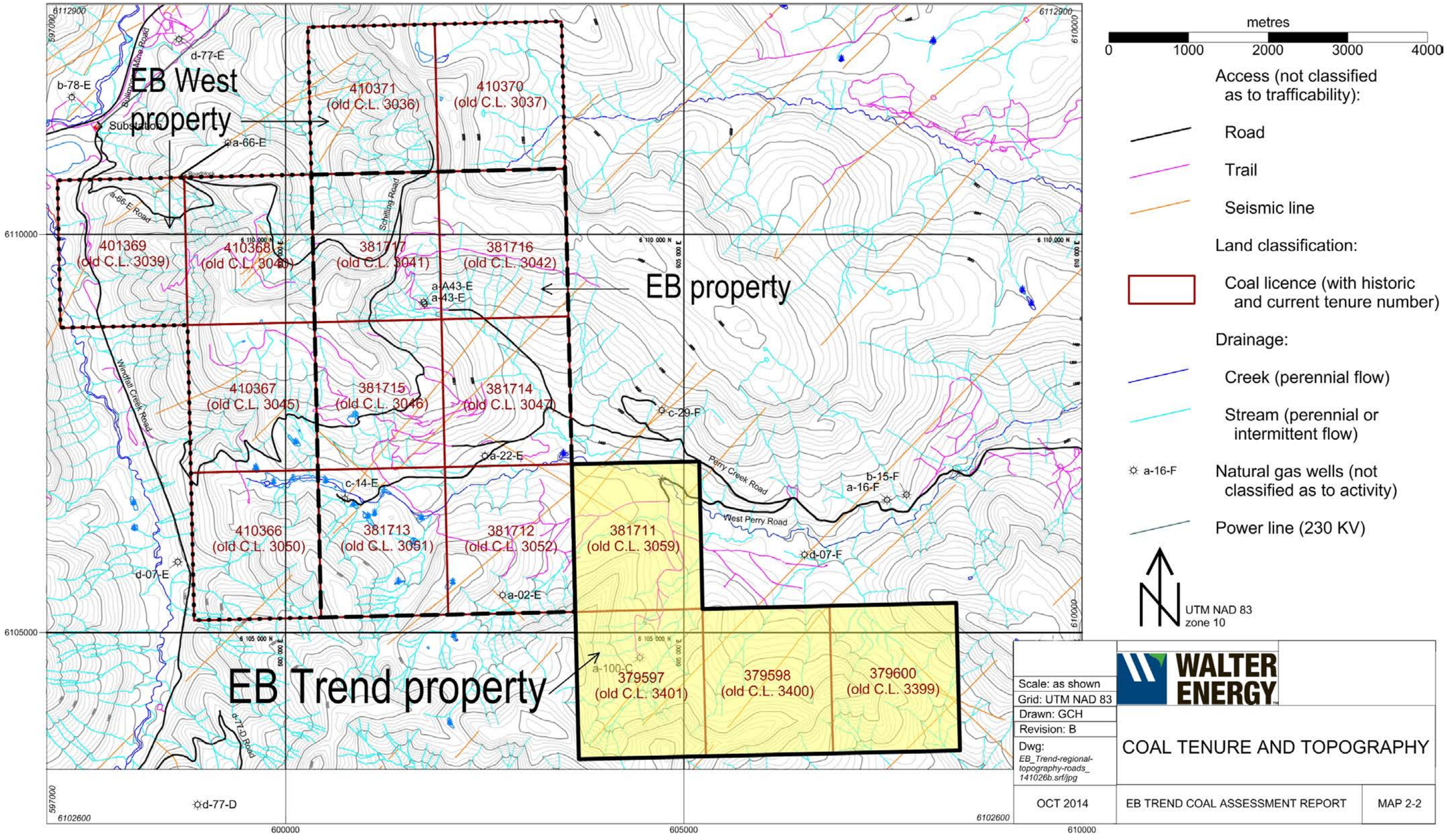
Georeferenced satellite photography is freely available via the *Google Earth* web-service, as discussed further below. In general, this imagery is sufficiently detailed for studies of gross geological and geomorphological structure, but mostly of year-2005 to year-2006 vintage (despite its copyright date of 2014), and therefore lacking in details of recent road-construction by the logging, mining and petroleum industries.

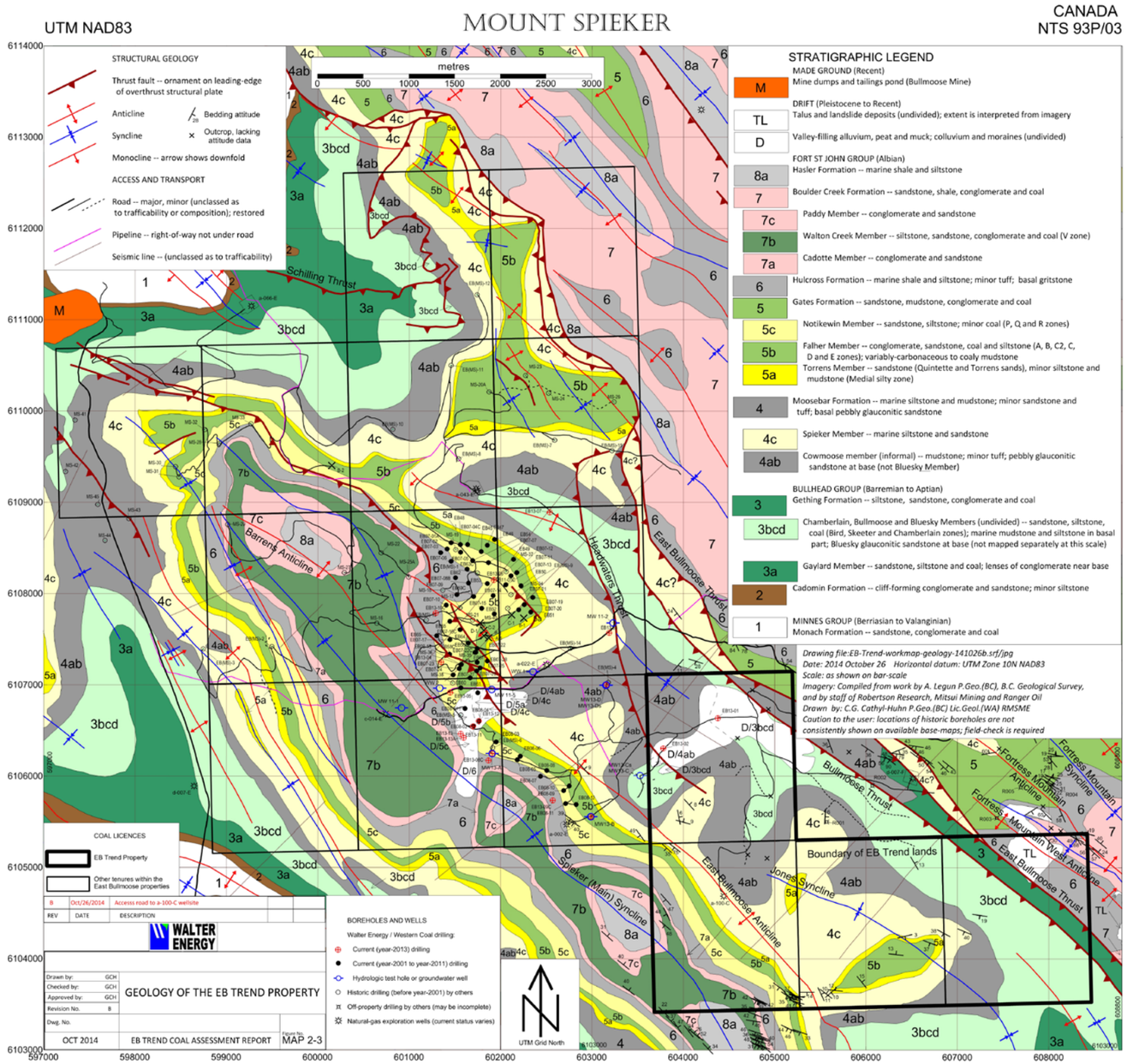
Various archival aerial photographs are held in WCCP's Canadian technical files; the vintage of these photographs is clearly quite old, as few roads or forestry cutblocks are shown on them. Nevertheless, the aerial photographs are useful for stereo-viewing of landforms.

Legal survey control points have been installed in conjunction with petroleum development, but their specific locations within the EB Trend coal property are not known.

2.5 Physiography, landscapes, climate, and forest cover

Elevations range from 1360 metres above sea level, in the valley-bottom of Perry Creek (near the property's northern edge) to 1925 metres above sea level, along Mount Reesor Ridge (within the southwestern part of the property). Terrain is generally mountainous, with very steep hillslopes, capped by rolling sub-alpine plateaux which have been dissected by steep northeast-draining gullies, ravines, creeks and glacial cirques.


EB West property
EB property
EB Trend property
410371 (old C.L. 3036)
410370 (old C.L. 3037)
401369 (old C.L. 3039)
410368 (old C.L. 3040)
381717 (old C.L. 3041)
381716 (old C.L. 3042)
410367 (old C.L. 3045)
381715 (old C.L. 3046)
381714 (old C.L. 3047)
410366 (old C.L. 3050)
381713 (old C.L. 3051)
381712 (old C.L. 3052)
381711 (old C.L. 3059)
379597 (old C.L. 3401)
379598 (old C.L. 3400)
379600 (old C.L. 3399)
Substation
Bullmoose Mine Road
Schilling Road
Windfall Creek Road
Perry Creek Road
West Perry Road
a-66-E Road
d-77-D Road
d-77-E
b-78-E
a-66-E
a-A43-E
a-43-E
c-29-F
a-22-E
c-14-E
b-15-F
a-16-F
d-07-F
d-07-E
a-02-E
a-100-C
d-77-D
6112900
6102600
597000
610000
6110000
6105000
600000
605000
610000
metres
0
1000
2000
3000
4000
Access (not classified as to trafficability):
Road
Trail
Seismic line
Land classification:
Coal licence (with historic and current tenure number)
Drainage:
Creek (perennial flow)
Stream (perennial or intermittent flow)
a-16-F
Natural gas wells (not classified as to activity)
Power line (230 KV)
UTM NAD 83 zone 10
Scale: as shown
Grid: UTM NAD 83
Drawn: GCH
Revision: B
Dwg: EB_Trend-regional-topography-roads_141026b.srf/jpg
WALTER ENERGY
COAL TENURE AND TOPOGRAPHY
OCT 2014
EB TREND COAL ASSESSMENT REPORT
MAP 2-2


UTM NAD83
MOUNT SPIEKER
CANADA
NTS 93P/03
STRUCTURAL GEOLOGY
Thrust fault -- ornament on leading-edge of overthrust structural plate
Anticline
Syncline
Bedding attitude
Outcrop, lacking attitude data
Monocline -- arrow shows downfold
ACCESS AND TRANSPORT
Road -- major, minor (unclassed as to trafficability or composition); restored
Pipeline -- right-of-way not under road
Seismic line -- (unclassed as to trafficability)
metres
0 500 1000 1500 2000 2500 3000
STRATIGRAPHIC LEGEND
MADE GROUND (Recent)
M Mine dumps and tailings pond (Bullmoose Mine)
DRIFT (Pleistocene to Recent)
TL Talus and landslide deposits (undivided); extent is interpreted from imagery
D Valley-filling alluvium, peat and muck; colluvium and moraines (undivided)
FORT ST JOHN GROUP (Albian)
8a Hasler Formation -- marine shale and siltstone
7 Boulder Creek Formation -- sandstone, shale, conglomerate and coal
7c Paddy Member -- conglomerate and sandstone
7b Walton Creek Member -- siltstone, sandstone, conglomerate and coal (V zone)
7a Cadotte Member -- conglomerate and sandstone
6 Hulcross Formation -- marine shale and siltstone; minor tuff; basal gritstone
5 Gates Formation -- sandstone, mudstone, conglomerate and coal
5c Notikewin Member -- sandstone, siltstone; minor coal (P, Q and R zones)
5b Falher Member -- conglomerate, sandstone, coal and siltstone (A, B, C2, C, D and E zones); variably-carbonaceous to coaly mudstone
5a Torrens Member -- sandstone (Quintette and Torrens sands), minor siltstone and mudstone (Medial silty zone)
4 Moosebar Formation -- marine siltstone and mudstone; minor sandstone and tuff; basal pebbly glauconitic sandstone
4c Spieker Member -- marine siltstone and sandstone
4ab Cowmoose member (informal) -- mudstone; minor tuff; pebbly glauconitic sandstone at base (not Bluesky Member)
BULLHEAD GROUP (Barremian to Aptian)
3 Gething Formation -- siltstone, sandstone, conglomerate and coal
3bcd Chamberlain, Bullmoose and Bluesky Members (undivided) -- sandstone, siltstone, coal (Bird, Skeeter and Chamberlain zones); marine mudstone and siltstone in basal part; Bluesky glauconitic sandstone at base (not mapped separately at this scale)
3a Gaylard Member -- sandstone, siltstone and coal; lenses of conglomerate near base
2 Cadomin Formation -- cliff-forming conglomerate and sandstone; minor siltstone
MINNES GROUP (Berriasian to Valanginian)
1 Monach Formation -- sandstone, conglomerate and coal
Drawing file:EB-Trend-workmap-geology-141026b.srf/jpg
Date: 2014 October 26 Horizontal datum: UTM Zone 10N NAD83
Scale: as shown on bar-scale
Imagery: Compiled from work by A. Legun P.Geo.(BC), B.C. Geological Survey, and by staff of Robertson Research, Mitsui Mining and Ranger Oil
Drawn by: C.G. Cathyl-Huhn P.Geo.(BC) Lic.Geol.(WA) RMSME
Caution to the user: locations of historic boreholes are not consistently shown on available base-maps; field-check is required
Schilling Thrust
Barrens Anticline
Hawkwater Thrust
East Bullmoose Thrust
Spieker (Main) Syncline
East Bullmoose Anticline
Jones Syncline
Bullmoose Thrust
Fortress Mountain Anticline
Fortress Mountain Syncline
Fortress Mountain West Anticline
Boundary of EB Trend lands
COAL LICENCES
EB Trend Property
Other tenures within the East Bullmoose properties
REV DATE DESCRIPTION
B Oct/26/2014 Access road to a-100-C wellsite
WALTER ENERGY
Drawn by: GCH
Checked by: GCH
Approved by: GCH
Revision No. B
Dwg. No.
GEOLOGY OF THE EB TREND PROPERTY
OCT 2014 EB TREND COAL ASSESSMENT REPORT Figure No. MAP 2-3
BOREHOLES AND WELLS
Walter Energy / Western Coal drilling:
Current (year-2013) drilling
Current (year-2001 to year-2011) drilling
Hydrologic test hole or groundwater well
Historic drilling (before year-2001) by others
Off-property drilling by others (may be incomplete)
Natural-gas exploration wells (current status varies)
UTM Grid North
6114000
6113000
6112000
6111000
6110000
6109000
6108000
6107000
6106000
6105000
6104000
6103000
597000 598000 599000 600000 601000 602000 603000 604000 605000 606000 607000 608000

On east- and north-facing slopes, winter snow-cover lingers into late summer, and small patches of firn persist year-round in the headwalls of the cirques.

Soil cover is patchy, consisting mainly, till, alluvium and peat at lower elevations, and talus and colluvium at higher elevations. Much of the upland plateau surface is covered by frost-shattered bedrock with interspersed patches of organic muck in poorly-drained areas.

EB Trend has a continental alpine climate, characterised by long, moderately cold, snowy winters and short, rainy summers. Snow and frost may occur in any month of the year. Winds are generally gusty and ongoing, with rare calm periods. Convective thunderstorms frequently occur during summer months, bringing intense rain-showers and occasional hail.

Coniferous forest covers the lower slopes of the property, declining in size and vigour with increasing altitude and wind-exposure. Subalpine slopes are occupied by patchy, stunted, densely-tangled coniferous krummholz, and the upland areas are covered by grasses, mosses and lichens. The EB Trend coal property is situated within two biogeoclimatic zones (Aldritt-McDowell, 1998; Macdonald and Hewitt, 2007).

- ESSF: the Engelmann Spruce-Subalpine Fir zone, above 1200 metres' , and beneath 1700 to 1800 metres' elevation, depending upon topographic aspect; characterised by a moderately dense coniferous forest; and
- BAFA: the Boreal Altai Fescue Alpine zone, above 1700 to 1800 metres' elevation, characterised by alpine tundra with willows, grasses, sedges and lichens and patches of krummholz subalpine fir and lodgepole pine, often comprising excellent habitat for caribou.

2.6 Historic work

Historic work at EB Trend consists of exploratory geological mapping, conducted on behalf of Triad Oil in 1959 (Jones, 1960), by Mitsui Mining (Shima and Nishio, 1975; Shima and Kinoshita, 1976; Yayoshi and Wada, 1977), Robertson Research (Jordan and Dawson, 1978), and Denison Mines Limited (Gormley, 1974) during the 1970s, and by Peace River Coal Incorporated (Jefferys, 2007) in 2006.

In addition to the exploratory mapping by industrial workers listed above, regional structural and stratigraphic mapping were undertaken by workers from the British Columbia Geological Survey Branch, published as open-file reports by Kilby and Wrightson (1987b) and Legun (2009b).

2.6.1 Comments on historic geological mapping

Jones' work for Triad Oil consisted of widely-separated traverses along ridgelines, aimed at elucidating the regional pattern of folds and major thrust-faults. Mapping conducted by Mitsui Mining's and Robertson Research's field parties, although done to exacting detail, only covers the northwesternmost part of the property (within Coal Licence 381711). Denison Mines' mapping was more of a reconnaissance nature, covering the remaining three coal licences which comprise the property's southern tier of tenures. Peace River Coal's mapping was intermediate in scope between the detailed work done on behalf of Mitsui Mining and Robertson Research and the regional studies done on behalf of Triad Oil and Denison Mines.

2.6.2 Historic drilling

No historic (pre-2001) drilling is known to have been done at EB Trend.

2.6.3 Cross-references to earlier studies

Historic work by others is duly referenced within the present text, and all such references consolidated with full bibliographic detail in **Section 8** of this report.

2.7 Current work

Current work at EB Trend, for the purposes of this report, comprises geological compilation (conducted in 2013) and the drilling of two exploratory boreholes, totalling 304 metres' drilled depth, within Coal Licence 381711 (also conducted in 2013).

2.7.1 Geological compilation and photogeological interpretation

Regional structural and stratigraphic compilation mapping, a portion of which was previously presented within Coal Assessment Report No.938 (Cathyl-Huhn and Avery, 2014b) was extended to cover the EB Trend property. Mapping has been updated to reflect the results of year-2013 drilling within the northwestern portion of the property, as well as findings of a photogeological study of the property's eastern portion. **Map 2-3** presents the current understanding of bedrock geology within the EB Trend property.

Data sources for the geological compilation included false-coloured satellite imagery from Google Earth, greyscale aerial photographs from the British Columbia government, and historic geological mapping as mentioned above in **Section 2.6**. Use was also made of geological structure observations tabulated by Jefferys (2007), whose work overlapped property boundaries to cover portions of the EB Trend coal property.

As a check on the geological compilation, site visits were made during the summer of 2013, to assess the congruence of structural interpretations as compared with the landforms visible from roadside vantage-points. Owing to thick forest cover on the lower hillslopes, and the late persistence of heavy snowpack, no attempt was made to conduct ground-based off-road traversing of geology.

2.7.2 Current drilling

Two boreholes (EB13-01 and EB13-02) were drilled in 2013, both of them situated along existing roads within Coal Licence 381711, at locations as shown in **Map 2-3**, and listed in **Table 2-2**. Both of these boreholes were drilled as open-holes with rotary-drilling rigs. Geophysical logs (as presented in **Appendix A** of this report) were run for both boreholes. Lithologic interpretations of both boreholes are presented as **Tables A-1** and **A-2**, within **Appendix A**.

Table 2-2: Current (year-2013) drilling at EB Trend

Borehole	Coordinates (UTM NAD83)		Collar elevation (metres)	Total depth (metres)	Method by which drilled	Geophysic-ally logged?
	Easting	Northing				
EB13-01	604377.4	6106635	1398.61	151.75	Rotary	Yes
EB13-02	603780.4	6106305	1433.46	152.25	Rotary	Yes

2.8 Information from adjoining property

Five boreholes (R001 through R005, as shown on **Map 2-3**) were drilled on behalf of Peace River Coal in 2006 (Coal Assessment Report No.901, by Jefferys, 2007), within their coal licences lying to the north of the EB Trend property, and therefore off-property with respect to EB Trend.

Coordinates of these boreholes, as given by Jefferys (*ibid.*, page 13) are presented in **Table 2-3.** Total depths are estimated from low-resolution scans of the boreholes' geophysical logs, as presented in Jefferys' report.

Table 2-3: Relevant drilling within adjoining property

Borehole	Coordinates (UTM NAD83)		Collar elevation (metres)	Total depth (metres)	Method by which drilled	Geophysic-ally logged?
	Easting	Northing				
R001	605569	6105500		ca.211	Rotary	Yes
R002	606069.3	6105897.3		ca.216.5	Rotary	Yes
R003	607342.9	6105543		ca.159.5	Rotary	Yes
R004	608008.2	6106139.8		ca.190.3	Rotary	Yes
R005	607692.6	6105877.4		ca.241.5	Rotary	Yes

2.9 Acknowledgements and professional responsibility

Gwyneth Cathyl-Huhn P.Geo. accepts overall professional responsibility for the contents of this report.

Thanks are due to Blake Snodsmith at Walter Energy's Alabama office, for providing a scalable TRIM base-mapping layer for the Sukunka-Quintette coalfield, including the area shown in **Map 2-2**. Thanks are also due to Preetpal Singh M.A.Sc. for assistance with scanning and expert data-wrangling of geophysical records. Dr. Peter B. Jones P.Geol., now retired, gave generously of his time in explaining regional structural concepts. David Richardson P.Geo. and Sara MacPhail P.Geo. at the B.C. Ministry of Natural Gas Operations provided copies of natural-gas well logs, and of Dr. Jones' geological maps compiled on behalf of Triad Oil (Jones, 1960).

3 Geology

Regional and local geology of EB Trend (and the Sukunka-Quintette coalfield in general) is known mainly from the extensive work of D.F. Stott (1960; 1961; 1963; 1968; 1973; 1974; 1982; 1998), and D.W. Gibson (1992a, 1992b) on behalf of the Geological Survey of Canada (1968; 1973; 1982; 1998). As well, numerous coal-company reports are available as open file documents from the provincial Geological Survey Branch. The most useful of these reports (available as Coal Assessment Report No.556) was written by G.R. Jordan and F.M. Dawson (1978), working for Robertson Research (North American) Limited, on behalf of Ranger Oil (Canada) Limited.

3.1 Regional geology

The EB Trend coal property lies within the Sukunka-Quintette coalfield of northeastern British Columbia, part of the Foothills structural province of the Canadian Cordillera. All rocks exposed at the ground surface are of Early Cretaceous age, belonging to the Bullhead (Barremian to Aptian stages) and Fort St. John (Albian stage) groups. Where the entire section has been preserved from erosion, total thickness of the Lower Cretaceous rocks is about 2.5 kilometres. Depth to Precambrian continental basement, including both Mesozoic and Palaeozoic rocks, is more substantial, in the range of 10 to 12 kilometres (McMechan, 1984), although some of this thickness is attributable to thrust-induced structural telescoping of the rock.

Regional geological mapping by M. McMechan (1994), also on behalf of the Geological Survey of Canada, covers the EB Trend property and nearby portions of the Sukunka-Quintette coalfield, at a scale of 1:250,000. More detailed regional mapping by P.B. Jones (1960), on behalf of Triad Oil, covers the EB Trend property and nearby areas, at a scale of 1:63,630 (one inch to one mile).

The majority of sedimentary rocks within the Sukunka-Quintette coalfield are clastic in nature, ranging in grain-size from claystones and mudstones through pebble-conglomerates. Lesser amounts of biologically- and chemically-derived sedimentary rocks are present, comprising coals, banded and nodular ironstones, glauconite-rich sandstones and gritstones, and impure dolomites.

Volcanic rocks constitute a very small component of the Jurassic and Early Cretaceous strata, comprising very fine- to fine-grained tuffs, interpreted to have originated as wind-borne distal ash-fall deposits from contemporaneous volcanoes situated within the Coast Plutonic Complex, far to the southwest of the property. The volcanic rocks characteristically occur as very thin (at most a few decimetres) yet regionally-extensive bands, which are of use as markers for structural and stratigraphic correlations. No intrusive rocks are known to occur at EB Trend, nor within the Sukunka-Quintette coalfield in general.

3.1.1 Regional stratigraphy

Regionally, coal is known to be present within five paleodelta systems, within the Boulder Creek, Gates, and Gething formations. Of these three formations, only the Gates and Gething formations have attracted any exploratory interest within the Sukunka-Quintette coalfield, including at EB Trend, and of those latter two formations, only the uppermost half of the

Gething has been tested by drilling at EB Trend.

During much of the Early Cretaceous, the Western Interior of North America was occupied by a shallow seaway, variably-designated by different authors as the Western Interior Sea, the Boreal Sea, or by various analogues of formation names, such as the Clearwater Sea, Hulcross Sea or Moosebar Sea. Into this seaway, the various paleodeltas were built.

Coal deposits formed atop the paleodeltas, as a result of plant growth, peat accumulation, and burial of that peat beneath sufficient sediment to protect the peat from subsequent erosion. Peat-forming and peat-burial processes were repeated several times, in concert with autogenic fluvial/deltaic processes such as meandering, avulsion and deltaic lobe-switching, and also in concert with wider-ranging allogenic processes such as eustatic sea-level change. The outcome of these processes was the development of several vertically-stacked coal zones, each comprised of one or more coal beds.

3.1.2 Regional tectonic setting

The EB Trend coal property, and its regional surroundings, is characterised by a thin-skinned deformational style comprising folded, laterally-arcuate thrust faults and associated fault-bend folds (Barss and Montandon, 1981).

Age relationships amongst the thrusts are as generally observed within the Cordilleran fold-thrust belts of the Laramide Orogen within North America, with the oldest thrusts occupying stratigraphically-higher positions, generally to the tectonic inboard side (hence, to the southwest) of the stratigraphically-lower and younger thrusts. As a general observation, the thrusts dip to the southwest and strike to the northwest, with vergence (sense of tectonic transport) to the northeast.

Thrusts range in scale from mesoscopic features with stratigraphic displacements of a few decimetres to a few metres, to regionally-throughgoing faults and fault zones (such as the Bullmoose Fault and associated splays) with stratigraphic displacements of several hundred metres to more than a thousand metres. Thrusts characteristically overlap in *en echelon* manner, with displacement gradually transferring from one fault to another via trains of folds (Dahlstrom, 1970).

Bedding dips within the Sukunka-Quintette coalfield are generally less than 20 degrees within the broad synclinoria which characterise the coalfield. Steep dips (rarely near-vertical to overturned) are occasionally observed within tightly-folded displacement-transfer zones near the ends of *en echelon* thrusts.

Regionally, the Hasler and Moosebar formations are often zones of *décollement* (tectonic detachment), characterised by near-bedding-parallel thrust faults (Cooper and others, 2004). Near-bedding detachments are occasionally seen within soft muddy siltstones and mudstones of the basal Falher Member of the Gates Formation, as well as within the weak lower mudstone unit of the Moosebar Formation. Some of the Gates Formation coals may also host bedding-parallel detachment zones, as expressed by the concentration of shearing within internal partings of impure coal or coaly rock.

Table 3-1: Table of lithostratigraphic units and significant coal beds

Geological Age		Lithostratigraphic Units				Thickness	Map-Units		Coal Beds/Coal Zones	
		Group	Formation	Member	Division				Bed	Zone
Early Cretaceous	Late Albian	Fort St. John	Hasler			>15 m	8a			
			Boulder Creek	Paddy		9 to 30 m	7	7c		
				Walton Creek		95 to 115 m		7b	V coal bed	
	Late Middle Albian			Cadotte		20 to 40 m		7a		
	Middle Albian		Hulcross			105 to 110m	6			
	Late Early Albian		Gates	Notikewin		63 to 105 m	5	5c	coals possibly present but not yet drilled within the property	
				Falher		75 to 85 m		5b	coals possibly present but not yet drilled within the property	
				Torrens	Quintette sandstone	25 m		5a		
					(unnamed siltstone)	13 m				
					Torrens sandstone	12 m				
			----- *uppermost extent of drilled rocks at EB Trend* -----							
			Moosebar	Spieker		150 to 170 m	4	4c		
				Cowmoose		75 to 110 m		4b		
				basal glauconitic zone		nil to 3 m		4a		
		Bull-head	Gething	Chamber-lain	(unnamed coal measures)	34 m	3	3d	Upper Bird	Bird
									Lower Bird	
									Skeeter coal bed	
									Chamberlain coal bed	
					Chamber-lain sandstone	11 to 17 m				
				Bullmoose	Upper	16 to 21 m		3c		
					Middle	1.5 to 3 m				
					Lower	15 to 17 m				
				Bluesky		0.3 to 3 m		3b		
	Late Aptian to Late Early Albian			Gaylard		150 m		3a	'Middle Coals' (unexplored)	
			----- *lowermost extent of drilled rocks at EB Trend* -----							
	Hauterivian to Barremian		Cadomin			50 m	2			
	Berriasian to Val-anginian	Minnes	Monach			>300 m	1		not yet explored	

Table 3-2: Stratigraphic tops within current boreholes

Hole	*Drift*	*QNTT*	*MEDI*	*TRSS*	*SPIE*	*COWM*	*GLAU*	*CHCM*	*CHSS*	*BLMU*	*BLMM*	*BLML*	*BSKY*	*GAYL*	*CADO*	*TD*
EB13-01	26.5							starts	44.7	61.5	78.0	79.8	96.7	99.6		
fault, established at 118.8 m (Gaylard over Spieker; may be Bullmoose Thrust)																
EB13-01 (concluded)					starts	141.9	DNR	DNR	DNR	DNR	DNR	DNR	DNR	DNR	DNR	151.75
EB13-02	23.9					starts										
fault, probable at 53.45 m (interpreted to follow bedding in basal Cowmoose)																
EB13-02 (continued)						starts	53.8	56.9								
fault, established at 63.85 m (Upper Bird coal repeated)																
EB13-02 (continued)								starts								
fault, established at 73.7 m (Lower Bird equivalent repeated)																
EB13-02 (concluded)								starts	102.40	113.6	134.0	136.6	DNR	DNR	DNR	152.25

Stratigraphic legend (all depths given in metres, as downhole measured depths based upon geophysical logs):
Drift = depth to bedrock; QNTT = Quintette sandstone; MEDI = medial siltstone unit; TRSS = Torrens sandstone
SPIE = Spieker Member; COWM = Cowmoose Member; GLAU = basal glauconitic sandstone; CHCM = Chamberlain coal-measures
CHSS = Chamberlain sandstone; BLMU = upper division of Bullmoose Member; BLMM = middle (sandy) division of Bullmoose Member
BLML = lower division of Bullmoose Member; GAYL = Gaylard Member; CADO = Cadomin Formation; TD = total depth of borehole

Table 3-3: Coal bed intersections within current boreholes

Hole	*Drift*	*BdU-roof*	*BdU-floor*	*BdL-roof*	*BdL-floor*	*SKR-roof*	*SKR-floor*	*CHM-roof*	*CHM-floor*
EB13-0126.5		(removed by erosion: beyond subcrop)			34.55	35.7	44.2	44.4	
EB13-0223.9	61.40		63.03						
fault, established at 63.85 m (Upper Bird coal repeated)									
EB13-02 (continued)		68.24	70.4	73.2 (≡)	73.7 (≡)				
fault, established at 73.7 m (Lower Bird equivalent repeated)									
EB13-02 (concluded)				75.4 (≡)	76.35 (≡)	92.3	93.1	101.85 (≡)	102.40 (≡)

Notes: depths in metres, from geophysical logs. Lower Bird coal bed in EB13-02 is mostly represented by carbonaceous shale; lower intersection of this bed includes 5 cm of dirty coal at its base. Chamberlain coal bed in this borehole is also represented by carbonaceous shale. Symbol (≡) denotes carbonaceous rock, stratigraphic equivalent of a coal bed. DNR = did not reach. Coal beds: BdU = Upper Bird; BdL = Lower Bird; SKR = Skeeter; CHM = Chamberlain.

3.2 Local geology

Approximately 1400 metres of Mesozoic (mostly Early Cretaceous) strata are present at EB Trend, locally thickened to 1800 to 1900 metres by structural telescoping along thrust-faults. The Mesozoic section is incomplete, owing to deep erosion of its uppermost beds, accomplished during the Late Tertiary and Quaternary.

With the exception of thin bands of tuffaceous volcanic ash, all of the strata within the EB Trend area are sedimentary rocks. Intrusive igneous rocks, volcanic flows, and evaporites are unknown within the EB Trend area. It is noteworthy that, as yet, nothing is known concerning the thickness and lateral extent of coal beds within some of the regionally-significant coal-bearing rocks. This lack of knowledge is attributable to lack of drilling, and poor outcrop exposure, and should not be construed to suggest that coals are expected to be scarce.

3.2.1 Local stratigraphy

Within the EB Trend property, rocks belonging to the Bullhead and Fort St. John groups are exposed at the ground surface, with the older rocks of the Minnes Group inferred to be present within the deeper subsurface.

Formations mapped (see **Map 2-3** and **Table 3-1**) as being present at outcrop range downwards from the Hasler Formation (map-unit 8a, the youngest mapped formation) to the Gething Formation (map-unit 3, the oldest mapped formation). **Table 3-2** presents stratigraphic tops (of formations, members, and internal subdivisions), together with significant faults within boreholes drilled at EB Trend. **Table 3-3** summarises the extent of known coal beds within the Gething Formation, based on limited drilling done to date.

Section 4 of this report presents a more detailed synopsis of stratigraphy, based on regional knowledge and the limited local drilling.

3.2.2 Local structural geology

The EB Trend coal property consists, essentially, of a gently-deformed layer cake of sedimentary rocks, generally present in normal (‘tops-up’) stratigraphic position, with upward-younging age relationships.

Exceptions to this general situation are presented by at least three northeast-verging, northwest-striking thrust faults, defining a series of narrow to broad structural ‘plates’ (thrust sheets) separated by complexly-crumpled smash zones adjacent to the thrusts. Each of the structural plates is thus telescoped upon the underlying plate, acting to structurally shorten (in a southwest-northeast direction) and thicken (in a vertical direction) the overall section of sedimentary rocks. Thrust faults are inferred to have developed in the typical downward-younging sequence of successive faulting.

Overall intensity of deformation (and hence structural shortening), as signified by increased inclination of bedding, and by shortened wavelength of folds, appears to increase from the southwestern corner of the EB Trend property to its northeastern corner.

Unlike in the case of the nearby EB West coal property (Cathyl-Huhn and Avery, 2014b), no attempt has been made to name structural ‘plates’, owing to the sparseness of surface and subsurface geological data.

3.2.3 Discussion of faults

As noted above, at least three northeast-verging thrust faults have been mapped at EB Trend, with several more low-displacement 'minor' thrust faults found within the two boreholes drilled thus far. **Map 2-3** depicts the structures under discussion.

From southwest to northeast, the thrust faults are:

- Headwaters Thrust, interpreted to have brought the uppermost coal-measures of the Gething Formation to the bedrock surface within a northeast-trending tributary valley of Perry Creek. The southeastward continuation of the Headwaters Thrust has not yet been established, and it may 'tip out' laterally in an anticline-syncline couple formed by the East Bullmoose Anticline and the Jones Syncline.

- Bullmoose Thrust, interpreted to have brought the uppermost Gething coal-measures over the Moosebar Formation for much of its length. Displacement of the Bullmoose Thrust appears to decrease southeastward along its trace, across a moderate- to steep-dipping displacement-transfer zone above the underlying East Bullmoose Thrust.

- East Bullmoose Thrust, interpreted to telescoped the Gething and Moosebar Formations over the Gates and Hulcross Formations. Displacement of the East Bullmoose Thrust appears to increase southeastward along its trace.

To the northeast of the East Bullmoose Thrust (and therefore at a lower structural level) a train of two northwest-striking anticlines and an intervening southeast-plunging syncline cross the northeastern corner of the EB Trend property. Dips are very steep within these compressed folds, and they may be associated with additional thrust faults not yet disclosed by mapping.

In the far southwestern corner of the EB Trend property, the troughline of the Spieker Syncline (occasionally referred to as the Main Syncline or Summit Syncline by past workers) follows the crestline of Mount Reesor Ridge. Dips between the Spieker Syncline and the East Bullmoose Anticline are consistently steep, typically about 45 degrees to the southwest.

Of the faults enumerated above, the Bullmoose Thrust is the major through-going structural feature at regional scale, with the East Bullmoose Thrust having a lesser degree of lateral continuity. Stratigraphic displacement across the Bullmoose Thrust is estimated to be 200 to 250 metres, while stratigraphic displacement across the East Bullmoose Thrust is estimated to be 300 to 400 metres. Stratigraphic displacement across the Headwaters Thrust is estimated to be 30 to 100 metres. It should be noted that, given the lack of drilling and outcrop section-measurement at EB Trend, these estimates of displacement are extremely crude.

Fault-to-bedding cutoff angles (alpha-angles) have not yet been estimated, owing to paucity of data at EB Trend. Alpha-angles of 30 degrees, in keeping with regional experience within the Foothills structural province, are considered to be plausible for competent strata. However, alpha-angles considerably less than 30 degrees (down to zero degrees in particularly weak strata such as the basal Cowmoose tuff-bearing shales of the Moosebar Formation) are considered to be locally possible.

4 Stratigraphic synopsis

The following discussion (modified from Cathyl-Huhn and Avery's year-2014 report on the EB West coal property) presents details of the lithology, inferred origin, typical thickness and contact relationships of the various lithostratigraphic units present at EB Trend, keyed to the map-unit numbers used in **Map 2-3** and **Table 3-1**. Units are discussed in stratigraphic order from uppermost (youngest) to lowermost (oldest) within the exposed sequence of strata. **Map 2-3** presents bedrock geology, upon which is overlaid the inferred extent of significantly-thick (ca. 20 metres or greater) unconsolidated sediments (including human-emplaced deposits associated with past mining activity) within the map-area.

4.1 Unconsolidated deposits (map-units M, TL and D)

Within the mapped area of **Map 2-3**, unconsolidated naturally-present and human-emplaced deposits, of Quaternary to Recent age, are shown as map-units M (made ground), TL (talus and landslide deposits) and D (alluvial, colluvial and glacial deposits, collectively mapped as 'Drift'). Map-unit M is not present within the boundaries of the EB Trend property, as its presence is associated with the historic operations of Bullmoose Mine, situated outside the EB Trend tenures. Map-units D and TL are, however, present within the EB Trend property.

4.1.1 Made ground (map-unit M)

Within the mapped area, but situated several kilometres to the northwest of the EB Trend coal property, made ground comprises mine waste material and coal-washery tailings associated with the historic operations of Teck Corporation's now-closed Bullmoose Mine. The extent of these deposits was mapped from satellite imagery; their thickness is unknown, but anticipated to exceed 20 metres.

4.1.2 Talus and landslide deposits (map-unit TL)

Blocky, grey-weathering, bouldery deposits of sparsely-vegetated to unvegetated material are prominently visible on steep north- and southwest-facing mountain slopes within the northeastern corner of Coal Licence 379600. Interpretation of satellite imagery clearly shows the lobate shape of these deposits, which are interpreted to be talus and/or landslide deposits of Late Pleistocene to Recent age. Morphology of the deposits suggests that they post-date the most recent deglaciation; however, their age is not directly known.

The source material for talus and landslide deposits is inferred to be the cliff-forming conglomerate of the Boulder Creek Formation, as exposed in steep slopes immediately above the upper margins of these deposits.

Thickness of talus and landslide deposits is unknown, although observed to be sufficient to conceal details of underlying bedrock structure.

4.1.3 Drift (map-unit D)

'Drift' is a collective term of convenience for undivided deposits of valley-filling alluvium, peat and muck, together with colluvial deposits and glacial till.

The thickness and extent of Drift within and adjacent to the EB Trend property has been

mapped mainly by interpretation of landforms on satellite imagery and aerial photographs, supported to a very limited extent by borehole information (**Table 3-2**), and constrained by the known occurrence of bedrock exposures. Thickness of Drift within Coal Licence 381711 locally exceeds 26 metres (as established by borehole EB13-01).

4.2 Fort St. John Group (map-units 8a through 4ab)

An incomplete section of the Fort St. John Group is present at EB Trend, owing to the group's uppermost rocks (of the Dunvegan, Cruiser and Goodrich formations) having been stripped off by erosion. The youngest remaining rocks belong to the basal part of the Hasler Formation.

At EB Trend, the Moosebar Formation comprises the only part of the Fort St. John Group to have been tested by drilling.

4.2.1 Hasler Formation (map-unit 8a)

Only the basal 15 metres of the Hasler Formation, comprising dark grey, rusty-weathering, rubbly- to platy-weathering shale, siltstone and sandstone, of shallow-marine origin, is present within the EB Trend property. Ironstone concretions are locally-abundant within the Hasler Formation. These rocks are poorly-exposed as colluvial rubble and felsenmeer, within the westernmost upland area of Coal Licence 379597.

The Hasler formation is of Late Albian age (Koke and Stelck, 1985). The Hasler's presumed upper contact with the overlying Goodrich Formation has been removed by erosion throughout the EB Trend property, whilst its disconformable contact with the underlying Paddy Member of the Boulder Creek Formation is placed at the base of a few decimetres of erosive-based pebbly mudstone to silty gritstone.

4.2.2 Boulder Creek Formation (map-unit 7)

The Boulder Creek Formation comprises 145 to 160 metres of interbedded conglomerate, sandstone, siltstone, mudstone and coal. Within the EB Trend property, the Boulder Creek is generally readily-divisible into three members: the upper coarse-grained Paddy Member (map-unit 7c), the medial, dominantly fine-grained coal-measures of the Walton Creek Member (map-unit 7b), and the lower coarse-grained Cadotte Member (map-unit 7a). The Paddy and Cadotte members correspond to similarly-named coarse-grained strata of the subsurface Deep Basin of northwestern Alberta, whereas the Walton Creek appears to be present only within the Foothills, including the EB Trend area (Gibson, 1992b; Krawetz, 2008; Roca and others, 2008; Henderson and others, 2014).

Within the EB Trend property, the Boulder Creek's three members can be readily recognised in outcrop sections as two cliff-forming bands separated by a medial recessive band. As such, the three members can also be readily traced in aerial photographs and satellite imagery. Boulder Creek rocks are present within the core of the Spieker Syncline, along the crest of Mount Reesor Ridge, thus occupying the southwestern portion of Coal Licence 379597.

The basal contact of the Boulder Creek Formation with the underlying Hulcross

Formation is generally abrupt and therefore considered to be conformable at local scale (Gibson, 1992b), although it may intertongue at regional scale.

4.2.2.1 Paddy Member (map-unit 7c)

The Paddy Member of the Boulder Creek Formation comprises 9 to 30 metres of thick-bedded to massive, cliff-forming pebble-conglomerate, gritstone, sandstone and minor siltstone, within the central portion of the Spieker Syncline. No coal, other than isolated discontinuous lenses of coalified plant trash, is known from the Paddy Member at EB West (Cathyl-Huhn and Avery, 2014b), and similarly the Paddy is expected to contain no significant amount of coal at EB Trend.

Satellite imagery suggests that the Paddy Member pinches out southeastward, or is confined to an isolated channel-fill, at the southern boundary of the EB Trend coal property.

The Paddy Member's age at EB Trend is not directly known, owing to lack of diagnostic fossils, but its age is constrained to Late Albian by the ages of underlying and overlying rocks (Gibson, 1992b). The basal contact of the Paddy Member with the underlying Walton Creek Member is inferred to be intertonguing at property-wide scale, and abrupt to erosional at local scale.

4.2.2.2 Walton Creek Member (map-unit 7b)

The Walton Creek Member of the Boulder Creek Formation comprises 95 to 115 metres of generally-recessive siltstone, variably-carbonaceous, locally root-penetrated mudstone and thin coal beds, of which only one (designated as the V coal bed) appears to be laterally-continuous within the vicinity of EB Trend. The swale-forming fine-grained rocks are punctuated by cliff-forming lenses of sandstone, gritstone and pebble-conglomerate, inferred to be channel-fills.

Gibson (1992b) considered the Walton Creek Member to be of probable Late Albian Age, based on angiosperm flora. The basal contact of the Walton Creek Member with the underlying Cadotte Member is generally abrupt, and regarded by Gibson (*op. cit.*) as being conformable, although Krawetz (2008) noted that the top of the Cadotte is usually distinctively 'lumpy'.

4.2.2.3 Cadotte Member (map-unit 7a)

The Cadotte Member of the Boulder Creek Formation comprises 20 to 40 metres of cliff-forming sandstone and pebble-conglomerate with rare thin interbeds of siltstone. The Cadotte generally coarsens upward, with its sandstones being at its base and its conglomerates being in its middle and at its top. Other than isolated coalified logs, the Cadotte Member is devoid of coal. The basal contact of the Cadotte Member with the underlying Hulcross Formation is generally abrupt and therefore considered to be conformable at local scale (Gibson, 1992b), although it may intertongue at regional scale.

4.2.3 Hulcross Formation (map-unit 6)

The Hulcross Formation comprises 105 to 110 metres of thinly-interbedded, locally-concretionary medium grey siltstone, fine-grained sandstone and dark grey mudstone with occasional very thin but extremely-persistent interbeds of soft, light grey to white, tuffaceous volcanic ash. Mesoscale (a few decimetres to a few metres thick) fining-upward sequences reminiscent of proximate turbidites or tempestites are common within the Hulcross Formation near EB Trend, as are trace-fossils and poorly-preserved shell fossils. Sideritic concretions are commonly found in isolated, laterally-persistent bands.

Fine-grained pyrite is locally-abundant within the Hulcross rocks, which are inferred to have been deposited beneath a stratified water column within a restricted-circulation seaway (Stelck and Leckie, 1988). Tuffaceous volcanic ash bands (colloquially termed as ‘ash bands’ or as ‘bentonites’ although their mineralogy may vary from that of typical bentonites) form laterally-extensive, readily-correlatable, distinctively light-weathering, locally popcorn-weathering, lithological and geophysical (high natural-gamma count rate) markers a few centimetres to a few decimetres thick (Kilby, 1985; Gibson, 1992b). Ash bands are of practical value in property-scale structural studies, as they aid the tracing of faults and folds through the Hulcross Formation.

The Hulcross Formation is of Middle Albian age (Stelck and Leckie, 1988; Gibson, 1992b). The formation’s immediate base is marked by a thin (generally a few decimetres, and rarely up to 2.2 metres thick) erosive-based bed of cherty pebbly sandstone or gritstone, locally informally termed the ‘Basal Hulcross grit’.

4.2.4 Gates Formation (map-unit 5)

The Gates Formation comprises 220 to 230 metres of interbedded sandstone, siltstone, conglomerate, shale and coal at EB West, and a similar thickness is expected to occur within the core of the Spieker Syncline at EB Trend. The Gates, as were the Boulder Creek and Hulcross formations, was formerly considered a member of the Commotion Formation (Stott, 1968), and that obsolete usage is evident in old coal assessment reports (*e.g.* Jordan and Dawson, 1978).

At EB Trend, and within the Sukunka-Quintette coalfield generally, the Gates Formation may be usefully subdivided into three members, in order from top down:

Notikewin Member, comprising 63 to 105 metres of interbedded, locally-glauconitic sandstone and siltstone, with minor conglomerate, carbonaceous mudstone and generally-thin coal;

Falher Member, comprising 75 to 85 metres of conglomerate, sandstone and generally-thick coal, with muddy siltstone, carbonaceous mudstone and silty mudstone; and

Torrens Member, comprising sandstone, with minor siltstone, and lacking coal.

Each of these members may in turn be further subdivided into informal or formal lithostratigraphic divisions (Leckie and Walker; 1982; Leckie, 1983; 1985; Caddel, 1999; Wadsworth and others, 2003; Caddel and Moslow, 2004), largely corresponding to changes in

the shoreline position of the Western Interior Seaway (Legun, 2006; 2007; 2008; 2009a). These finer subdivisions of the Gates Formation aid in the determination of the stratigraphic displacements of thrust-faults, and in the correct correlation of the formation's coal beds.

Details of the formation's subdivisions, as observed in the closely-drilled EB West coal property, are presented in Coal Assessment Report 938 (Cathyl-Huhn and Avery, 2014b). A corresponding discussion for EB Trend is not yet possible, owing to the lack of drilling, and lack of measured outcrop sections, within the Gates Formation at EB Trend.

The Gates Formation is of late Early Albian age (Stott, 1982; Wan, 1996). The basal contact of the Gates Formation with the underlying Moosebar Formation is gradational by interbedding at both regional and local scale. Details of the three members of the Gates are presented below.

4.2.4.1 Notes concerning Gates Formation coals

Coals of the Gates Formation, and their enclosing sedimentary rocks, were deposited on the shoreline of the Western Interior Seaway between 108.7 and 111.0 million years ago, as part of an extensive complex of coastal plains, deltas and estuaries. Throughout the period of Gates Formation sedimentation, the shallow waters of the Western Interior Seaway generally lay a few kilometres to a few tens of kilometres northeast of EB Trend, with the exception of a few isolated 'marine bands' associated with more substantial transgressions of the sea into and atop coal-forming coastal plain sediments. Such transgressions occasionally induced splitting within the Gates Formation coals (Wadsworth and others, 2003); splits were also occasionally induced by crevasse-splays from river channels, and perhaps also by drowning of coal-forming wetlands beneath lakes and ponds.

Within the nearby EB Trend (Cathyl-Huhn and Avery, 2014b) and EB Main (Minnes, 2007; Lortie and Burton, 2012) coal properties, numerous coal zones, each comprising one or more individually-recognisable coal beds, are present within the Gates Formation.

Coal zones and coal beds are designated by an upward-progressing system of lettering, from the A zone near the base of the formation, to the P, Q and R zones near the top of the formation. This scheme of designation resembles the upward-progressing lettering used at Teck Corporation's nearby Bullmoose Mine (with the exception that coal zones P, Q and R are not recognised at Bullmoose), and is the inverse of the downward-progressing lettering used at Walter Energy's Perry Creek Mine.

Coal zones A through E occur within the Falher Member of the Gates Formation, whereas coal zones P through R occur within the Notikewin Member of the Gates Formation. Unlike the situation at the nearby EB West and EB Main coal properties, neither test-pitting nor seam-tracing has been done within the Gates Formation at EB Trend.

4.2.4.2 Notikewin Member (map-unit 5c)

The Notikewin Member of the Gates Formation comprises 63 to 105 metres of siltstone and sandstone with minor conglomerate, variably-carbonaceous, locally root-bearing mudstone, and thin coal beds. Overall, the Notikewin is finer-grained than the underlying

Falher Member of the Gates Formation (Leckie and Walker, 1982), and it tends to be more recessive-weathering than the Falher, although the Notikewin's basal sandstone/ conglomerate division locally forms a cliff band in hillside exposures.

The Notikewin Member at EB West (Cathyl-Huhn and Avery, 2014b), and in nearby parts of the Sukunka-Quintette coalfield (Leckie, 1985), may be readily divided into four informal lithostratigraphic divisions. A similar subdivision may ultimately be possible within the EB Trend property, but cannot be currently accomplished, owing to lack of drilling and/or measured outcrop sections at EB Trend.

The basal contact of the Notikewin Member atop the underlying Falher Member is abrupt to erosional, almost always marked by a few centimetres to decimetres of pebbly gritstone to pebble-conglomerate.

4.2.4.3 Falher Member (map-unit 5b)

The Falher Member of the Gates Formation comprises 75 to 85 m of conglomerate, sandstone and coal, accompanied by lesser proportions of muddy siltstone, carbonaceous mudstone and silty mudstone. On a regional basis, Falher coals are generally thicker than are the coals of the Notikewin Member (Cathyl-Huhn and Avery, 2014b), but the Falher coals' thickness and frequency at EB Trend are as yet not known, owing to lack of exploration.

The Falher Member is of Late Early Albian age (Wan, 1996). The basal contact of the Falher Member atop the Torrens Member is universally abrupt, and locally-undulating in detail.

4.2.4.4 Torrens Member (map-unit 5a)

Within the Sukunka-Quintette coalfield, the term 'Torrens Member' is often applied as a local name for the thick sandstone underlying the lowest of the mineable Gates coal beds. Within the Mt. Spieker area (including the EB Trend, EB Main and EB West coal properties), however, there are two of these sandstone units, the Quintette and Torrens sandstones, separated by a thick medial fine-grained 'silty zone' of interbedded siltstone, sandstone and shale. The silty zone lacks mineable coal at Mt. Spieker, despite its being the host of the K coal zone in the Quintette mines, further to the south within the coalfield (Cathyl-Huhn and Avery, 2014c).

The top of the Quintette Sandstone is almost always root-penetrated, at times distinctly softer, darker and carbonaceous to coaly (likely a paleosol), readily distinguishable from the harder, lighter-coloured and cleaner main body of the sandstone.

At EB Trend, the Torrens Member has not been drilled, and so its thickness is only known from map patterns, which indicate that the Torrens is about 50 metres thick. The Quintette Sandstone is assumed to be about 25 metres thick (Jordan and Dawson, 1978), whereas the medial silty zone is assumed to be about 13 metres thick, and the basal Torrens Sandstone is assumed to be about 12 metres thick.

The age of the Torrens Member is not directly known, but presumed to be Late Early Albian. The basal contact of the Torrens Member with the underlying Spieker Member of the Moosebar Formation is gradational by interbedding.

4.2.5 Moosebar Formation (map-unit 4)

The Moosebar Formation comprises 225 to 380 metres of dark grey, locally-concretionary mudstone and siltstone, with minor thin interbeds of sandstone and tuff, and a thin basal conglomerate. The wide variation of the Moosebar's thickness is likely due to overthrusting and concomitant tectonic thickening of its incompetent shales.

The Moosebar Formation is of Early Albian age (Stott, 1968). Its basal contact with the underlying Gething Formation is abrupt, and generally erosional, characteristically marked by a very thin band of variably-glauconitic gritty sandstone or pebbly gritstone.

At EB Trend, and within the Sukunka-Quintette coalfield generally, the Moosebar Formation may be divided into three units. In order from top down, these are:

- Spieker Member (map-unit 4c): thinly-interbedded siltstone and sandstone, 150 to 170 metres thick;
- Cowmoose member (map-unit 4b): massive-appearing dark grey to black mudstone, with occasional thin bands of tuff, generally 75 to 110 metres thick, but possibly tectonically-thickened to 230 metres thick (Cathyl-Huhn and Avery, 2014b);
- Basal glauconitic zone (map-unit 4a): variably-glauconitic gritty sandstone or pebbly gritstone, nil to 3 metres thick.

In the geological map (**Map 2-3**) presented with this report, map-units 4a and 4b are mapped together as 'unit 4ab', insofar as the basal glauconitic zone (unit 4a) is so thin that it cannot be mapped separately at any property-wide scale.

4.2.5.1 Spieker Member (map-unit 4c)

The Spieker Member comprises 150 to 170 metres of thinly-interbedded, overall coarsening-upward sandy siltstone and sandstone, pervasively-bioturbated and possibly originating as proximal shallow-marine turbidites (Leckie, 1983) in front of the advancing Falher paleodelta. Sandstone beds become thicker, coarser, and more abundant towards the top of the Spieker, and on the whole the Spieker Member is a transitional unit (Duff and Gilchrist, 1981) between the lower Moosebar mudstone and the overlying Torrens sandstones. In some earlier reports, the Spieker Member is termed the 'Sukunka Member' of the now-deprecated Commotion Formation (*vide* Wallis and Jordan, 1975).

The age of the Spieker Member is not directly known, but presumed to be Early Albian to possibly late Early Albian. Lithologically, the basal contact of the Spieker Member with the underlying Cowmoose Member is drawn at the base of the lowest band of sandy siltstone overlying the mudstones of the Cowmoose. In geophysical logs (see borehole EB13-02 at 141.9 metres' depth), the Spieker/Cowmoose contact is marked by an abrupt upward decrease in natural gamma-ray count-rate and a slightly less-abrupt upward increase in density-log response.

4.2.5.2 Cowmoose Member (map-unit 4b)

The Cowmoose Member of the Moosebar Formation comprises 75 to 90 metres of rubbly-weathering, massive-appearing black mudstone, punctuated by laterally-persistent bands crowded with ironstone concretions, and several thin (a few millimetres to a few decimetres) but laterally-persistent bands of light olive drab to white tuff. The tuff bands are useful as local structural markers (Duff and Gilchrist, 1981; Kilby, 1984a; Jordan and Dawson, 1988). The name 'Cowmoose' is newly-coined as an informal but practically-useful stratigraphic name, for the purposes of Walter Energy's geological studies; these rocks were previously referred to as the 'basal mudstone member' of the Moosebar Formation (Cathyl-Huhn and Avery, 2014b) or simply as the 'mudstone member' (Duff and Gilchrist, 1981).

The recommended type-section of the Cowmoose Member is on the northeastern face of Cowmoose Mountain, ten kilometres northwest of the EB Trend property. The recommended alternative reference-section of the Cowmoose Member is on the western face of Mount Spieker, within the EB West coal property, situated five kilometres north-northwest of the EB Trend property.

Within the EB Trend property, the Cowmoose Member is locally exposed in road-cuttings and shale-pits along access roads. The Cowmoose mudstones are sparsely-bioturbated, and locally contain sparse to abundant burrow-fillings, irregular blebs and euhedral crystals of pyrite, indicative of overall anoxic depositional conditions. Pyrite is particularly abundant near the base of the Cowmoose Member.

The age of the Cowmoose Member is Early Albian (as noted for the mudstones of the Moosebar Formation by Stott, 1968). The basal contact of the Cowmoose mudstones over the underlying basal glauconitic zone is gradational to abrupt, and generally easily-recognised on geophysical logs.

4.2.5.3 Basal glauconitic zone (map-unit 4a)

The basal glauconitic zone of the Moosebar Formation comprises 0.2 to perhaps 3 metres of variably-glauconitic, chert-rich lithic arenite, locally containing stringers or lenses of gritstone or pebble-conglomerate. This zone is locally altogether absent; hence its minimum thickness of 'nil' as given in **Table 3.1**. Glauconite development within this unit is patchy, in contrast with its more obvious presence in other parts of the Sukunka-Quintette coalfield. Earlier reports (Wallis and Jordan, 1975; Jordan and Dawson, 1978) denoted this zone as the Bluesky Formation, on the grounds of its lithologic similarity to the typical Bluesky rocks of the Alberta Syncline and Deep Basin, but that correlation is now understood to be incorrect (Kilby, 1984b; Legun, 1990; Gibson, 1992a). The Bluesky Member *sensu stricto* is currently understood to form part of the Gething Formation, underlying the Gething's Bullmoose Member, and overlying the Gaylard Member.

The age of the basal glauconitic zone of the Moosebar Formation is not directly known, but presumed to be Early Albian. Its basal contact with the underlying Chamberlain Member of the Gething Formation is abrupt, and locally erosional, with several metres of relief at local scale.

4.3 Bullhead Group (map-units 3 and 2)

The Bullhead Group consists of two formations, the Gething Formation which comprises the majority of the group's thickness, and the underlying, thinner Cadomin Formation (Stott, 1963; 1968; 1973; McLean, 1977). Both formations are well-represented in outcrop at EB Trend, although only the uppermost part of the Gething has been tested by drilling. Drilling at EB Trend has not yet reached the basal half of the Gething, nor any part of the underlying Cadomin.

4.3.1 Gething Formation (map-unit 3)

The Gething Formation, of Early Aptian to Early Albian age within the Early Cretaceous (Gibson, 1992a), comprises thin to thick interbeds of siltstone, sandstone, mudstone and coal, with lesser amounts of gritstone, pebble-conglomerate, ironstone and tuff.

The Gething Formation originated as a complex of non-marine to shallow-marine sedimentary deposits, laid down by meandering and braided streams and rivers within a widely-extensive belt of coastal deltas, of which two (the Gaylard and Chamberlain paleodeltas) extended into the Mt. Spieker area, including the EB Trend coal property.

Coals of the Gething Formation at EB Trend, and their enclosing sedimentary rocks, were deposited between 111 and 123 million years ago (Gibson, *ibid.*), on the basis of regional plant-fossil and foraminiferal zonations.

Following upon suggestions made by coal-company geologists (Wallis and Jordan, 1975) and subsequent correlation by the British Columbia Geological Survey (Duff and Gilchrist, 1981; Legun, 1990), Gibson formally divided the Gething Formation into three members: the upper, non-marine to transitional Chamberlain Member, the middle marine Bullmoose Member, and the basal, non-marine to transitional Gaylard Member. A fourth member of the Gething Formation, the Bluesky Member, is one the basis of more recent work (Cathyl-Huhn and Avery, 2014b) also inferred to be present between the base of the Bullmoose Member and the top of the Gaylard Member.

Complete (albeit broken by thrust-faults) sections of the Chamberlain, Bullmoose and Bluesky members have been drilled at EB Trend, and the uppermost 22 metres only of the Gaylard Member has been drilled as well.

In the geological map accompanying this report (**Map 2-3**), the Gething Formation is mapped as two rather than four divisions: the Chamberlain, Bullmoose and Bluesky members (map-unit 3bcd) and the Gaylard Member (map-unit 3a). Correlation studies and structural studies of the Gething rocks are presently being undertaken to better clarify the mappability of all four of the Gething Formation's members within the Mt. Spieker area (including at EB Trend); the discussion given below is therefore preliminary in scope.

4.3.1.1 Chamberlain Member (map-unit 3d)

At EB Trend, the Chamberlain Member comprises 45 to 51 metres of thickly-interbedded, brown-weathering sandstone and siltstone, containing three regionally-significant coal zones (Wallis and Jordan, 1975): the Bird Zone (containing the Upper Bird and Lower Bird coal beds) near the member's top, and the Skeeter and Chamberlain coal beds within the member's middle.

The Chamberlain Member may be readily divided into two divisions on the basis of lithology: an upper coal-measures unit comprising interbedded siltstone, sandstone and coal, and a lower dominantly-sandy unit (informally denoted as the 'Chamberlain sandstone'). The Chamberlain sandstone forms a consistent marker bed in the northern half of the Sukunka-Quintette coalfield, including the EB Trend area.

The age of the Chamberlain Member is late Early Albian (Gibson, 1992a). The basal contact of the Chamberlain Member with the underlying Bullmoose Member is drawn at the base of the lowest of the (usually two) thick sandstones beneath the Chamberlain coal bed. This contact is generally abrupt at local scale, but probably gradational by interfingering at the regional scale.

4.3.1.2 Details of Chamberlain Member coals

The coal-measures unit has a drilled thickness of 34 metres within its one complete drilled section at EB Trend. In the two boreholes which intersected the underlying Chamberlain sandstone, it has a drilled thickness of 11 to 17 metres.

Unlike the situation at the nearby EB West and EB Main coal properties, neither test-pitting nor seam-tracing has been done within the Chamberlain Member at EB Trend. The Chamberlain Member has, however, been drilled. Coal thicknesses encountered by drilling at EB Trend are set forth in **Table 3-3**, and discussed below.

- The Upper Bird coal bed was intersected twice in borehole EB13-02, owing to thrust-faulting. Its shallower intersection has a drilled thickness of 1.63 metres (at a depth of 61.4 metres), whereas its deeper intersection has a drilled thickness of 2.16 metres inclusive of 0.26 metre of dirty top coal (at a depth of 68.24 metres).
- The Lower Bird coal bed at EB Trend is generally only represented by thin beds of carbonaceous mudstone, in one instance (borehole EB13-02, at a depth of 76.2 metres) accompanied by 0.15 metres of dirty coal.
- The Skeeter coal bed was intersected in both year-2013 boreholes at EB Trend. Borehole EB13-01 found a drilled thickness of 1.15 metres inclusive of 0.15 metre of dirty top coal (at a depth of 34.55 metres), and borehole EB13-02 found a drilled thickness of 1.9 metres inclusive of 0.1 metre of dirty top coal and 0.1 metre of dirty floor coal (at a depth of 92.3 metres).
- The Chamberlain coal bed (in contrast to its generally-mineable thickness of 1.5 to 3 metres in the nearby Sukunka coal property) is only represented by carbonaceous mudstone at EB Trend, in one instance (borehole EB13-01, at a depth of 44.2 metres) accompanied by 0.2 metres of dirty coal.

Although the Upper Bird and Skeeter coal beds at least locally attain plausible thickness for underground mining at EB Trend (given good structural conditions, as yet unproven) they are markedly thinner than the Bird coal seen at EB West (locally over 4 metres, as reported by Cathyl-Huhn and Avery, 2014b).

4.3.1.3 Bullmoose Member (map-unit 3c)

The Bullmoose Member comprises 35 to 40 metres of thinly-interbedded, recessive-weathering mudstone, siltstone and minor sandstone of turbiditic aspect, forming several fining-upward sequences within an overall coarsening-upward sequence. At EB Trend, and possibly elsewhere within the Mt. Spieker area, three lithologic divisions may be recognised within the Bullmoose Member: an uppermost siltstone/sandstone unit (16 to 21 metres thick), a medial sandstone/siltstone unit (1.5 to 3 metres thick), and a basal mudstone/siltstone unit 915 to 17 metres thick). The Bullmoose Member possibly forms bedrock within the Perry Creek valley in the easternmost portion of the EB Trend property, but thus far at EB Trend its presence is solely established by its two year-2013 borehole intersections.

Where seen in outcrop within the EB West coal property (Cathyl-Huhn and Avery, 2014b), the Bullmoose Member does not contain any coal, other than isolated coalified logs and coarse, poorly-preserved ‘plant trash’, likely of drifted origin. The general lack of coal is also seen in the two year-2013 boreholes at EB Trend. The Bullmoose Member does, however, contain abundant molluscan fossils, including *Pecten (Entolium)* cf. *irenense* McLearn (Gibson, 1992a) and *Yoldia kissoumi* (Duff and Gilchrist, 1981), which, although not age-diagnostic, are locally-characteristic of the unit.

The Bullmoose Member is of late Early Albian age (Gibson, 1992a); its basal contact with the Bluesky Member is generally gradational, but locally abrupt.

4.3.1.4 Bluesky Member (map-unit 3b)

The Bluesky Member comprises 0.3 to 3 metres of pebbly mudstone to gritty sandstone, at times slightly to moderately glauconitic, with occasional pyrite flecks. The basal contact of the Bluesky with the underlying Gaylard Member has not been observed at outcrop EB Trend (although it was intersected by borehole EB13-01 at a depth of 99.6 metres); however, elsewhere within the Sukunka-Quintette coalfield it is generally abrupt to erosional.

The age of the Bluesky Member is not directly known, but likely to be late Early Albian. The Bluesky Member of the Gething Formation, as its name implies, is likely to be correlative if not strictly coeval with the Bluesky Formation of the Dawson Creek area.

4.3.1.5 Gaylard Member (map-unit 3a)

The Gaylard Member comprises about 150 metres of thickly-interbedded siltstone, mudstone and brown-weathering channel-filling sandstone, accompanied by minor ironstone, tuff, gritstone and conglomerate. Numerous poorly-exposed coal beds are present within the Gaylard Member at EB West (Shima and Nishio, 1975; Cathyl-Huhn

and Avery, 2014b), but no Gaylard coals have thus far been seen at outcrop, nor intersected by drilling, at EB Trend.

The age of the Gaylard Member is Hauterivian to late Early Albian (Gibson, 1992a). Its basal contact with the underlying Cadomin Formation is abrupt to possibly erosional at the local scale (Cant, 1996) and interfingering at the regional scale (Stott, 1968; Gibson, 1992a), drawn at the top of a bed of coarse-grained, often gritty and occasionally pebbly sandstone which may laterally grade into more typical pebble-conglomerate characteristic of the Cadomin.

4.3.2 Cadomin Formation (map-unit 2)

Regionally within the Sukunka-Quintette coalfield, the Cadomin Formation immediately underlies the Gething Formation, forming the basal part of the Bullhead Group (Stott, 1968). The Cadomin is resistant to erosion, and typically forms ledges to cliffs beneath the more-subdued slopes of the Gaylard Member.

The Cadomin comprises one or more thick beds of coarse-grained, gritty to pebbly sandstone and pebble-to cobble-conglomerate (McLean, 1977; Jordan and Dawson, 1978) with occasional lenses of siltstone and pebbly gritstone, and rare thin lenses of dirty coal. Sandy phases of the Cadomin Formation thus strongly resemble the basal pebbly sandstones of the Gaylard Member, and the Cadomin's distinction from the Gaylard locally rests mainly upon the Cadomin Formation's greater lateral continuity.

The top of Cadomin Formation has not been reached by any of the boreholes drilled at EB Trend, nor in any boreholes drilled at Walter Energy's adjoining properties. The Cadomin Formation is not interpreted to outcrop at any point within the EB Trend property, as suggested by its mapped outcrop trace (as shown on **Map 2-3**) lying completely outside the property's boundaries.

At EB Trend and within the Mt. Spieker area in general, the Cadomin Formation is estimated to be 50 metres thick (Jordan and Dawson, 1978). Its basal contact with the underlying Monach Formation is likely to be erosional, with considerable local scour into the older sediments. Regionally, the base of the Cadomin marks a northeastward-deepening angular contact, cutting down into successively-older rocks of the Minnes Group (Stott, 1973).

4.4 Minnes Group (map-unit 1)

The Minnes Group is virtually unexplored in the vicinity of the EB Trend property, owing to its outcropping position in valley-bottoms, where thick Drift cover generally obscures bedrock. The total thickness of the Minnes Group is at least 2000 metres (Stott, 1998). The Minnes Group within the Sukunka-Quintette coalfield comprises three formations: from top down, the Monach, Beattie Peaks and Monteith formations. Of these three, only the sandstone-rich, potentially coal-bearing Monach Formation is expected to outcrop near EB Trend, within the valley of South Bullmoose Creek, two to three kilometres west of EB Trend.

5 Coal quality and coal resources

No coal-quality information is available for the EB Trend coal licences, owing to lack of historic nor current sampling of coals. Neither historic nor current coal-resource estimates are known to exist for the EB Trend coal licences. Prior to year-2013, nothing at all was publicly-known concerning the thickness and resource base (if any) of coal beds at EB Trend.

On the basis of the two year-2013 boreholes, the presence of coal has been established for the Chamberlain Member of the Gething Formation, within a small area near the northwestern corner of the property. Two closely-spaced boreholes, however, are not sufficient to support resource estimation at the present time, especially given that nothing is yet known of the Gething coals' quality at EB Trend.

6 Reclamation

Disturbance associated with year-2013 drilling at EB Trend was minimal, owing to the two boreholes (EB13-01 and EB13-02) being drilled at wide spots along existing roadways, using air-based drilling systems rather than mud-based systems. Drill sites were cleared of equipment, supplies and trash prior to removal of the rotary-drilling rig. Sites were then levelled, coarse woody debris was scattered on the sites, and then the sides were seeded with appropriate native seed mix.

7 Statement of costs

‘Current work’ within the EB Trend coal property, for purposes of the present report, comprises exploratory work done between the years 2001 and 2013. All such work was done during year-2013, no exploratory work having been done within the property in previous years.

For the year-2013 drilling programme, Wolverine Coal Partnership’s exploratory costs ascribable to the EB Trend coal property are not directly known, as the costs have not been broken down by coal licence. However, an estimate can be made by applying the British Columbia average exploratory costs as calculated by L.R. Avery and reported in Coal Assessment Report No.936 (Cathyl-Huhn and Avery, 2014a) to the unit quantities of drilling and associated work done during 2013 – all of which was done within Coal Licence 381711. **Table 7-1** presents results of this estimate.

During year-2013, no detailed accounting was made of the division of geological labour involved in the regional photogeological compilation study, but a reasonable estimate of work time on the senior geologist’s part (Gwyneth Cathyl-Huhn) is two days at nine hours/day. Given direct labour cost of $55.58/hour, the 18 working hours would amount to $1000.44, which may be rounded to $500. Photogeological costs are allocated as ‘report preparation’ within **Table 7-1**, to be divided equally amongst all four coal licences comprising the EB Trend property.

Table 7-1: Estimated exploratory cost breakdown by activity

Item	Quantity [Q]	Unit cost [C]	[Q]x[C]	Cost of work [Q x C] by tenure 379597	379598	379599	381711
Drilling (number of holes)	2						
Metreages:							
rotary-drilling	304m						
core-drilling	nil						
Estimated drilling costs:							
rotary-drilling	304m	@ $201.53/m	$61,265.12				$61,265.12
core-drilling	nil	@ $210.34/m					
Geophysical metreage:	303.28m						
Estimated geophysical cost	303.28m	@ $17.56/m	$5,325.60				$5,325.60
Analytical work:							
proximate analyses	none						
washability tests	none						
petrographic studies	none						
Consultants	0 person-days						
Food/accommodation	0 person-days						
Mobe/demob within BC	not allocated						
Aircraft support	none						
Vehicle rentals	none						
Equipment/supplies	not allocated						
Instrument rentals	none						
Contract jobs/unit costs	none						
Report preparation	18 hr	@ $55.58/hr	$1000	$250	$250	$250	$250
Management	not allocated						
	TOTALS		$67,590.72	$250	$250	$250	$66,840.72

Notes: unit costs for drilling and geophysical work derived from Provincial averages by L.R. Avery (methodology as reported in Coal Assessment Report 936 – Cathyl-Huhn and Avery, 2014a). Geophysical log metreage is slightly lower than drilled metreage (as reported on geophysical logs) owing to tool commencing logging slightly above bottoms of holes; this is a normal occurrence.

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9 Conclusions

The EB Trend coal property contains coal-measures of Early Cretaceous (Barremian to Albian) age, within the Bullhead and Fort St. John groups of sedimentary rocks. These rocks are deformed by thrust faults and associated folds, consistent with the overall thin-skinned structural style of the Rocky Mountain Foothills of northeastern British Columbia. Coal of potentially-mineable thickness is known to occur within the Chamberlain Member of the Gething Formation (part of the Bullhead Group). Stratigraphically-higher coals of the Gates Formation (part of the Fort St. John Group) -- and stratigraphically-lower coals of the Gaylard Member of the Gething Formation -- have not yet been explored at EB Trend.

Historic exploration work at EB Trend comprised geological mapping on behalf of coal companies, an oil company, and both federal and provincial geological survey agencies.

The present work on the EB Trend coal property, here reported as concerns year-2013, comprises the drilling of two rotary-drilled (non-coring) boreholes, totalling 304 metres' depth, and the construction of a geological map from aerial and satellite imagery, supported by collection and re-interpretation of data from previous reports. This work was conducted by members of Walter Canadian Coal Partnership's regional geological staff, as part of a broader examination of coal properties within the Brazion and Sukunka-Quintette coalfields of northeastern British Columbia, Canada.

The extent of exploration to date is insufficient to define coal resources, as only two boreholes have been drilled into solely one of the three regionally-significant coal-bearing depositional systems. No information is available concerning in-situ ('raw') coal quality, nor washability, nor coal petrography. The EB Trend property merits further work, albeit at a 'grassroots' stage of understanding.

10 Statements of qualifications

I, Preetpal Singh M.A.Sc., do hereby certify that:

a) I am currently employed on a full-time basis by Walter Canadian Coal Partnership, a subsidiary of Walter Energy, in their Northeast British Columbia office in Tumbler Ridge, British Columbia.

b) This certificate applies to the current report, titled *Coal Assessment Report for the EB Trend coal licences, Mt. Spieker area, British Columbia*, dated October 28, 2014.

c) I am a member of the IEEE Computer Society since 2006.

d) I am in the process of applying for registration with the Association of Professional Engineers and Geoscientists of British Columbia.

e) I received my Bachelor of Science in Computer Science from Laurentian University in 2008, and my Master's of Applied Science in Mineral Resource Engineering, also from Laurentian University, in 2012.

f) I have worked as a data analyst for Walter Canadian Coal Partnership since July of 2013.

g) I am a contributing author of this report, titled *Coal Assessment Report for the EB Trend coal licences, Mt. Spieker area, British Columbia*, dated October 28, 2014, concerning the EB Trend coal property.

I, C.G. Cathyl-Huhn P.Geo.(BC) Lic.Geol.(WA) RMSME, do hereby certify that:

a) I am currently employed on a full-time basis by Walter Canadian Coal Partnership, a subsidiary of Walter Energy, in their Northeast British Columbia office in Tumbler Ridge, British Columbia.

b) This certificate applies to the current report, titled *Coal Assessment Report for the EB Trend coal licences, Mt. Spieker area, British Columbia*, dated October 28, 2014.

c) I am a member (Professional Geoscientist, Licence No.20550) of the Association of Professional Engineers and Geoscientists of British Columbia, licensed as a geologist (Licence No.2089) in Washington State, and a founding Registered Member of the Society for Mining, Metallurgy and Exploration (SME, Member No.518350). I have worked as a colliery geologist in several countries for over 36 years since my graduation from university.

d) I certify that by reason of my education, affiliation with professional associations, and past relevant work experience, having written numerous published and private geological reports and technical papers concerning coalfield geology, coal-mining geology and coal-resource estimation, that I am qualified as a Qualified Person as defined by Canadian *National Instrument 43-101* and a Competent Person as defined by the Australian *JORC Code*.

e) My most recent visit to the EB Trend coal property was in July 2014.

f) I am principal author of this report, titled *Coal Assessment Report for the EB Trend coal licences, Mt. Spieker area, British Columbia*, dated October 28, 2014, concerning the EB Trend coal property.

g) As of the date of the writing of this report, I am not independent of Walter Canadian Coal Partnership and Walter Energy, pursuant to the tests in Section 1.4 of *National Instrument 43-101*.

"original signed and sealed by"
Dated this 28th day of October, 2014. C.G. Cathyl-Huhn P.Geo. Lic.Geol. RMSME

Appendix A: Geological and geophysical data for current boreholes

Following are interpreted lithologic results, and downhole geophysical logs for the two year-2013 boreholes (EB13-01 and EB13-02) drilled at EB Trend. Stratigraphic interpretations are presented as **Tables A-1** and **A-2**, for boreholes EB13-01 and EB13-02 respectively. Details of downhole geophysical logs run are presented in **Table A-3.**

All positional, elevation and depth data are given in metres. Depths are drilled or logged depths ('measured' depths, as opposed to 'true vertical' depths), uncorrected for deviation of the boreholes from vertical. Positional data is given in terms of Zone10N of the Universal Transverse Mercator grid system, relative to the North American Datum of 1983 (NAD 83).

A.1 Lithological interpretation of boreholes

Lithological interpretations are based primarily on natural-gamma, caliper, compensated density, and neutron log responses, following industry-standard methods recommended by Hoffman, Jordan and Wallis (1982). Depths have been adjusted to match the depth track on the gamma-caliper-resistivity-density log (as acquired by the Model 9239 sonde).

Table A-1: Interpretation of borehole EB13-01

Lithology	Horizon	Assurance of existence	From (m)	To (m)	Drilled thickness
OB	Drift		0	26.5	26.5
R	starts in Chamberlain Member		26.5	29.9	
CBSH			29.9	30.3	
R			30.3	34.55	
DC	Skeeter coal bed		34.55	34.7	0.15
C	Skeeter coal bed		34.7	35.7	1
R			35.7	42.1	
CBSH			42.1	42.6	
R			42.6	44	
CR	Chamberlain coal bed		44	44.2	
DC	Chamberlain coal bed		44.2	44.4	0.2
CR	Chamberlain coal bed		44.4	44.65	
R			44.65	44.7	
R	Chamberlain Sandstone		44.7	61.5	
R	Upper Bullmoose Member		61.5	78	
R	Middle Bullmoose Member		78	79.8	
R	Lower Bullmoose Member		79.8	96.7	
R	Bluesky Member		96.7	99.6	
R	Gaylard Member		99.6	118.8	
FAULT	BULLMOOSE FAULT	Established	118.8	118.81	
R	Spieker Member		118.81	141.9	
R	Cowmoose Member		141.9	151.75	

Notes: ASH = high-gamma zone, inferred to be volcanic ash band; C = coal (density <1.5); CBSH = carbonaceous shale; CR = coaly rock (density 1.7 to 1.9), DC = dirty coal (density 1.5 to 1.7); R = rock

Table A-2: Interpretation of borehole EB13-02

Lithology	Horizon	Assurance of existence	From (m)	To (m)	Drilled thickness
OB	Drift		0	23.9	23.9
R	starts in Cowmoose Member		23.9	39.15	
ASH			39.15	39.25	
R			39.25	41.8	
ASH			41.8	41.9	
R			41.9	53.45	
FAULT	FAULT	Possible	53.45	53.46	
R			53.46	53.8	
R	Basal glauconitic zone		53.8	56.9	
R	Chamberlain Member		56.9	60.4	
CBSH			60.4	60.85	
R			60.85	61.4	
C	Upper Bird coal bed		61.4	63.03	1.63
CR			63.03	63.3	
R			63.3	63.85	
FAULT	FAULT	Established	63.85	63.86	
R			63.86	65	
CBSH			65	65.55	
R			65.55	68.24	
DC	Upper Bird coal bed		68.24	68.5	0.26
C	Upper Bird coal bed		68.5	70.4	1.9
CR			70.4	70.7	
R			70.7	73.2	
CBSH	Lower Bird coal bed		73.2	73.7	
FAULT	FAULT	Probable	73.7	73.71	
R			73.71	75.4	
CBSH	Lower Bird coal bed		75.4	76.2	
DC	Lower Bird coal bed		76.2	76.35	0.15
R			76.35	83.15	
CBSH			83.15	83.7	
R			83.7	92.1	
CR			92.1	92.3	
DC	Skeeter coal bed		92.3	92.4	0.1
C	Skeeter coal bed		92.4	93.1	0.7
DC	Skeeter coal bed		93.1	93.2	0.1
CBSH			93.2	93.4	
R			93.4	101.85	
CBSH	Chamberlain coal bed		101.85	102.4	
R	Chamberlain Sandstone		102.4	113.6	
R	Upper Bullmoose Member		113.6	134	
R	Middle Bullmoose Member		134	136.6	
R	Lower Bullmoose Member		136.6	152.25	

Notes: ASH = high-gamma zone, inferred to be volcanic ash band; C = coal (density <1.5); CBSH = carbonaceous shale; CR = coaly rock (density 1.7 to 1.9), DC = dirty coal (density 1.5 to 1.7); R = rock

A.2 Geophysical logging

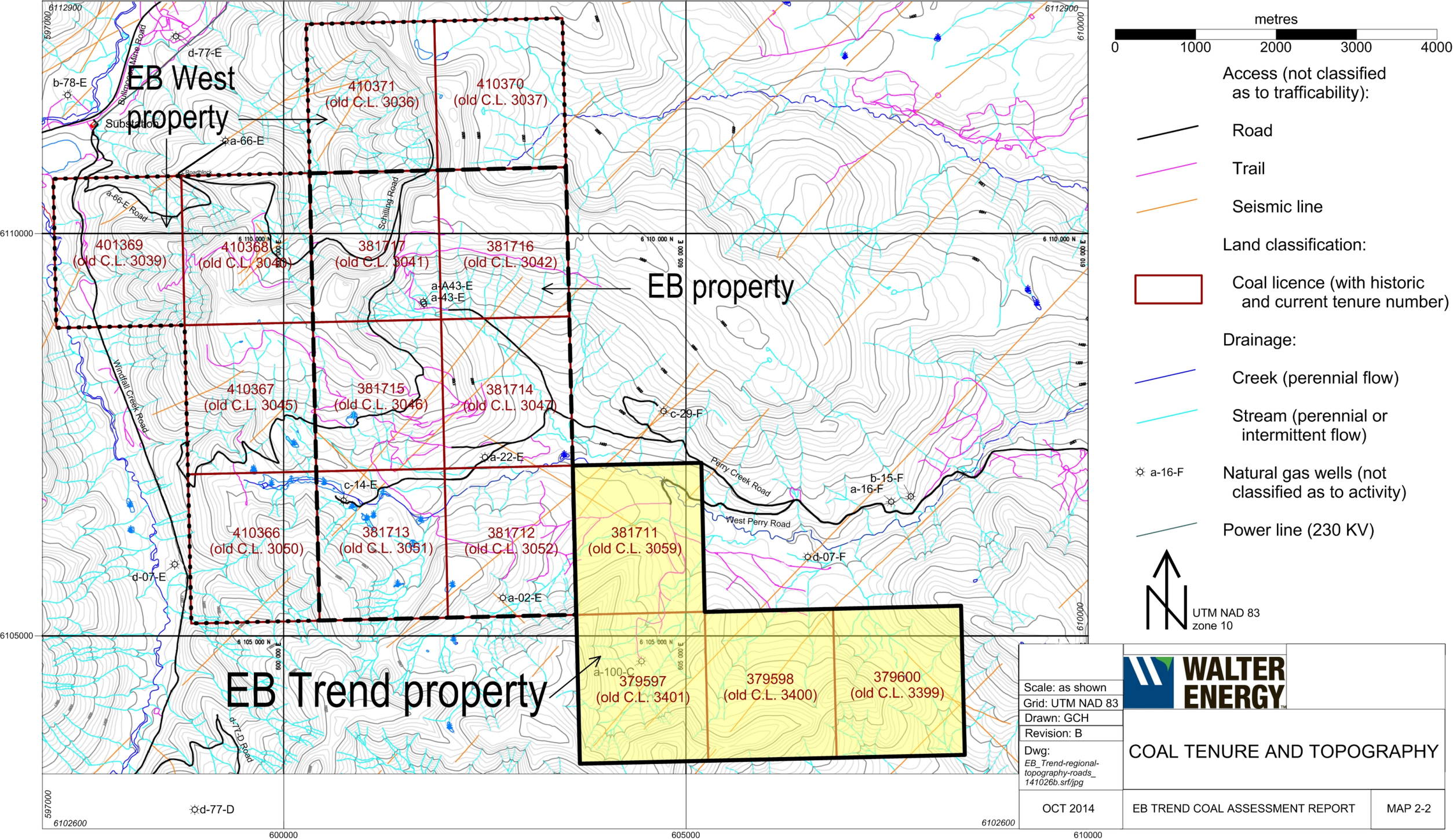
Geophysical logging (**Table A-3**) was performed by Century Wireline Services, using their slimhole suite of coalfield sondes. Gamma, caliper, resistivity and compensated sidewall density logs were acquired with Century's Model 9239 sonde, whereas neutron and verticality logs were acquired with their Model 9055 sonde.

All geophysical logs follow similar presentations, with rightward-increasing gamma response in the left track, and rightward-increasing neutron response in the right track. Gamma and neutron readings are given in API (American Petroleum Institute) units. Density logs are calibrated to indicate apparent bulk density of the strata, increasing rightward from 1.0 to 3.0 grams/cubic centimetre. The top of the logged sections is presented at the top of the logs, and the base of the sections is presented at the base of the logs, to constant vertical scale.

Interpretation and correlation of the logs was done by Gwyneth Cathyl-Huhn P.Geo, as presented above in **Tables A-1** and **A-2** of this report. Marker beds, formation and member tops, and the tops and bases of coal beds as shown on the interpreted logs are presented in **Tables 3-2** and **3-3** of this report. **Table A-3**, presented below, summarises the depths investigated in each borehole by the various logs. Scanned versions of geophysical logs are presented on the compact disk (CD) accompanying this report.

Table A-3: Downhole geophysical logs run in current boreholes

Borehole	UTM NAD83		Collar Elevation	Logs run to depths as shown					
	Easting	Northing		Gamma/ Caliper/ Resistivity/ Density	Gamma/ Density through rods	Dip-meter	Gamma/ Neutron	Neutron through rods	Verticality/ Deviation
EB13-01	604377.4	6106635	1398.61	151.18			151.62		144.36
EB13-02	603780.4	6106305	1433.46	152.1			151.56		149.89



Scale: as shown	WALTER ENERGY
Grid: UTM NAD 83	
Drawn: GCH	
Revision: B	COAL TENURE AND TOPOGRAPHY
Dwg: *EB_Trend-regional-topography-roads_141026b.srf/jpg*	
OCT 2014	EB TREND COAL ASSESSMENT REPORT — MAP 2-2

UTM NAD83

MOUNT SPIEKER

CANADA
NTS 93P/03

metres
0 500 1000 1500 2000 2500 3000

STRUCTURAL GEOLOGY

Thrust fault -- ornament on leading-edge of overthrust structural plate

Anticline

Syncline

Monocline -- arrow shows downfold

Bedding attitude (28)

Outcrop, lacking attitude data

ACCESS AND TRANSPORT

Road -- major, minor (unclassed as to trafficability or composition); restored

Pipeline -- right-of-way not under road

Seismic line -- (unclassed as to trafficability)

STRATIGRAPHIC LEGEND

MADE GROUND (Recent)

M — Mine dumps and tailings pond (Bullmoose Mine)

DRIFT (Pleistocene to Recent)

TL — Talus and landslide deposits (undivided); extent is interpreted from imagery

D — Valley-filling alluvium, peat and muck; colluvium and moraines (undivided)

FORT ST JOHN GROUP (Albian)

8a — Hasler Formation -- marine shale and siltstone

7 — Boulder Creek Formation -- sandstone, shale, conglomerate and coal

7c — Paddy Member -- conglomerate and sandstone

7b — Walton Creek Member -- siltstone, sandstone, conglomerate and coal (V zone)

7a — Cadotte Member -- conglomerate and sandstone

6 — Hulcross Formation -- marine shale and siltstone; minor tuff; basal gritstone

5 — Gates Formation -- sandstone, mudstone, conglomerate and coal

5c — Notikewin Member -- sandstone, siltstone; minor coal (P, Q and R zones)

5b — Falher Member -- conglomerate, sandstone, coal and siltstone (A, B, C2, C, D and E zones); variably-carbonaceous to coaly mudstone

5a — Torrens Member -- sandstone (Quintette and Torrens sands), minor siltstone and mudstone (Medial silty zone)

4 — Moosebar Formation -- marine siltstone and mudstone; minor sandstone and tuff; basal pebbly glauconitic sandstone

4c — Spieker Member -- marine siltstone and sandstone

4ab — Cowmoose member (informal) -- mudstone; minor tuff; pebbly glauconitic sandstone at base (not Bluesky Member)

BULLHEAD GROUP (Barremian to Aptian)

3 — Gething Formation -- siltstone, sandstone, conglomerate and coal

3bcd — Chamberlain, Bullmoose and Bluesky Members (undivided) -- sandstone, siltstone, coal (Bird, Skeeter and Chamberlain zones); marine mudstone and siltstone in basal part; Bluesky glauconitic sandstone at base (not mapped separately at this scale)

3a — Gaylard Member -- sandstone, siltstone and coal; lenses of conglomerate near base

2 — Cadomin Formation -- cliff-forming conglomerate and sandstone; minor siltstone

MINNES GROUP (Berriasian to Valanginian)

1 — Monach Formation -- sandstone, conglomerate and coal

Schilling Thrust
Barrens Anticline
Headwaters Thrust
East Bullmoose Thrust
Bullmoose Thrust
Spieker (Main) Syncline
East Bullmoose Anticline
Jones Syncline
Fortress Mountain Anticline
Fortress Mountain Syncline
Fortress Mountain West Anticline
Boundary of EB Trend lands

Drawing file:EB-Trend-workmap-geology-141026b.srf/jpg
Date: 2014 October 26 Horizontal datum: UTM Zone 10N NAD83
Scale: as shown on bar-scale
Imagery: Compiled from work by A. Legun P.Geo.(BC), B.C. Geological Survey, and by staff of Robertson Research, Mitsui Mining and Ranger Oil
Drawn by: C.G. Cathyl-Huhn P.Geo.(BC) Lic.Geol.(WA) RMSME
Caution to the user: locations of historic boreholes are not consistently shown on available base-maps; field-check is required

COAL LICENCES

EB Trend Property

Other tenures within the East Bullmoose properties

REV	DATE	DESCRIPTION
B	Oct/26/2014	Accesss road to a-100-C wellsite

WALTER ENERGY

Drawn by:	GCH
Checked by:	GCH
Approved by:	GCH
Revision No.	B
Dwg. No.	

GEOLOGY OF THE EB TREND PROPERTY

OCT 2014 | EB TREND COAL ASSESSMENT REPORT | Figure No. MAP 2-3

BOREHOLES AND WELLS

Walter Energy / Western Coal drilling:

- Current (year-2013) drilling
- Current (year-2001 to year-2011) drilling
- Hydrologic test hole or groundwater well
- Historic drilling (before year-2001) by others
- Off-property drilling by others (may be incomplete)
- Natural-gas exploration wells (current status varies)

UTM Grid North

6114000 6113000 6112000 6111000 6110000 6109000 6108000 6107000 6106000 6105000 6104000 6103000

597000 598000 599000 600000 601000 602000 603000 604000 605000 606000 607000 608000