ASSESSMENT REPORT TITLE PAGE AND SUMMARY

BC Geological Survey
Coal Assessment Report
956

TITLE OF REPORT: Groundhog Property 2013 Geological Assessment Report

TOTAL COST: $8,661,287.98

AUTHOR(S): Hayden Mackenzie & Brad Van Den Bussche, P. Geol.

SIGNATURE(S):

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YEAR OF WORK: 2013

PROPERTY NAME: Groundhog

CLAIM NAME(S) (on which work was done):

417079, 417080, 417081, 417082, 417085, **41708**8, 417089, 417090, 417094, 417095, 417096, 417098, 417520, 417521, 417522, 417523

COMMODITIES SOUGHT: Anthracite Coal

MINERAL INVENTORY MINFILE NUMBER(S),IF KNOWN:

MINING DIVISION: Ominica
NTS / BCGS: 104 A 16
LATITUDE: 56° 52’ __________"
LONGITUDE: 128° 26’ __________" (at centre of work)
UTM Zone: 9N EASTING: 545000 NORTHING: 6305000

OWNER(S): Atrum Coal Groundhog Inc.

MAILING ADDRESS: 401-915 Fort Street, Victoria, BC V8V 3K3

OPERATOR(S) [who paid for the work]: Atrum Coal Groundhog Inc.

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REPORT KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralization, size and attitude. **Do not use abbreviations or codes**)

Anthracite; Groundhog

REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS:

TYPE OF WORK IN THIS REPORT	EXTENT OF WORK (in metric units)	ON WHICH CLAIMS	PROJECT COSTS APPORTIONED (incl. support)
GEOLOGICAL (scale, area)			
Ground, mapping			
Photo interpretation			
GEOPHYSICAL (line-kilometres)			
Ground			
Magnetic			
Electromagnetic			
Induced Polarization			
Radiometric			
Seismic			
Other			
Airborne			
GEOCHEMICAL (number of samples analysed for …)			
Soil			
Silt			
Rock			
Other			
DRILLING (total metres, number of holes, size, storage location)			
Core	8000 m 43 HQ, 21 PQ. Groundhog Camp	417079, 417094, 417080, 417095, 417081, 417096, 417082, 417098, 417085, 417520, **41708**8, 417521, 417089, 417522, 417090, 417523	8,661,287.98
Non-core			
RELATED TECHNICAL			
Sampling / Assaying			
Petrographic			
Mineralographic			
Metallurgic			
PROSPECTING (scale/area)			
PREPATORY / PHYSICAL			
Line/grid (km)			
Topo/Photogrammetric (scale, area)			
Legal Surveys (scale, area)			
Road, local access (km)/trail			
Trench (number/metres)			
Underground development (metres)			
Other			
		TOTAL COST	8,661,287.98

Portions of Section 6 (Coal Quality) and Section 7 (Resources), and all parts of Appendices 5, 6, 7, 8, 9, and 12 remain confidential under the terms of the Coal Act Regulation, and have been removed from the public version.

http://www.bclaws.ca/civix/document/id/complete/statreg/251_2004

Groundhog Anthracite Project Geological Assessment Report 2013

Atrum Coal

September 2014

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1. Summary

The Groundhog Anthracite Project (Groundhog) is situated within the Groundhog Coalfield located in northwestern British Columbia's Cassiar Land District. The project lies close to the northern extremity of the Skeena Mountains within the Bowser Basin approximately 180 km north of Hazelton and 150 km northeast of Stewart, British Columbia, Canada. Other nearby cities include Smithers, British Columbia 240 km to the south, and Prince George, British Columbia 490 km to the southeast. Current access to Atrum Coal's Groundhog Project is limited to the Chipmunk and Kluatantan airstrips, both of which are located southeast of the property.

In May 2012 Atrum Coal Groundhog Inc. (Atrum) acquired Groundhog and conducted their first field program in September and October 2012. A second field program ran from May to October 2013 with a focus on the north-west section of the property.
The Groundhog Anthracite Property currently consists of 16 contiguous coal licences covering 7,472ha and seven adjoining coal licence applications covering 11,118 Ha for a total of 18,590 ha.

Geologically, the Groundhog Coalfield is located in the northern portion of the Bowser Basin, bounded by the Skeena Arch to the north and the Stikine Arch to the south

Using the nomenclature coined by Cookanoo and Bustin in 1991, the formations of the Bowser Lake Group from oldest to youngest are as follows: the Ashman Formation, Currier Formation, McEvoy Formation, and the Devil's Claw Formation. The coal measures are located within the Currier Formation, which at Groundhog is approximately 600 metres thick and comprised of siltstone, mudstone, sandstone and coal. There are at least 25 known coal seams within the Currier Formation on the Groundhog Property, numbered from #90 at the top of the coal sequence through to #10 seam located at the base of the coal sequence. Seam numbers in increments of 5 are typically more significant and easier to correlate. Seams range in thickness from tens of centimetres to more than 7 metres, and typically range from .5 to 3 metres for the main seams. The sediments of the Bowser basin have undergone two major deformational events, the first of which was of the highest intensity. Compression from the northeast and the southwest occurred during the uplift of the Coast Crystalline Belt. Locally the result of this F1 deformation can be observed in the northwest-southeast trending Beirnes Synclinorium.

The 2012 field program consisted of 4,992 metres of drilling in 15 diamond drill cored holes, all of which were located on the coal licences. In total 833 core samples were collected from the 2012 drilling program, of which 507 individual ply samples were analyzed for raw coal quality. From the initial ply samples, 80 composite samples were made to represent some potential product intervals and basic size and washability work was done on these composites. In addition 10 samples were selected and petrographic analysis was performed by Pearson and Associates of Victoria, BC.

The 2013 field program consisted of approximately 8000 meters of drilling in 64 diamond drill cored holes, all of which were located on the coal licences. 43 of the holes were HQ and 21 were PQ. Many of the holes were drilled from a common pad, some inclined and others to gain a larger bulk sample. In total 1216 core samples were collected from the 2013 drilling program and sent to either ALS laboratories in Richmond or Loring Laboratories in Calgary. All samples were weighed and air dried, some were selected for testing, others were combined to create composite

samples. Drop shatter tests, sizing, washability and an extended series of coal quality tests were done on these composites. In addition, 14 samples were selected for geotechnical testing including 14 UCS with modulus, 7 slake durability and 3 direct shear tests were conducted by Golder Associates in Vancouver, BC.

Coal on the Groundhog Coalfield is anthracite in rank by the ASTM classification of coal rank with RoMax vitrinite values generally ranging from 3.83 to more than 5 percent.

Air Dry moisture from the raw coal quality analysis of all samples ranges from <.1 to 4% and averages about .8% Air dry ash ranges from 15.35 to 93% and averages 50% (this range and average includes rock partings within the coal seams therefore skewing the results towards a higher ash average). Sulphur on an air dry basis ranges from near zero to 17% and averages 1.5% with a median of .7% (the high sulphur values in some samples are typically due to the nugget effect of pyrite nodules)

The results show it is possible to clean the raw coal to less than 10% ash product with a calorific value around 7500Kcal/kg.

Coal resources have been estimated and reported according to resource classification in two large resource blocks – namely, Block "Res_01" located on the eastern side of the Skeena River, and Block "Res_02" located on the western side of the Skeena River. Resource blocks are limited by tenement outlines, a 100 metre offset from the Skeena River and by an interpreted fault boundary in the south east. The summary coal resource table for reporting under the JORC Code, 2004, is shown below

TABLE 1.1: RESOURCE ESTIMATION TABLE

Depth	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	TOTAL (Mt)
<50 m	2	61	91	154
<100 m	7	168	240	415
<200 m	13	388	592	993
<300 m	16	521	883	1420
<400 m	16	553	998	1567

2. Introduction

2.1. Location and Physiographic Setting

The Groundhog Anthracite Project (Groundhog) is situated within the Groundhog Coalfield located in northwestern British Columbia's Cassiar Land District. The project lies close to the northern extremity of the Skeena Mountains within the Bowser Basin approximately 180 km north of Hazelton and 150 km northeast of Stewart, British Columbia, Canada. Other nearby cities include Smithers, British Columbia 240 km to the south, and Prince George, British Columbia 490 km to the southeast (Figure 2.1)

FIGURE 2.1: LOCATION OF GROUNDHOG ANTHRACITE PROJECT, NEARBY PORTS AND RAILWAY LINES

The Groundhog Coalfield sits within the catchment area of Skeena River system. The Groundhog Anthracite property itself is bisected north to south by the Skeena River and is contained to the western slopes of the Skeena River valley and the northeast flank of Devil's Claw Mountain. The property reaches from the north slope of Mt. Jackson to just south of Beirnes Creek, and the drainages of Discovery, Davis, Evans, and Anthracite Creek run though the property from the southwest to the northeast until they meet the Skeena River. The eastern portion of the property is characterized by low to moderate relief while the western edge of the property's elevation is steeper due the position of Devil's Claw Mountain.

The most abundant trees in the area are the alpine species including spruce and fir as well as poplar. The tree line is approximately 1,350m with tree growth fairly dense below 1,100m.

2.2. Access

Current access to Atrum Coal's Groundhog Project is limited to the Chipmunk and Kluatantan airstrips, both of which are located southeast of the property. The Kluatantan airstrip lies directly beside the project's base camp and is used regularly by fixed wing aircraft and helicopters providing transport and supplies to the camp.

A portion of the British Columbia Railway (BCR) extends from Prince George northwest to Bear Lake. Prior to 1977 steel for the rail was laid from Bear Lake to the Chipmunk airstrip located 30 km southeast of the property but the railway was not completed. North of the airstrip a construction road was graded and cleared parallel to the east bank of the Skeena River and continues to 5 km southeast of the property. From this point to just beyond the northern edge of the property the line has been graded and cleared but remains in poor condition.

If the rail line leading to the Groundhog Property were to be completed, access to sea ports along the west coast would be possible. The distance by rail from Atrum's property to Fort St. James, Prince George, Prince Rupert, and Vancouver is 381 km, 497 km, 1,234 km, and 1,294 km respectively.

2.3. Climate

The regional climate surrounding the Groundhog Property can be classed as Northern Cordillera and is characterized by long sub-zero winters and short cool summers. The Chipmunk Weather Station located approximately 25 km southeast of the property has recorded average monthly temperatures from -17.8 degrees Celsius in January to 12.0 degrees Celsius in July. The average precipitation recorded in the nearby Dease Lake is 420 mm per year, which includes the rainfall equivalent of a mean annual snowfall of 229 cm per year. In 2013 Atrum installed a weather station in the field area in the north-west section of the field area, this continues to gather local weather data.

River monitoring stations were installed early in the 2013 field season on the Skeena River and other major tributaries, these constantly monitor water levels and monthly samples are taken to gather base line data for water quality. Water level and quality are also monitored through two down hole piezometers and four monitoring wells which were installed towards the end of the drilling program in September and October 2013.

2.4. Historical Perspective

During the 1872 to 1878 gold rush, prospectors traveling to Cassiar from Fraser Lake made the first coal discoveries near the Groundhog Coalfield. It wasn't until 1900 though, that the first report mentioning the Groundhog Coalfield was given to the Canadian Department of Railways and Canals by V.H. Dupont. His report detailed the existence of several outcroppings of coal located at the convergence of Didene Creek and the Spatsizi River approximately 50 km northwest of Atrum Coal's current Groundhog Project.

In 1903 the first claims were staked in the Groundhog Coalfield by James McEvoy and W.W. Leach, who also has holdings on the Skeena River and the Discovery, Currier and Davis Creeks. Preliminary exploration of the area commenced in 1904 and inquiries were made into the building of a rail route near the coalfield.

During the period between 1910 and 1912 exploration was carried out by various companies and individuals. G.H. Malloch completed a geological evaluation of the southern Groundhog Property in 1911 and was the first to begin applying nomenclature to the local stratigraphic formations. The abundance of interest in the area around this time was partially due to the expectation that the Canadian Northeastern Railway would be built to extend near the Groundhog Coalfield's location. With the onset of World War One all exploration ceased along with the railway construction.

Activity at the Groundhog Coalfield did not resume until several years after the end of the Second World War. In 1948 A.F. Buckman and B.A. Latour of the Geological Survey of Canada (GSC) conducted geological reconnaissance and compiled a report of their findings along with the details of all previous exploration that had taken place. The GSC revisited the Groundhog Coalfield in 1957 with Operation Stikine. This resulted in the creation of a base map but no definitive correlation of coal seams, stratigraphy, or structural information.

In 1966 Coastal Coal acquired coal exploration licences on the Discovery Property in the Groundhog Coalfield. Two years later in 1968 Professor R.V. Best and a team spent nine weeks conducting helicopter assisted exploration of the licenced areas during which approximately 3,885 km^2 was mapped. From this exploration, Best was able to divide the local strata into four definable unites: Lower Conglomerate, Lower Shale, Upper Shale and Upper Conglomerate. The 56 surface samples taken during this time were subjected to proximate analysis. The report written by J.M. Black detailed the results of this analysis but did not indicate which laboratory processed the samples. Black's report also provided the sample's locations on extensive hand drawn geological maps of the property.

From 1969 to 1970, W.D. Thompson led a joint venture in the Groundhog Coalfield between Quintana Minerals Corporation, National Coal Corporation Ltd, and Placer Development Ltd. Exploration consisted of surface mapping and six diamond drill holes, most of which plot just west of Atrum Coal's current Groundhog Property. Samples were taken from coal seams within the six drill holes and sent for proximate analysis and specific gravity testing at Commercial Testing and Engineering (CT&E) in Ladner, British Columbia.

Thompson's team determined that the property was directly underlain by rocks of what was termed the "Coal-Bearing Lithosome". This lithosome was part of the nomenclature Thompson had designed for the stratigraphic sequence he assembled for the property, which is listed in depositional order as follows: McEvoy Ridge Lithosome, Coal-Bearing Lithosome, Devil's Claw Conglomerate Lithosome and the Lonesome Mountain Lithosome. The local strata were further subdivided into three facies and correlated with the depositional and tectonic history of the Bowser Basin in 1974 by G.H Eisbacher. Eisbacher examined the eastern margin of the basin and applied the following titles to his subdivisions: Duti River-Slamgeesh Facies, Groundhog-Gunanoot Facies, and the Jenkins Creek Facies.

In 1977 BC Hydro considered using coal to operate a thermal power generating plant and appointed W.D. Thompson, from the previously mentioned joint venture, to review all work that had been done in the Groundhog Coalfield. All drilling, trenching, sampling and mapping was detailed in an extensive report. After examining all existing information, Thompson stated "The coalfield is in the very early stages of exploration, so therefore it is not possible to accurately calculate the coal reserves or the tonnage of recoverable clean coal. However, it is shown that the area between Evans Creek and Discovery Creek is underlain by relatively undisturbed coal seams." From this data Thompson determined four exploration targets for BC Hydro to explore.

In 1978 Groundhog Coal acquired seventy-seven coal exploration licences in the Groundhog Coalfield. The company started out with a large exploration program aimed at reviewing and confirming previous work done in the area, but after some initial analysis it was decided that the local geology was not as clearly defined as originally anticipated. The project was reorganized with a focus on the more promising targets, and coal exploration licences were reduced from seventy-seven to three which encompassed parts of Upper Discovery Creek and Davis Creek. Traverses along both Upper Discovery Creek and Davis Creek were carried out by B. Mountford in the field seasons of 1978 and 1979. Mountford dug out and measured partially exposed coal seams along Upper Discovery Creek but noted he was unable to locate several of the coal seams along Davis Creek which had been mentioned in previous reports.

In 1980 Mountford, accompanied by L.G. Scott, completed a helicopter assisted preliminary geological program on the three remaining Groundhog Coal exploration licences. Kerr reported after mapping a 25 km area with evenly spaced 25m grids that coal outcroppings were few and far between and generally only found adjacent to the main creeks. When encountered, the coal seams were sampled and mapped in detail. Measurements taken during these field excursions led Kerr to conclude that there was no evidence to support the existence of any major structural disturbances in the Groundhog Coalfield aside from gently dipping 10^{o} to 20^{o} beds with strikes varying from 130^{o} to 185^{o}. Surface samples taken were sent for proximal analysis at Commercial Testing and Engineering (CT&E) in Ladner, British Columbia.

Later in 1980, L.G. Scott obtained 6 more coal exploration licences in the Groundhog Coalfield, of which John Kerr and team completed a cumulative eleven day preliminary analysis. These new licences covered several known and projected coal outcroppings near Telfer Creek, Beirnes Creek, and Currier Creek.

In 1981 coal exploration licences were issued to Petro-Canada for the eastern boundary of the Groundhog Coalfield. After initial exploration of the area, Petro-Canada concluded that insufficient thickness and quality of the coal seams, in conjunction with tight folding, made the area unsuitable for conventional mining. Despite suggesting that the currently held licences be abandoned, Petro-Canada recommended the close monitoring of any GSC programs taking place in the Bowser Basin as well as any exploration being conducted by other licence holders in the area.

Other work completed in 1981 with the Groundhog Coalfield included six diamond drill holes completed by Imperial Metals near or on the current Groundhog Property. No official report was released but geophysical logs, strip logs, and descriptive logs were filed with the BC government.

In 1982 and 1983 Suncor acquired twenty-nine coal exploration licences amounting to a 6,439 hectare property located in the southern portion of the Groundhog Coalfield near Mount Jackson. In 1983 Suncor carried out a helicopter supported geological mapping, trenching, and sampling program spanning all the licences held. Sixteen trenches totaling 104.2m were dug, and samples taken were sent to Calgary for analyses by Birtley Coal and Minerals Testing Ltd. Field teams traversed the exposed south facing slopes of Mount Jackson and Falconer Mountain. From these traverses stratigraphic columns were created and it was interpreted that coal seams should be present underneath the lower north facing slopes of Mount Jackson and extend beneath the Jackson Flats, McEvoy Flats, and Trail Creek.

In 1984 Groundhog Coal Limited commenced an exploration program on six licences they obtained in 1982. The licences were located west of the Skeena River valley between Beirnes Creek and Currier Creek. The program consisted of geological mapping, trenching, and sampling but no drill program was conducted. A total of twelve trenches were dug, from which 23 representative coal samples were taken and subjected to analysis at Cyclone Engineering Sales Ltd. (Cyclone) in Edmonton, Alberta.

Indicated resource estimates calculated by Groundhog Coal Limited following their 1984 exploration program included information obtained from samples, trenches, and diamond drill holes completed by National Joint Venture's 1970 program and Imperial Metals' 1981 program. Estimates were based on the classifications adopted by Cordillera Region and Energy, Mines and Resources Canada in Report ER79-9, Coal Resources and Reserves of Canada. In their report Groundhog Coal Limited further defined their indicated resources as "those computed partly from specific measurements and partly from reasonable geologic projections. For the mountainous regions the maximum distance between points of observation should be 600 metres or less". According to those parameters Groundhog Coal Limited calculated the historical in-situ indicated resources at 11.5 million tonnes within their coal exploration licence area.

Gulf Resources Canada Limited also conducted exploration programs in 1983 and 1984 on thirty-two coal exploration licences making up their Evans Creek Property just east of the licences held by Groundhog Coal Limited. The programs consisted of helicopter supported 1:10,000 scale geological mapping based along drainage channels, and nine hand trenches. Representative samples taken from trenched coal seams with a true thickness greater than 0.5 metres were sent to C T & E in 1983 and Loring Laboratories Ltd in Calgary, Alberta for analysis in 1984.

Between 1985 and 1988 Gulf added eighteen new licences to the south of their initial thirty-two licences. Work done in 1985 on the Evans Creek Property was used as the basis for a speculative resource estimate 504 million tonnes. After an exploration program consisting of geological mapping, trenching, and sampling was carried out in 1988, Gulf's speculative resources estimate for the expanded Evans Creek Property was brought up to 1,538Mt.

In 2008, a drill program was completed by WestHawk. The work consisted of geologic mapping, trenching, diamond drilling, downhole geophysical logging, sampling and subsequent analytical work. Samples were subjected to both coal quality analyses and one sample was tested for vitrinite reflectance.

The original 2012 Moose Mountain Technical Services model was built with twenty-three diamond drillholes totaling 4,643.2m and 30 hand trenches totaling 95.5m.

In May 2012 Atrum Coal Groundhog Inc. (Atrum) acquired Groundhog and conducted their first field program in September and October 2012.
Atrum conducted an extensive field program consisting of diamond core drilling, field mapping and hand trenching from May to October in 2013.

2.5. Acknowledgements

The work undertaken for the Groundhog geological investigation between September 2012 and November 2013, including the 2012 field exploration program was conducted by various contractors, consultants and staff under the management and supervision of Atrum Coal Groundhog Ltd. staff. This report was prepared by Mr. B Van Den Bussche of Kaybri Resource Management Ltd. with input from Hayden Mackenzie and the rest of the Atrum geological staff and the following groups:

- Loring Laboratories Ltd. for sample coal quality analyses
- Pearson Petrographics for coal petrographic analysis
- Dr. Barry Ryan for input and assistance in coal quality analysis
- CJL Enterprises for Management and Expediting
- Lakelse Helicopters for helicopter field support
- Century Geophysics for downhole geophysical logging
- Moose Mountain Resources for geological consulting support
- Earnest Popyk for coal logging and quality support
- Tysata Airlines for fixed wing air support
- Driftwood Drilling Ltd. for Core Drilling Services
- Knight Piesold
- McElhanney
- Shane Uren for environmental work and permitting
- ALS Labs for sample coal quality analysis
- Golder Associates for geotechnical work
- DMT Geosciences for field staff

Mr. Brad Van Den Bussche (P.Geol.) of Atrum Coal Groundhog Inc. received a Bachelor of Science Degree in Geology (Honors) (1985) from the University of Manitoba and is a professional geologist registered under APEGGA in the Province of Alberta. Since university graduation he has been employed as an exploration and development geologist with Gulf Canada Resources Ltd., worked as Chief Geologist at Norwest Mine Services Ltd., was involved as a partner at Coal Gas Technology Ltd., and worked as VP Exploration for numerous junior resource companies (Richards Oil and Gas Ltd., Antioquia Gold Inc. and Atrum Coal NL) through his wholly owned consulting company Kaybri Resource Management Ltd.

Mr. Hayden Mackenzie of Atrum Coal Groundhog received a Bachelor of Science in Geology and a Master of Science in Engineering Geology from the University of Canterbury. Hayden has been employed as a Geologist and Engineering Geologist with CRL Energy in New Zealand with published research on acid rock drainage remediation as well as extensive experience in exploration project management for coal and Coal Bed Methane programs in New Zealand, Indonesia and Vietnam. He worked as a Senior Geologist for Coal Marketing International, managing exploration programs in Indonesia and Australia and conducting research and analysis of international coal markets and trading. Hayden has been working directly and indirectly through DMT Geosciences with Atrum Coal since May 2013 and is now the Atrum Coal Geology Manager.

3. Tenure

The Groundhog Anthracite Property currently consists of 16 contiguous coal licences covering 7,472 Ha and seven adjoining coal licence applications covering 11,118 Ha for a total of 18,590 Ha. The property coal licences are all held by Atrum Coal Groundhog Inc. and are summarized on Table 3.1 and Table 3.2 and shown on Figure 3.1 – a larger map is appended (Appendix 14)

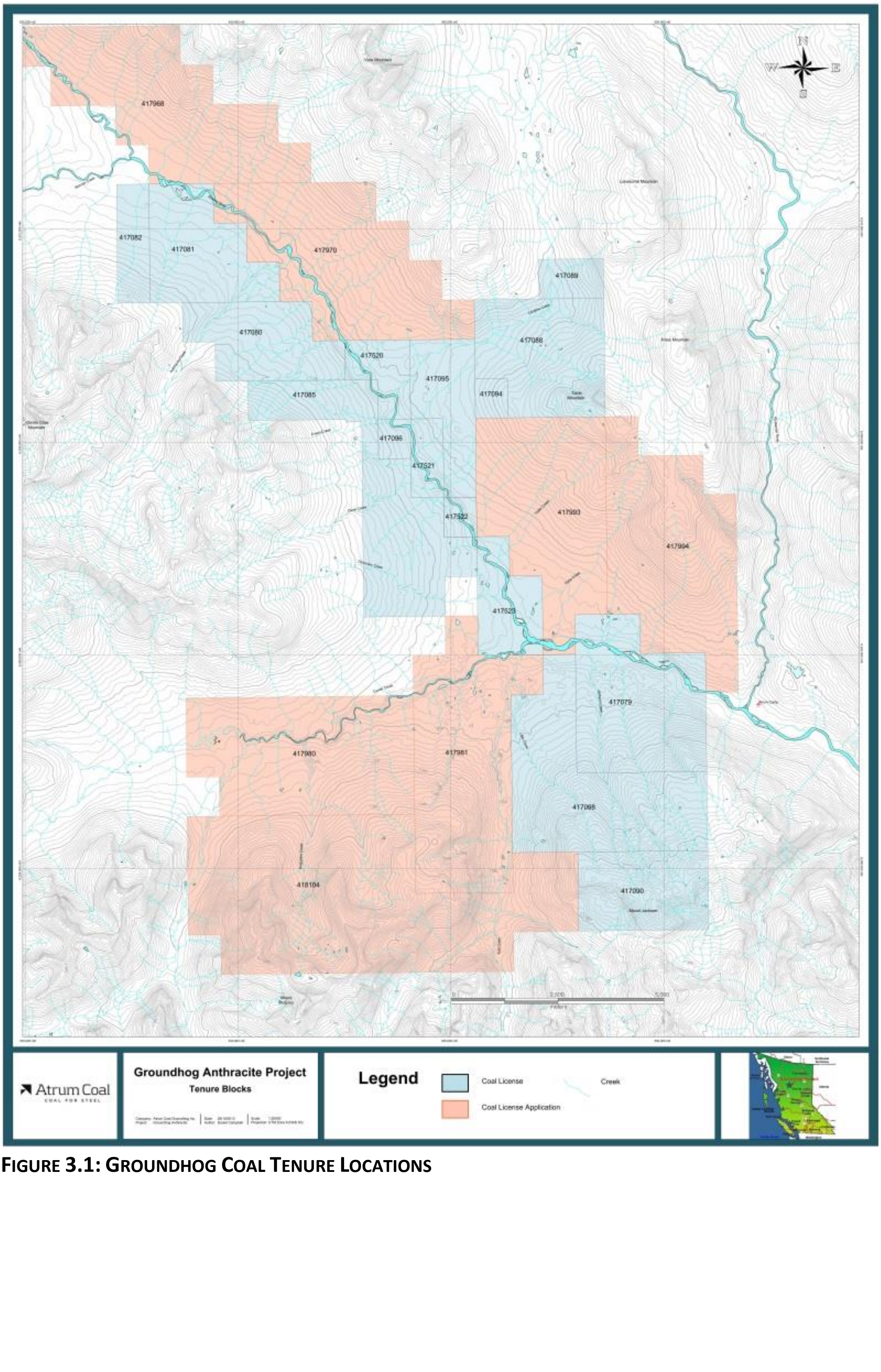


FIGURE 3.1: GROUNDHOG COAL TENURE LOCATIONS

TABLE 3.1: GROUNDHOG COAL TENURES - COAL LICENSES

Tenure Number	Owner Number		Map Number	Work Recorded To	Status	Mining Division	Area
417079	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	991
417080	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	565
417081	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	636
417082	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	212
417085	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	1031
417088	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	777
417089	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	142
417090	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	568
417094	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	71
417095	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	425
417096	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	71
417098	147498	100%	104A089	2013.10.21	Good standing	15 OMINECA	1204
417520	147498	100%	104A089	2013.09.12	Good standing	15 OMINECA	212
417521	147498	100%	104A089	2013.09.12	Good standing	15 OMINECA	142
417522	147498	100%	104A089	2013.09.12	Good standing	15 OMINECA	71
417523	147498	100%	104A089	2013.09.12	Good standing	15 OMINECA	354

TABLE 3.2: GROUNDHOG COAL TENURES - COAL LICENSE APPLICATIONS

Tenure Number	Owner Number		Map Number	Work Recorded To	Status	Mining Division	Area
418104	147498	100%	104A089		Good standing	15 OMINECA	2775
417968	147498	100%	104A089		Good standing	15 OMINECA	1411
417970	147498	100%	104A089		Good standing	15 OMINECA	1412
417993	147498	100%	104A089		Good standing	15 OMINECA	1273
417994	147498	100%	104A089		Good standing	15 OMINECA	1415
417981	147498	100%	104A089		Good standing	15 OMINECA	1416
417980	147498	100%	104A089		Good standing	15 OMINECA	1416

4. Geology

4.1. Regional Geology

The Groundhog Coalfield is located in the northern portion of the Bowser Basin, bounded by the Skeena Arch to the north and the Stikine Arch to the south (Figure 4.1). The basin is situated in the Cordilleran Eugeosyncline and characterized by a regressive coarsening upwards sequence of clastic sediments deposited when uplift of the Coastal Mountains formed an inland sea. This marine regression deposited an approximately 4000 metre thick regressive sequence known as the Bowser Lake Group. The Bowser Lake Group is unconformably overlain by the Late Cretaceous Tango Creek Member of the Sustut Group and unconformably overlies the Triassic/Jurassic Takla-Hazelton assemblage, though neither of these bounding assemblages is present on Atrum Coal's Property. Figure 4.2 shows a Stratigraphic Column for the Groundhog Property.

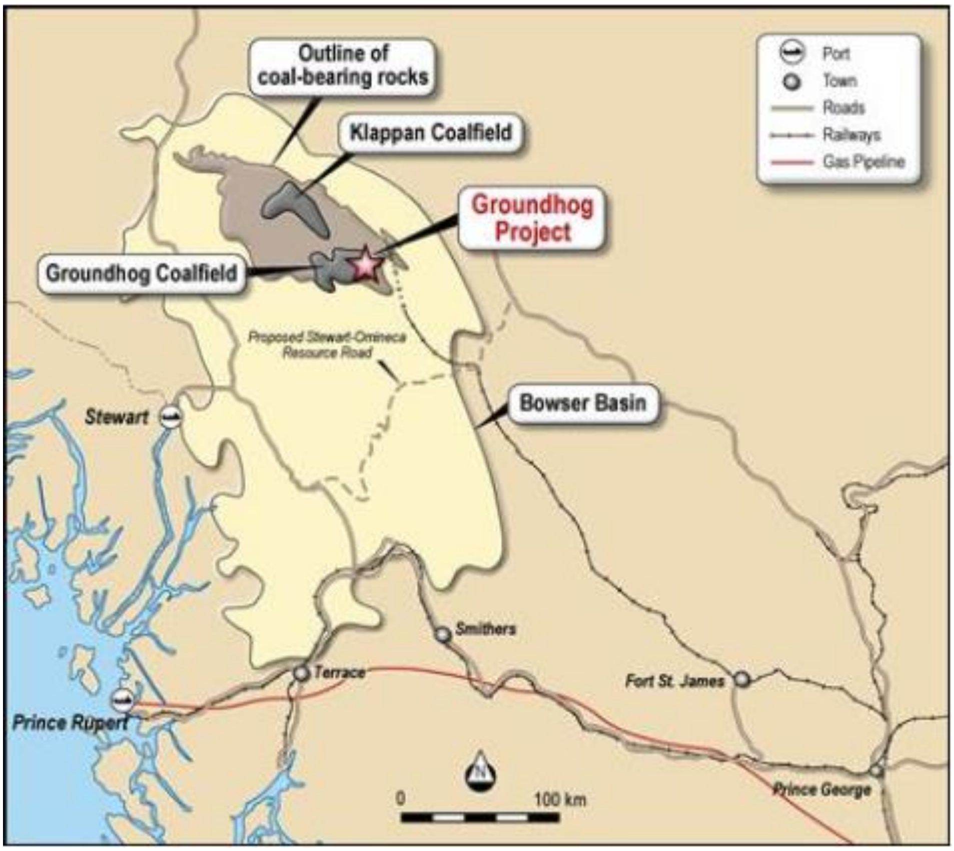


FIGURE 4.1: GROUNDHOG COALFIELD LOCATION

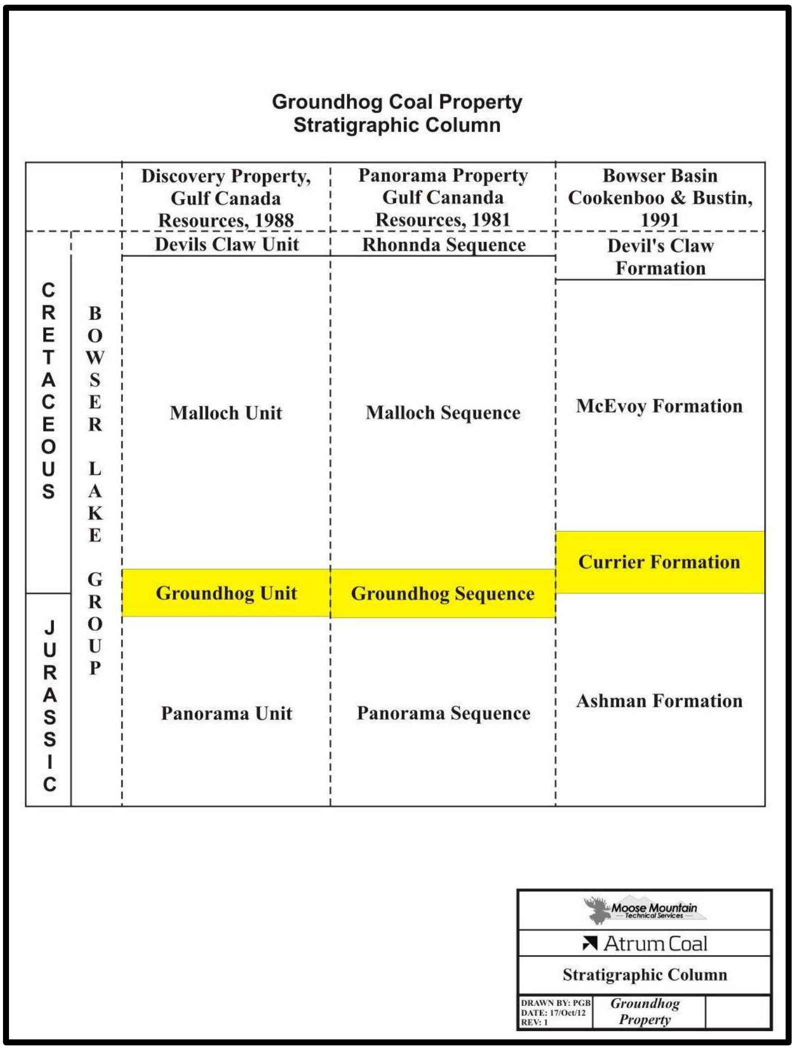


FIGURE 4.2: STRATIGRAPHIC COLUMN (TABLE OF FORMATIONS) - GROUNDHOG PROPERTY, (MMTS, 2012)

Using the nomenclature coined by Cookanoo and Bustin in 1991, the formations of the Bowser Lake Group from oldest to youngest are as follows: the Ashman Formation, Currier Formation, McEvoy Formation, and the Devil's Claw Formation.

4.1.1. Ashman Formation

The approximately 1800 metre thick, fully marine Ashman Formation is the oldest formation in the Bowser Lake Group and has been referred to in pre-1991 reports as the Panorama Sequence or the Panorama Unit. The Jurassic age formation is composed of mostly dark bluish grey to black shale that coarsens upwards repetitively to shallow-marine sandy mudstone and sandstone. Weathered tan coloured sandstone units near the top of the formation have been noted by Gulf geologists as containing bivalve fossils.

4.1.2. Currier Formation

The Currier Formation is approximately 1000 metre thick and is the primary coal bearing formation of the Groundhog Coalfield. Prior to 1991 the Currier Formation was referred to either as the Groundhog Sequence or Groundhog Unit. The change from a fully marine depositional environment to this alternating marine and non-marine depositional environment is recorded in the gradational contact between the Ashman and Currier Formations. The deltaic Currier

Formation is composed of alternating beds of shale and sandstone with lesser amounts of siltstone, conglomerate and coal. The coarsening upwards strata range from 30 to 60 metre thick beds at the bottom of the formation then begin to thin into 6 to 10 metre thick beds approaching the top.

Gulf geologists noted that the thickest coal seams were located closer to the bottom of the Currier Formation in what they called the Groundhog Unit which was approximately 600 metres thick. The unit is reported as having a slight orange colour to it which helped distinguish it from the underlying Panorama Unit (Ashman Formation). A one metre thick orange band of bivalve bearing mudstone was recorded by Gulf as overlying the thick orange sandstone bed which marks the top of the Panorama Unit (Ashman Formation). Despite being distinctive, the bivalve bearing bed is discontinuous and has thus far not been useful for correlation purposes.

Historically the northern part of the Bowser Basin has good coal development within the Currier Formation. Twenty-five meta-anthracite to anthracite grade coal seams have been recorded in the northern Bowser Basin.

4.1.3. McEvoy Formation

Strata from the 600 to 1000 metre thick McEvoy Formation are interpreted as being deposited in paralic marine and brackish waters from a fluvially dominated delta system. Evidence for this depositional environment can be seen in terrestrial plant fossils preserved in the sediments. Coarsening-upward, silty mudstones are the dominant facies but sandstones and conglomerates are present, as well as thin sub-anthracite seams. The gradational contact with the overlaying Devil’s Claw Formation is observed as a major increase in the frequency of conglomerate units.

4.1.4. Devil’s Claw Formation

The Devil’s Claw Formation consists primarily of thick successions of conglomerates with minor interbeds of sandstone, siltstone and shale. This 300 to 500 metre thick formation is interpreted as being deposited in a high energy environment such as that of an alluvial fan. Both large scale cross bedding of conglomerates with pebble to cobble sized clasts and homogenous conglomerates can be seen in the Devil’s Claw Formation. Both are clast-supported and composed of well-sorted and well-rounded chert, volcanic quartz and occasionally granodiorite clasts.

4.2. Local Geology

4.2.1. Coal Seam Geology

The coal-bearing Currier Formation consists of alternating beds of shale and sandstone, with lesser amounts of siltstone, conglomerate and coal. Strata are generally arranged in coarsening-upward units ranging from 30 m to 60 m thick in the lower part of the formation. On the Groundhog Anthracite Project, the thickness of the coal-bearing unit, locally known as the Groundhog Unit, is approximately 600 m thick.

Coal occurrences indicate the base of the Groundhog unit.

Atrum’s 2013 exploration drilling program focussed on the northwest sector (known as the ‘North West Area’) of the Groundhog Anthracite project. Specific licence numbers are listed below in Table 4.1. The exploration focus in the North West Area (NW area) during 2013 was a consequence of the positive coal intersections derived from the eight cored drillholes drilled during the 2012 season. Drill site locations are shown in Figure 4.3.

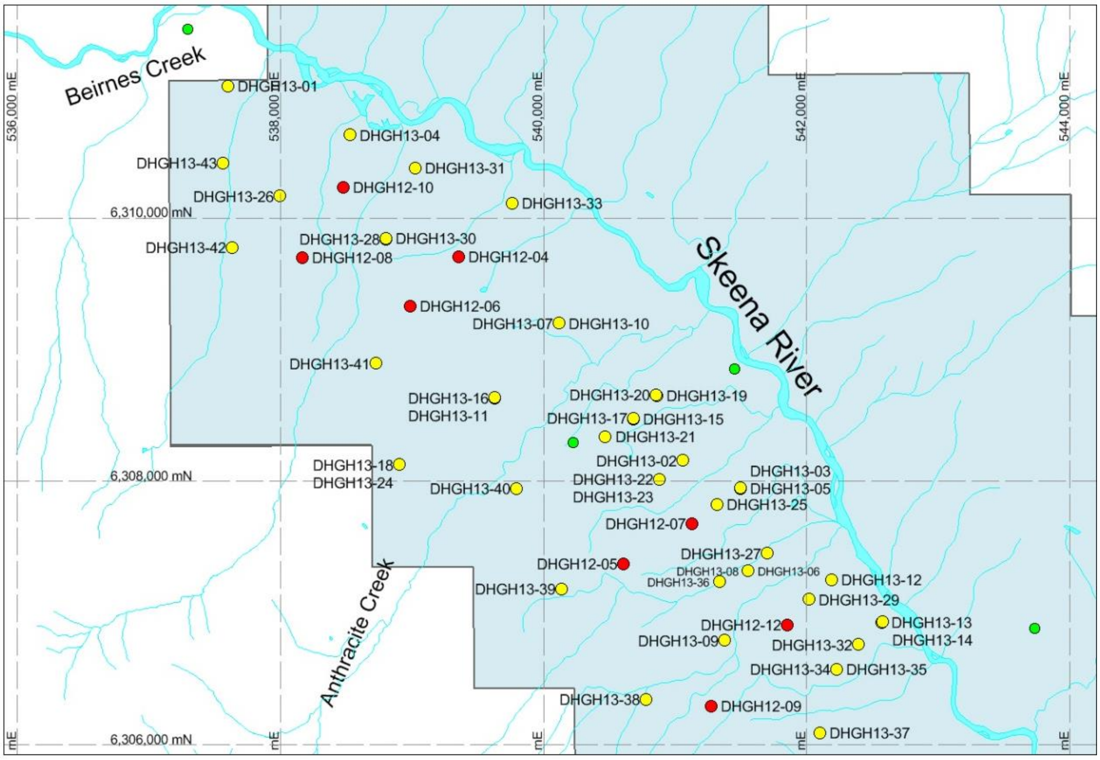


FIGURE 4.3: DRILLHOLE LOCATIONS WITHIN THE NW AREA

TABLE 4.1: LIST OF LICENSE NUMBERS WITHIN THE NW AREA

Licence Number
417298
417297
417528
417082
417081
417080
417083
471085

The 2013 drilling comprised of 43 HQ diamond drillholes (both inclined and vertical), and an additional 19 PQ holes. Combined with the historic drilling and trenches, a total of 52 drill holes and 5 trenches are located within the NW area. Table 4.2 is a list of all drillholes and trenches within the NW area.

TABLE 4.2: LIST OF HQ DRILLHOLES AND TRENCHES WITHIN THE NW AREA

ID	YEAR	AZIMUTH	DIP	TOTAL DEPTH	EASTING	NORTHING	ELEVATION	TYPE
DDH_81_06	1981	0	-90	133.19	540223	6308295	1083.47	Cored
DHGH12_04	2012	0	-90	309.67	539352	6309707	1064.25	Cored
DHGH12_05	2012	0	-90	333.75	540607	6307374	1152.36	Cored
DHGH12_06	2012	0	-90	315.77	538983	6309330	1104.07	Cored
DHGH12_07	2012	0	-90	288.64	541125	6307678	1105.74	Cored
DHGH12_08	2012	0	-90	307.23	538166	6309698	1100.35	Cored
DHGH12_09	2012	0	-90	398.06	541271	6306293	1178.92	Cored
DHGH12_10	2012	0	-90	309.67	538480	6310235	1053.12	Cored
DHGH12_12	2012	0	-90	306.32	541850	6306912	1101.74	Cored
TRC83049	1983	0	-90	1.5	540800	6309080	1010.20	Chip
TRC83097	1983	0	-90	1.41	539583	6307905	1120	Chip
TRC83102	1983	0	-90	1.19	540383	6308925	1040	Chip
TRC84001	1984	0	-90	1.2	540453	6308935	1040	Chip
TRC84009	1984	0	-90	2.1	541543	6306425	1152.61	Chip
DHGH13_01	2013	0	-90	391.88	537600.1	6311000	1026.334	Cored
DHGH13_02	2013	0	-90	189.07	541054	6308159	1074.13	Cored
DHGH13_03	2013	0	-90	236.62	541493	6307945	1037.92	Cored
DHGH13_04	2013	0	-90	334.37	538528	6310630	1017.59	Cored
DHGH13_05	2013	53	-60	65.2	541497	6307950	1036.74	Cored
DHGH13_06	2013	0	-90	380.6	541552	6307322	1087.77	Cored
DHGH13_07	2013	0	-90	471	540118	6309201	1061.00	Cored
DHGH13_08	2013	137	-60	90.83	541553	6307325	1087.21	Cored
DHGH13_09	2013	0	-90	248.74	541376	6306793	1135.46	Cored
DHGH13_10	2013	134	-62	72.24	540115	6309200	1061.28	Cored
DHGH13_11	2013	0	-90	355.34	539625	6308631	1108.68	Cored
DHGH13_12	2013	0	-90	101.86	542188	6307253	1015.78	Cored
DHGH13_13	2013	0	-90	65	542571	6306930	974.532	Cored
DHGH13_14	2013	137	60	61.8	542573	6306933	973.081	Cored
DHGH13_15	2013	0	-90	85	540681	6308475	1074.71	Cored
DHGH13_16	2013	137	50	81.56	539627	6308635	1108.83	Cored

ID	YEAR	AZIMUTH	DIP	TOTAL DEPTH	EASTING	NORTHING	ELEVATION	TYPE
DHGH13_17	2013	140	51.8	81	540683	6308479	1074.33	Cored
DHGH13_18	2013	0	-90	439.84	538906	6308128	1199.04	Cored
DHGH13_19	2013	0	-90	69	540859	6308652	1049.62	Cored
DHGH13_20	2013	130	50	100	540856	6308656	1049.72	Cored
DHGH13_21	2013	0	-90	139	540468	6308342	1085.37	Cored
DHGH13_22	2013	0	-90	124.06	540878	6308015	1094.95	Cored
DHGH13_23	2013	130	71.5	56.7	540878	6308016	1094.83	Cored
DHGH13_24	2013	28	61	56.4	538906	6308128	1199.04	Cored
DHGH13_25	2013	0	-90	67.05	541315	6307824	1078.34	Cored
DHGH13_26	2013	0	-90	102.12	537993	6310167	1062.17	Cored
DHGH13_27	2013	0	-90	90	541701	6307453	1059.88	Cored
DHGH13_28	2013	0	-90	65.29	538801	6309840	1076.25	Cored
DHGH13_29	2013	0	-90	115.97	542014	6307105	1052.24	Cored
DHGH13_30	2013	130	80	14.33	538801	6309844	1076.22	Cored
DHGH13_31	2013	0	-90	57	539023	6310380	1037.13	Cored
DHGH13_32	2013	0	-90	103.83	542389	6306760	1036.46	Cored
DHGH13_33	2013	0	-90	69	539762	6310110	1030.40	Cored
DHGH13_34	2013	0	-90	136.91	542224	6306574	1068.75	Cored
DHGH13_35	2013	130	70	55.1	542224	6306574	1068.75	Cored
DHGH13_36	2013	0	-90	83.29	541335	6307238	1111.26	Cored
DHGH13_37	2013	0	-90	166.73	542096	6306092	1114.85	Cored
DHGH13_38	2013	0	-90	218.15	540778	6306344	1211.35	Cored
DHGH13_39	2013	0	-90	323.89	540138	6307183	1175.10	Cored
DHGH13_40	2013	0	-90	210.488	539791	6307948	1114.48	Cored
DHGH13_41	2013	0	-90	273.01	538727	6308897	1139.61	Cored
DHGH13_42	2013	0	-90	78.33	537630	6309775	1102.52	Cored
DHGH13_43	2013	0	-90	56.58	537560	6310416	1046.47	Cored
GH-TR-13-01	2013	116	-	6.64	539564	6307919	-	Chip
GH-TR-13-02	2013	290	-	1.8	540276	6308831	-	Chip
GH-TR-13-03	2013	138	-	13.49	544570	6303906	-	Chip
GH-TR -13-04	2013	20	-	1.5	546684	6299262	-	Chip

ID	YEAR	AZIMUTH	DIP	TOTAL DEPTH	EASTING	NORTHING	ELEVATION	TYPE
GH-TR -13-05	2013	25	-	1.1	546711	6299263	-	Chip
GH-TR -13-06	2013	22	-	1.6	546685	6299244	-	Chip
GH-TR -13-07	2013	76	-	4.4	548423	6294615	-	Chip
GH-TR -13-08	2013	103	-	0.6	548903	6294655	-	Chip
GH-TR -13-09	2013	33	-	1.95	549729	6294284	-	Chip
GH-TR -13-10	2013	349	-	5.7	549940	6294270	-	Chip
GH-TR -13-11	2013	219	-	2.3	549805	6294325	-	Chip
GH-TR -13-12	2013	252	-	0.7	550199	6294334	-	Chip
GH-TR -13-13	2013	235	-	2.3	550251	6294234	-	Chip
GH-TR -13-14	2013	257	-	3.03	545076	6294376	-	Chip
GH-TR -13-15	2013	209	-	2.51	544943	6294530	-	Chip

Drilling based on current geological modelling has correlated a total of 46 seams. The seam naming convention is a numbering system from seam S30 at the base of the correlated stratigraphy to seam S92 being the uppermost in the correlated sequence. Table 4.3 lists all drillholes within the NW area with seam thickness intersections within each drillhole.

TABLE 4.3: LIST OF DRILLHOLES IN THE NW AREA SHOWING THE THICKNESS OF CORRELATED SEAM INTERSECTIONS (INCLUDING MINOR PARTINGS) PER DRILLHOLE (MAJOR SEAMS ARE HIGHLIGHTED IN RED)

	S92	S90	S88	S87	S86	S85	S81	S80	S79	S78	S76	S75	S73	S72	S70	S69	S68	S67	S65	S64	S62	S61	S60
DDH_81_06								0.79							0.94								
DHGH12_04														0.50	1.27				0.52	0.30		2.20	1.03
DHGH12_05	0.45	1.41				0.39	1.14	0.90							1.51				0.14	1.20	1.00	0.44	1.86
DHGH12_06						0.41		1.68							3.13				1.06	0.56	0.67	1.01	0.78
DHGH12_07								1.21		0.50					3.85		1.00		0.98				0.44
DHGH12_08								3.56						1.38	3.45				0.33	0.54	0.78	2.42	1.62
DHGH12_09						0.87		1.01		0.38		0.24		0.86	1.42	0.45	0.82		0.41				1.00
DHGH12_10																	1.09		0.68				0.67
DHGH12_12			0.75	0.62	1.08	2.26		1.00		0.27		0.40			2.58				1.10	0.82			4.22
DHGH13_01						2.75		0.65							2.15	0.70	0.36	0.35	0.50				0.45
DHGH13_02					0.45	3.25	1.05	1.20							1.70		0.90		1.45				1.99
DHGH13_03						0.70		0.85						3.55	3.85				1.03	0.45	0.40		0.50
DHGH13_04															1.50				0.41	0.50		0.40	0.48
DHGH13_05						0.90		0.75						0.45	2.00				0.75	0.83			
DHGH13_06															2.00				1.70				1.80
DHGH13_07															1.40				1.57				1.30
DHGH13_08															2.15				1.00				3.00
DHGH13_09			0.85	0.30	0.60	0.30		0.30		0.60		0.40		0.25	1.50							1.67	0.65
DHGH13_11		0.90	0.40		0.47	0.61		0.50				0.45			2.60	0.90	0.75	0.74	0.30	0.40			
DHGH13_12						1.85									1.77				1.42				1.05
DHGH13_13															3.00								
DHGH13_14															2.56								
DHGH13_15						5.95		1.25	0.45						1.66								
DHGH13_16						0.59		0.34															
DHGH13_17						1.90		0.70	0.95						1.13								
DHGH13_18						1.81		0.55	0.50	0.32		0.52			1.07		2.05						
DHGH13_19						0.56									2.77								
DHGH13_20						0.92									2.71								
DHGH13_21															2.26				0.84				0.37
DHGH13_22															1.45		0.42		0.86	0.30			1.00
DHGH13_23					0.55	0.30		0.62							0.56								
DHGH13_25						1.20		1.57															
DHGH13_26						2.16		0.99	1.30					0.63	3.41				0.43				

	S58	S56	S55	S54	S53	S51	S50	S49	S48	S47	S45	S44	S43	S42	S41	S40	S39	S37	S36	S35	S32	S31	S30
DDH_81_06																							
DHGH12_04			2.42	1.04			1.17			0.66	1.59			0.63	0.70	0.69							
DHGH12_05			1.57				3.12				0.91					6.72	0.53		0.54	0.50			
DHGH12_06		1.30	2.92	0.96			0.55				1.21	0.71	0.68			1.00							
DHGH12_07			1.08			0.30	1.20	0.51			0.51					3.20							
DHGH12_08		0.32	2.81	0.49	0.53	0.92	1.09				0.89	0.60	0.36	0.55	0.84	1.22							
DHGH12_09		0.77	1.92				2.05				2.63		0.53		0.90	5.65	0.78		0.76	0.45			
DHGH12_10			0.44				0.47									3.17				0.98			2.65
DHGH12_12			0.76				0.43	1.63	0.71		1.07					2.32							
DHGH13_01		0.30	0.32	0.40	0.25	0.30	1.50				1.93	0.65	1.30			3.65		0.30		1.00			3.05
DHGH13_02							1.10																
DHGH13_03			1.90				1.00	0.65			0.52					2.82							
DHGH13_04							0.30				0.41		1.50			1.95				1.00	0.35	0.50	
DHGH13_05																							
DHGH13_06							2.88				0.70	0.30				4.75	0.80		0.75	5.40	4.15	1.95	2.29
DHGH13_07			0.15				1.10		0.30		1.60	0.65				2.90				1.20	0.30	0.15	1.69
DHGH13_08																							
DHGH13_09			1.63	1.00		1.11	1.00	0.49	0.65														
DHGH13_11							0.62	1.05			0.85	0.65	0.36			1.08							
DHGH13_12																							
DHGH13_13																							
DHGH13_14																							
DHGH13_15																							
DHGH13_16																							
DHGH13_17																							
DHGH13_18			0.46								1.75		0.61			1.56	0.52			1.00	0.81		
DHGH13_19																							
DHGH13_20																							
DHGH13_21			1.68				2.03				2.34					4.23							
DHGH13_22																							
DHGH13_23																							
DHGH13_25																							
DHGH13_26																							

DHGH13_27															1.04				0.91		2.12	0.31	1.09																							
DHGH13_28															2.33		0.55																													
DHGH13_29					0.57	3.05			0.72	1.02																																				
DHGH13_30															2.02																															
DHGH13_31															1.32		0.19		2.61																											
DHGH13_32								0.68		0.48					2.77																															
DHGH13_33																	0.80		0.40			0.28	0.54																							
DHGH13_34			0.90			0.95		0.21							2.75																															
DHGH13_35			0.38			1.74																																								
DHGH13_36											0.25	0.52		1.00	2.25		0.71		1.40																											
DHGH13_37			0.40	0.32	0.48	0.55		0.85							1.08		1.05		0.65				2.18			3.42				1.05																
DHGH13_38		0.75	0.73	0.78	0.40	0.93		0.57	0.62					1.53	1.28	0.80	0.97		0.35																											
DHGH13_39		0.40				1.03	0.31	0.38							1.25		1.37		0.43							0.56				0.60	0.67	0.33		0.33												
DHGH13_40		0.34	0.29	0.95	0.76	0.50		0.65		1.25					1.07				0.45				0.55			0.20	0.15																			
DHGH13_41					1.00	1.80		0.44							2.10				0.48	0.39			2.41	0.37																						
DHGH13_43													0.60		4.75																															
Average Thickness	0.45	0.76	0.59	0.59	0.64	1.44	0.83	0.90	0.76	0.60	0.25	0.42	0.60	1.13	2.08	0.71	0.87	0.54	0.84	0.57	0.99	1.09	1.29	0.37	0.67	1.43	0.67	0.39	0.66	1.22	0.83	0.50	0.66	1.20	0.59	0.76	0.59	0.81	2.93	0.66	0.30	0.68	1.44	1.40	0.87	2.42
No. of intersections	1	5	8	5	10	28	3	27	6	8	1	6	1	9	43	4	15	2	30	11	5	8	24	1	4	17	6	2	4	19	6	4	1	16	6	7	2	3	16	4	1	3	8	4	3	4

4.3. Interburden, veins and pyrite

The interburden sediments that separate coal seams in the NW area are comprised mainly of interbedded siltstone, sandstone and carbonaceous mudstone beds, with minor conglomerate. A vertical drillhole showing typical intersections of the coal seam and interburden stratigraphy is shown in Figure 4.4.

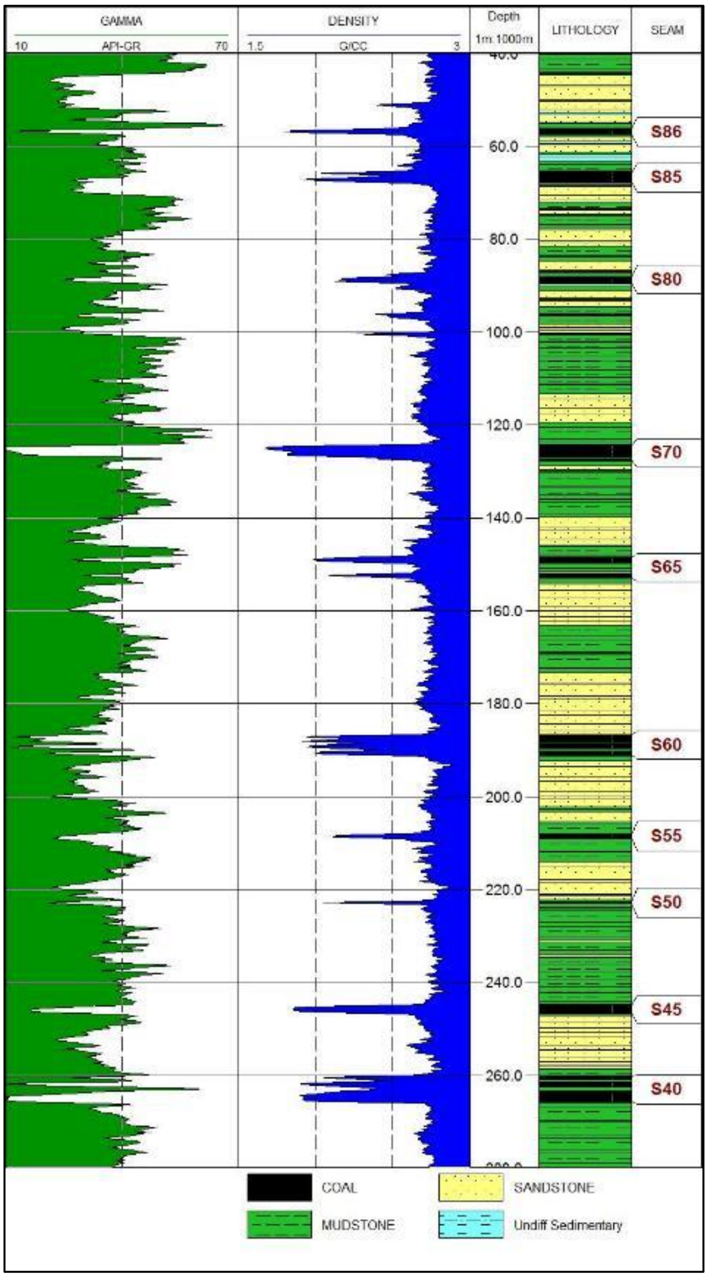


FIGURE 4.4: TYPICAL STRATIGRAPHY OF THE GROUNDHOG AREA

The siltstones and sandstones display numerous thin carbonaceous laminations and shelly fragments sometimes forming into pebbly lag beds. Bioturbation and dewatering structures are common within the sediments. Bedding dips range from horizontal to near vertical. Localised veining occurs within both the sediments and coal seams with veins comprised mainly of quartz, dolomite and minor siderite. Within the coal seams, thin quartz veins and pyrite (lenses or disseminated) are locally abundant, an example of quartz veins and disseminated pyrite is shown in Figure 4.5.

FIGURE 4.5 EXAMPLE OF DISSEMINATED PYRITE AND QUARTZ VEINING WITHIN DHGH13-03

4.4.Coal Seam Targets

Atrum's primary exploration focus during the 2013 field season was to target the S70 seam followed by a secondary deeper target comprising the S40 seam located some 100 to 200 metres below the S70. Of the 43 holes drilled during 2013, eight intersected the S40 seam, resulting in considerably fewer intersections and coal quality information below the shallower S70 target.

4.4.1. Seam S70

The S70 coal seam is the primary target in the NW area due to its relative thick and continuous nature, as well as good quality and its potential for both open pit and underground mining. The S70 coal seam was the focus of exploration drilling during 2013 drilling campaign with a high percentage of drillholes terminating after intersecting the S70.

The S70 coal seam was intersected in 43 of the 52 drillholes within the NW area. In two drillholes (DHGH12_10 and DHGH13_33) the S70 sub-cropped, and the remaining four drillholes terminated before intersecting the S70 seam. Intersection depths for the S70 range from 5.07 m in DHGH13_28 to 196.20 m in DHGH13_39. The average depth to the S70 is 71.92 m.

Seam thickness ranges from 0.56 m to 4.75 m, with drill intersections averaging 2.08 m in thickness and an average modelled thickness of 1.94 m. Seam thickness is relatively consistent across the NW area, however there is evidence at one location (drillhole DHGH13_03) of structural thickening. This interpretation is supported by down hole geophysics and core photography.

The most prominently folding interpreted to affect the coal seams within this project is the younger F2 folding. This folds the coal seam into a series of synclines and anticlines trending northeast southwest with fold axis trending to the northeast with steeper north-eastern limbs. The S70 coal seam dips vary considerably from almost horizontal to greater than 50°.

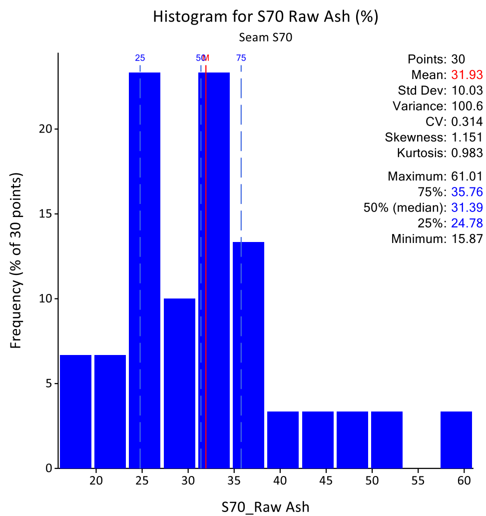
The S70 seam in some instances includes thin, generally less than 30cm, mudstone partings within the seam. Table 4.4 summarises the occurrence of seam parting material in the S70 seam.

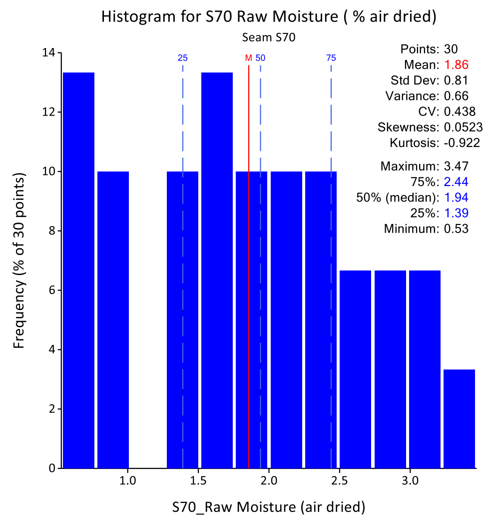
TABLE 4.4: S70 PARTING SUMMARY

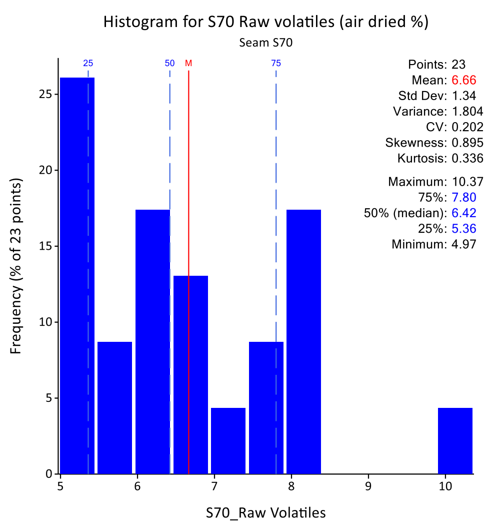
Borehole	Seam	Seam_Thick	Parting_Thick	%_Parting
DDH_81_06	S70	0.94	0.00	0
DHGH12_04	S70	1.27	0.00	0
DHGH12_05	S70	1.51	0.00	0
DHGH12_06	S70	3.13	0.30	10
DHGH12_07	S70	3.85	0.20	5
DHGH12_08	S70	3.45	0.00	0
DHGH12_09	S70	1.42	0.00	0
DHGH12_12	S70	2.58	0.00	0
DHGH13_01	S70	2.15	0.40	19
DHGH13_02	S70	1.70	0.00	0
DHGH13_03	S70	3.85	0.36	9
DHGH13_04	S70	1.50	0.04	3
DHGH13_05	S70	2.00	0.00	0
DHGH13_06	S70	2.00	0.00	0
DHGH13_07	S70	1.40	0.00	0
DHGH13_08	S70	2.15	0.00	0
DHGH13_09	S70	1.50	0.28	19
DHGH13_11	S70	2.60	0.00	0
DHGH13_12	S70	1.77	0.00	0
DHGH13_13	S70	3.00	0.07	2
DHGH13_14	S70	2.56	0.00	0
DHGH13_15	S70	1.66	0.20	12
DHGH13_18	S70	1.07	0.00	0
DHGH13_19	S70	2.77	0.00	0
DHGH13_20	S70	2.71	0.00	0
DHGH13_21	S70	2.26	0.20	9
DHGH13_22	S70	1.45	0.10	7
DHGH13_23	S70	0.56	0.00	0
DHGH13_26	S70	3.41	0.36	11
DHGH13_27	S70	1.04	0.00	0
DHGH13_28	S70	2.33	0.00	0
DHGH13_30	S70	2.02	0.48	24
DHGH13_31	S70	1.32	0.00	0
DHGH13_32	S70	2.77	0.16	6
DHGH13_34	S70	2.75	0.20	7
DHGH13_36	S70	2.25	0.00	0
DHGH13_37	S70	1.08	0.08	7
DHGH13_38	S70	1.28	0.00	0
DHGH13_39	S70	1.25	0.10	8
DHGH13_40	S70	1.07	0.00	0
DHGH13_41	S70	2.10	0.00	0
DHGH13_43	S70	4.75	0.61	13

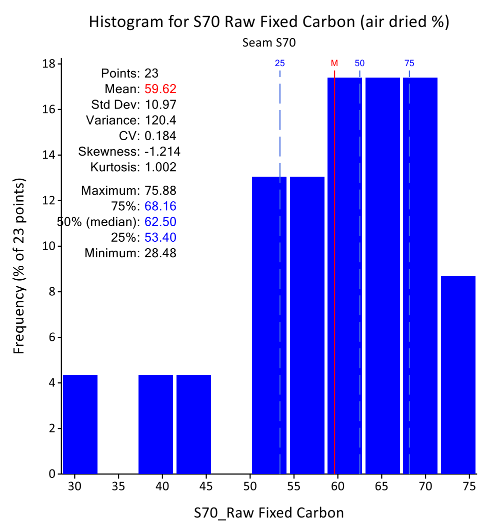
Coal quality composites

The raw coal qualities from analysed samples were composited across seam intervals in the Minescape coal quality model. Histograms of these raw coal quality parameters are presented below for the S70 seam.









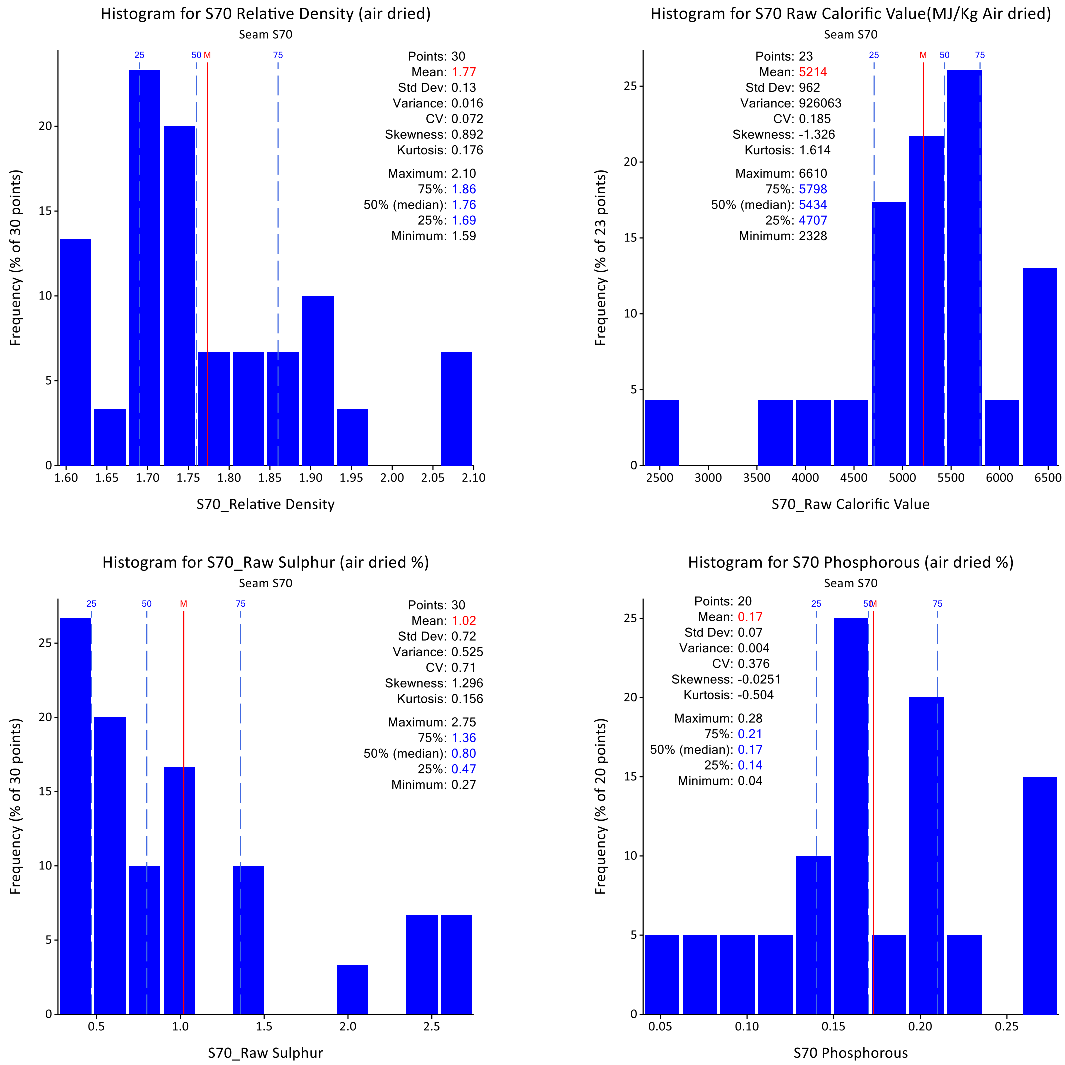


FIGURE 4.6: HISTOGRAMS FOR PROXIMATE COAL QUALITY PARAMETERS, S70

4.4.2. Seam S40

Occurrence

The S40 is considered by Atrum to be the secondary deeper coal seam target. The S40 coal seam was intersected in 16 of the 52 drillholes within the NW area. Intersection depth ranges from 117.22 m in DHGH13_21 to 370.99 m in DHGH13_18. The average depth to the S40 is 265.29 m.

Seam thickness intersections range from 0.69 m to 6.72 m, averaging 2.93 m with a modelled average thickness of 2.67 m. Seam thickness is relatively consistent across the NW area with no established trend in thickness identified from the current dataset.

Characteristics of S40 vary slightly across the NW project area. S40 generally does not have partings. When partings are present they primarily occur as carbonaceous mudstone. Table 4.5 shows parting occurrences in S40. An example of the S40 geophysical signature and core photography is shown in Figure 4.7.

TABLE 4.5: S40 PARTING SUMMARY

Borehole	Seam	Seam_Thick	Parting_Thick	%_Parting
DHGH12_04	S40	0.69	0.00	0
DHGH12_05	S40	6.72	0.00	0
DHGH12_06	S40	1.00	0.00	0
DHGH12_07	S40	3.20	0.00	0
DHGH12_08	S40	1.22	0.00	0
DHGH12_09	S40	5.65	0.00	0
DHGH12_10	S40	3.17	0.50	16
DHGH12_12	S40	2.32	0.00	0
DHGH13_01	S40	3.65	0.48	13
DHGH13_03	S40	2.82	0.97	34
DHGH13_04	S40	1.95	0.00	0
DHGH13_06	S40	4.75	0.00	0
DHGH13_07	S40	2.90	0.05	2
DHGH13_11	S40	1.08	0.00	0
DHGH13_18	S40	1.56	0.00	0
DHGH13_21	S40	4.23	0.00	0

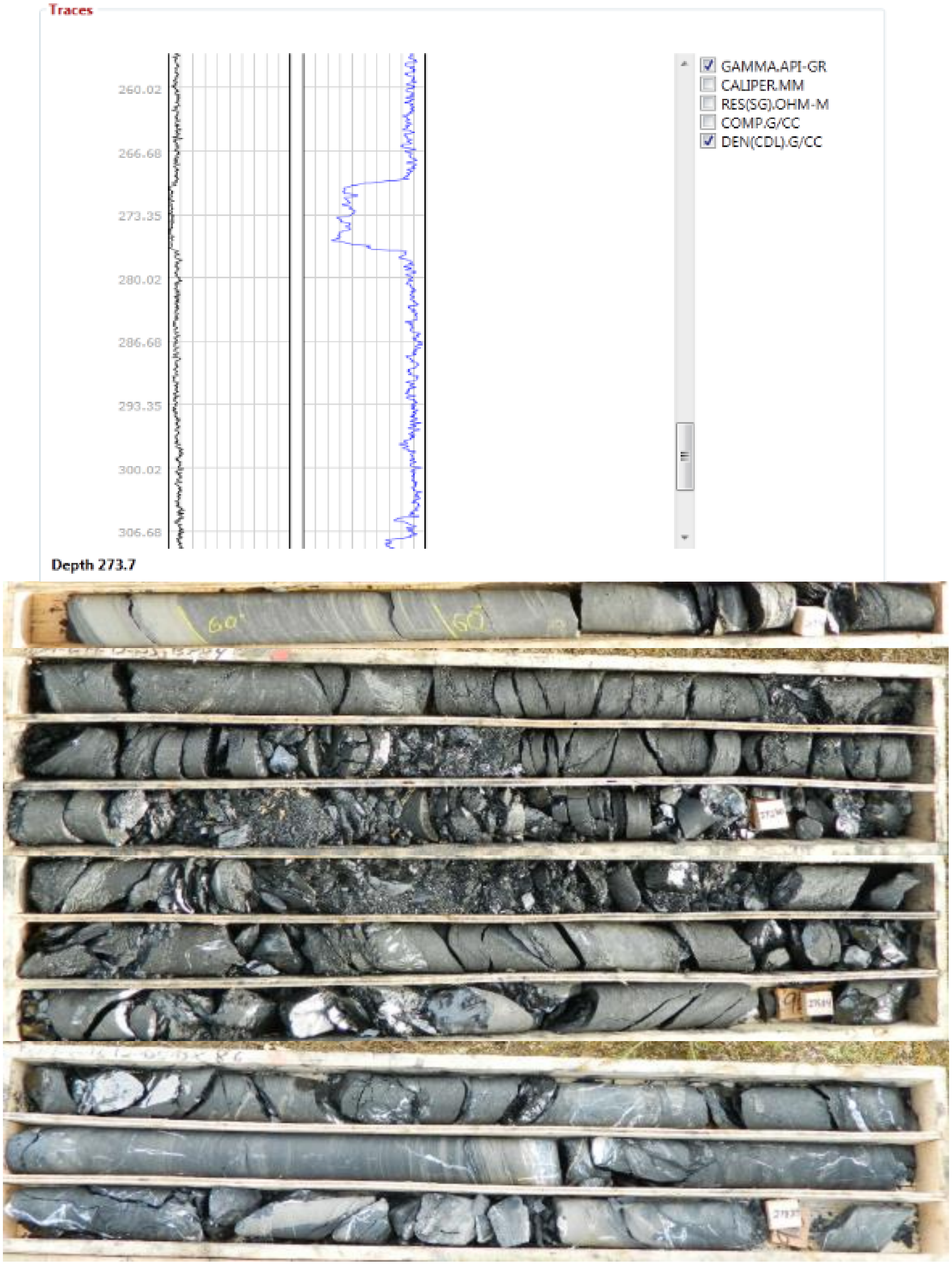
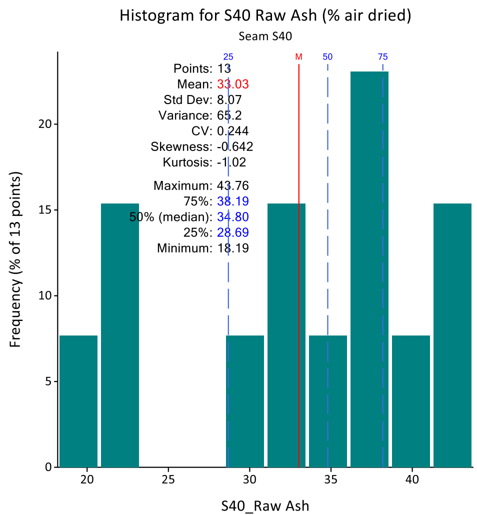
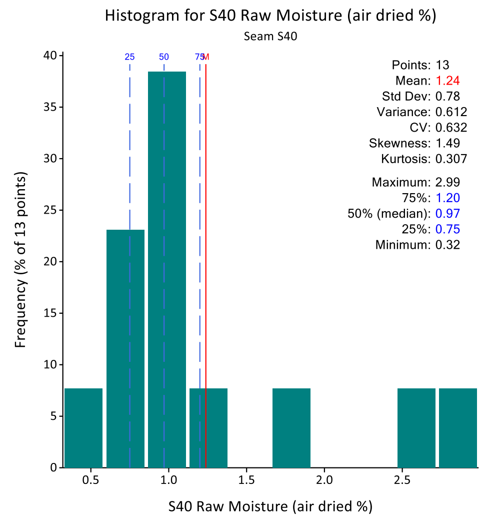


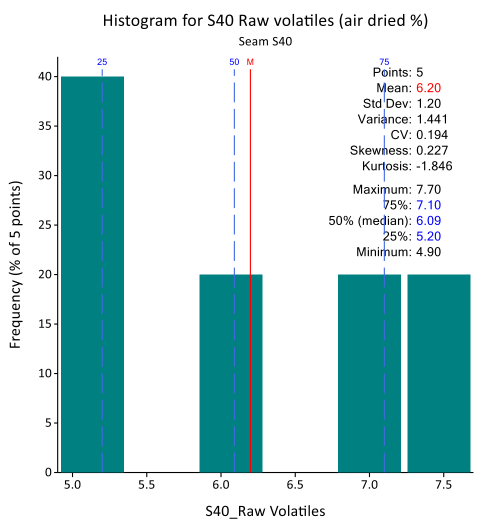
FIGURE 4.7: GEOPHYSICAL LOG AND CORE PHOTOGRAPHY OF THE S40 SEAM IN DHGH12-05

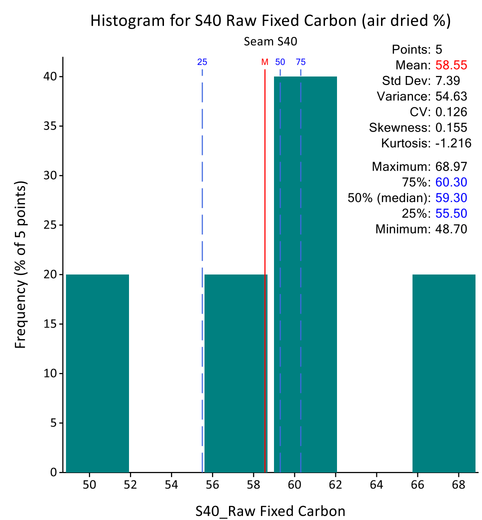
Coal quality

The raw coal qualities from analysed samples were composited across seam intervals in the Minescape coal quality model. Histograms of these raw coal quality parameters are presented below for the S40 seam.









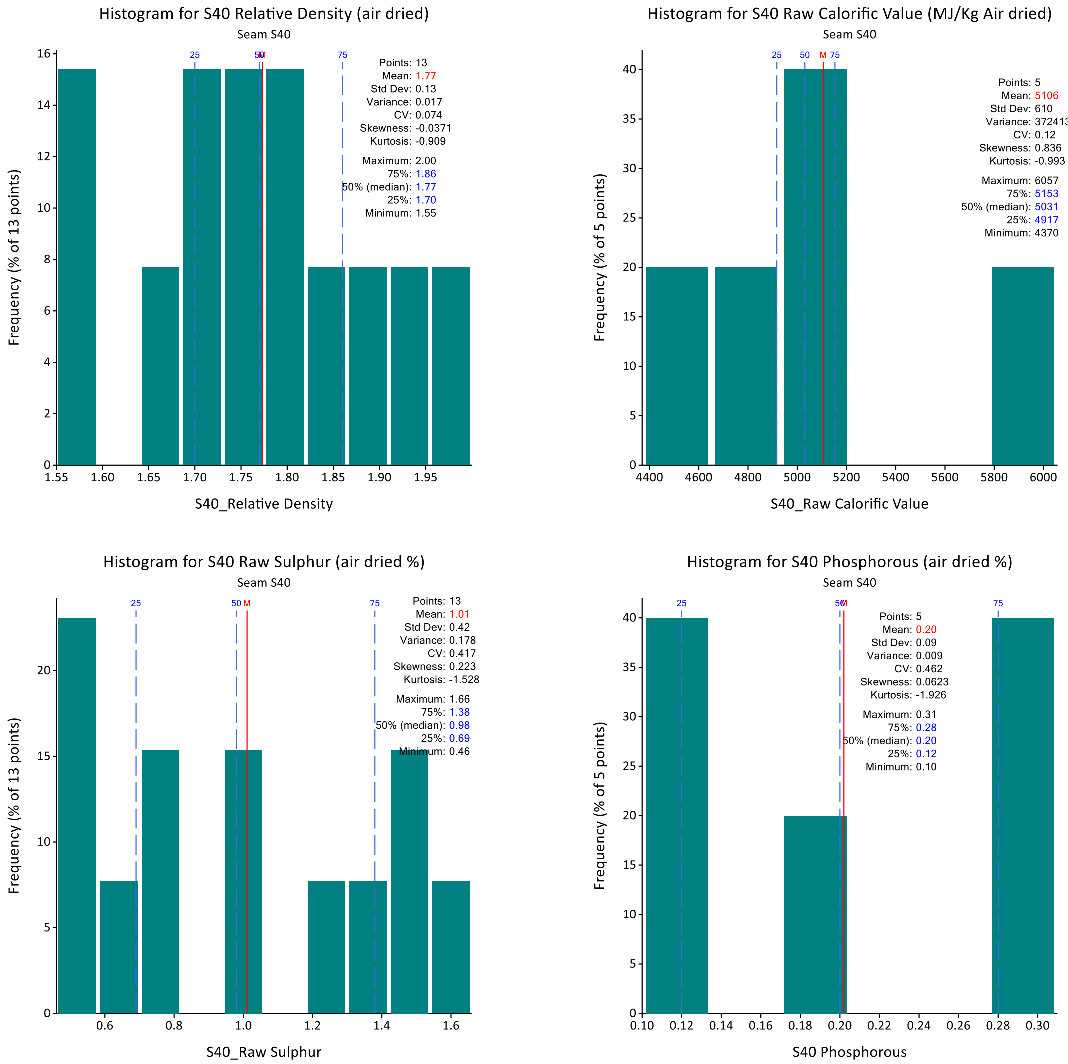


FIGURE 4.8: HISTOGRAMS FOR PROXIMATE COAL QUALITY PARAMETERS, S40

4.4.3. Other Coal seams of Significance

The remaining seams within the Atrum project were not key to the Atrum 2013 exploration strategy, there is therefore considerably less coal quality sampling for these seams, this is particularly the case in the deeper seams. Xstract has selected six seams based on the below criteria (S80, S85, S60, S65, S50 and S55) to review coal quality proximate analysis.

The seams were selected based on a set criterion on seam thickness and intersection points. The criteria for average coal seam intersection is defined as greater than 0.5m in both drilling intersections and resource model thickness. The seam also requires greater than 15 drillhole intersection points within the NW exploration area.

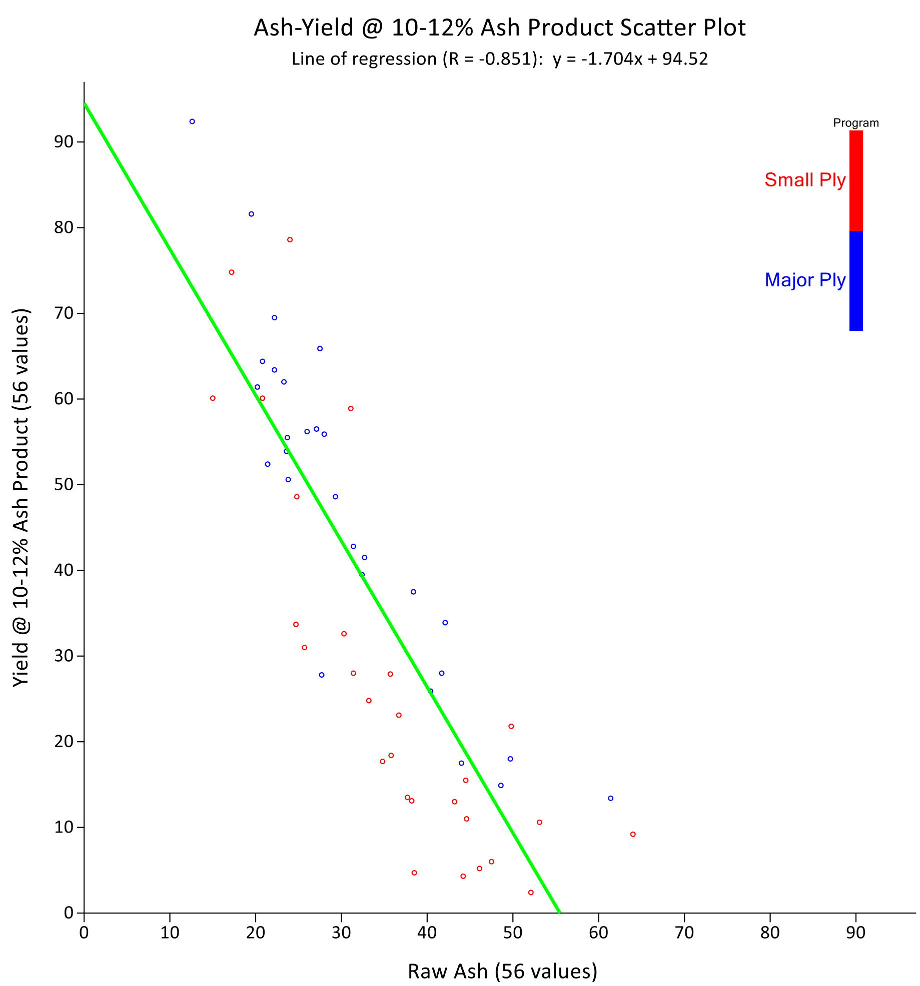


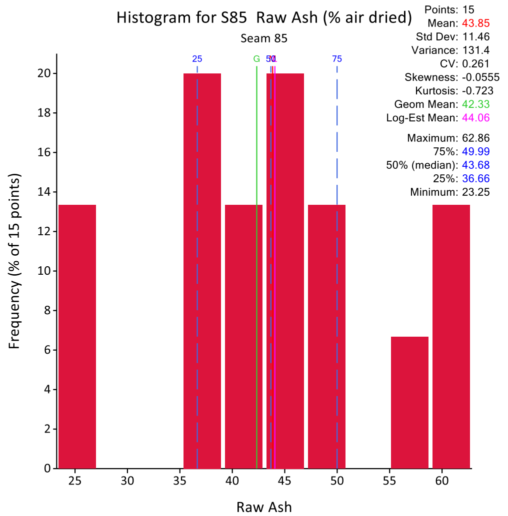
FIGURE 4.9: SCATTER PLOT OF RAW ASH VS. YIELD AT A 10-12% PRODUCT ASH CUT OFF

TABLE 4.6: RAW ASH (RA) COMPOSITES STATISTICS

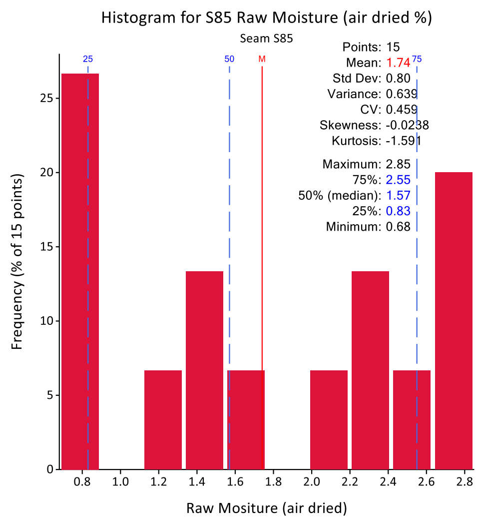
Seam Name	No of sample points	Raw ash Average Value	Drillhole with Minimum value	Min values	Drillhole with Maximum Value	Max Value	Standard Deviation	Skewness	Kurtosis
S92	1	39.16	DHGH12_05	39.16	DHGH12_05	39.16	-	-	-
S91	0	-	-	-	-	-	-		
S90	2	30.95	DHGH12_05	19.36	DHGH13_11	42.55	16.4	-	-
S88	3	65.65	DHGH13_09	54.36	DHGH13_34	81.7	14.28	0.54	-
S87	1	39.92	DHGH12_12	39.92	DHGH12_12	39.92	-	-	-
S86	2	48.63	DHGH12_12	41.26	DHGH13_29	56	10.42	-	-
S85	14	44.25	DHGH13_35	23.25	DHGH12_12	62.86	11.79	-0.15	-0.63
S81	2	51.13	DHGH12_05	41.76	DHGH13_02	60.5	13.25	-	-
S80	11	45.11	DHGH13_25	27.97	DHGH13_32	61.3	10.27	0.12	-0.81
S79	2	41.61	DHGH13_26	34.82	DHGH13_15	48.4	9.6	-	-
S78	3	47.75	DHGH12_12	42.63	DHGH12_07	56.39	7.53	0.67	-
S75	1	53.12	DHGH12_12	53.12	DHGH12_12	53.12	-	-	-
S72	6	39.38	DHGH13_03	24.69	DHGH13_36	54.2	11.13	0.17	-1.25
S70	30	31.93	DHGH13_22	15.87	DHGH13_30	61.01	10.03	1.09	1.12
S69	1	30.34	DHGH13_01	30.34	DHGH13_01	30.34	-	-	-
S68	7	51.58	DHGH13_33	36.5	DHGH13_01	85.84	16.92	1.24	0.49
S67	0	-	-	-	-	-	-		
S65	14	42.05	DHGH13_22	13.9	DHGH12_04	83.26	18.11	0.66	0.18
S64	6	44.33	DHGH13_04	29.66	DHGH12_12	50.6	7.73	-1.29	0.29
S62	4	42.2	DHGH12_05	36.38	DHGH12_08	53.73	7.96	0.94	-0.86
S61	6	36.1	DHGH12_08	25.56	DHGH13_04	48.99	9.9	0.32	-1.52
S60	12	40.89	DHGH13_07	20.82	DHGH12_09	83.86	16.25	1.43	2.26
S56	3	46.5	DHGH12_09	35.26	DHGH12_06	68.77	19.29	0.71	-
S55	10	46.98	DHGH13_03	20.24	DHGH12_06	58.91	11.06	-1.42	1.52
S54	4	51.02	DHGH13_09	41.52	DHGH12_06	60.78	10.21	0.01	-1.96
S53	1	35.58	DHGH12_08	35.58	DHGH12_08	35.58	-	-	-
S51	3	48.23	DHGH12_08	34.71	DHGH13_09	67.1	16.85	0.52	-

S50	10	38.52	DHGH13_06	17.15	DHGH12_08	70.02	15.56	0.58	-0.24
S49	3	38.31	DHGH13_11	27.9	DHGH12_12	48.62	10.36	-0.02	-
S48	2	35.47	DHGH13_09	32.8	DHGH12_12	38.13	3.77	-	-
S47	0	-	-	-	-	-	-		
S46	0	-	-	-	-	-	-		
S45	7	39.59	DHGH12_04	23.37	DHGH12_12	64.83	13.03	0.9	0.25
S44	2	46.31	DHGH12_06	36.63	DHGH12_08	56	13.7	-	-
S43	3	39.29	DHGH12_06	18.22	DHGH13_01	53.7	18.65	-0.57	-
S40	13	33.03	DHGH12_07	18.19	DHGH12_08	43.76	8.07	-0.57	-0.85
S36	2	48.27	DHGH12_05	46.21	DHGH12_09	50.34	2.92	-	-
S35	5	53.99	DHGH12_09	32.34	DHGH12_05	79.05	20.16	0.15	-1.58
S32	0	-	-	-	-	-	-		
S31	0	-	-	-	-	-	-		
S30	2	34.08	DHGH12_10	32.15	DHGH13_06	36	2.72	-	-

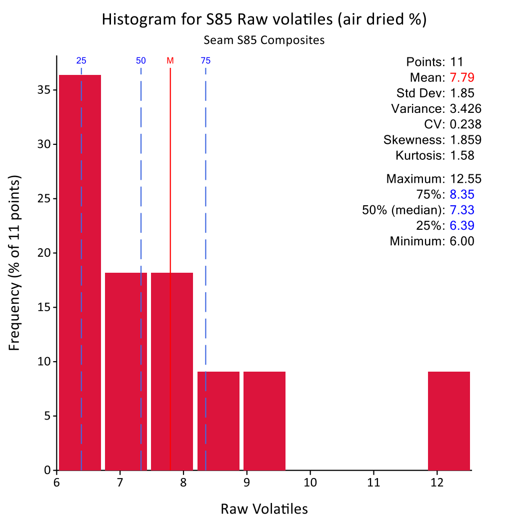
Seam 85



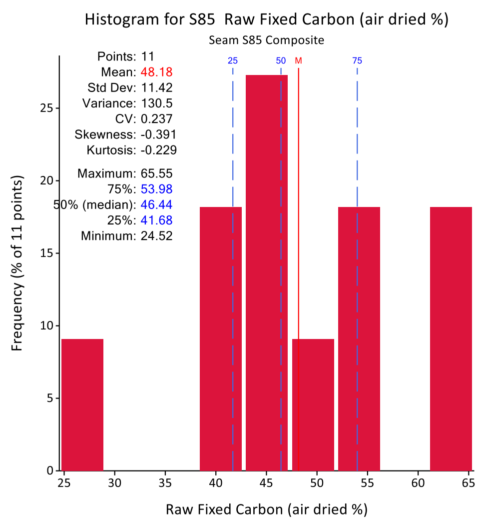
Histogram for S85 Raw Ash (% air dried)
Seam 85
Points: 15
Mean: 43.85
Std Dev: 11.46
Variance: 131.4
CV: 0.261
Skewness: -0.0555
Kurtosis: -0.723
Geom Mean: 42.33
Log-Est Mean: 44.06
Maximum: 62.86
75%: 49.99
50% (median): 43.68
25%: 36.66
Minimum: 23.25
Frequency (% of 15 points)
Raw Ash



Histogram for S85 Raw Moisture (air dried %)
Seam S85
Points: 15
Mean: 1.74
Std Dev: 0.80
Variance: 0.639
CV: 0.459
Skewness: -0.0238
Kurtosis: -1.591
Maximum: 2.85
75%: 2.55
50% (median): 1.57
25%: 0.83
Minimum: 0.68
Frequency (% of 15 points)
Raw Mositure (air dried)



Histogram for S85 Raw volatiles (air dried %)
Seam S85 Composites
Points: 11
Mean: 7.79
Std Dev: 1.85
Variance: 3.426
CV: 0.238
Skewness: 1.859
Kurtosis: 1.58
Maximum: 12.55
75%: 8.35
50% (median): 7.33
25%: 6.39
Minimum: 6.00
Frequency (% of 11 points)
Raw Volatiles



Histogram for S85 Raw Fixed Carbon (air dried %)
Seam S85 Composite
Points: 11
Mean: 48.18
Std Dev: 11.42
Variance: 130.5
CV: 0.237
Skewness: -0.391
Kurtosis: -0.229
Maximum: 65.55
75%: 53.98
50% (median): 46.44
25%: 41.68
Minimum: 24.52
Frequency (% of 11 points)
Raw Fixed Carbon (air dried %)

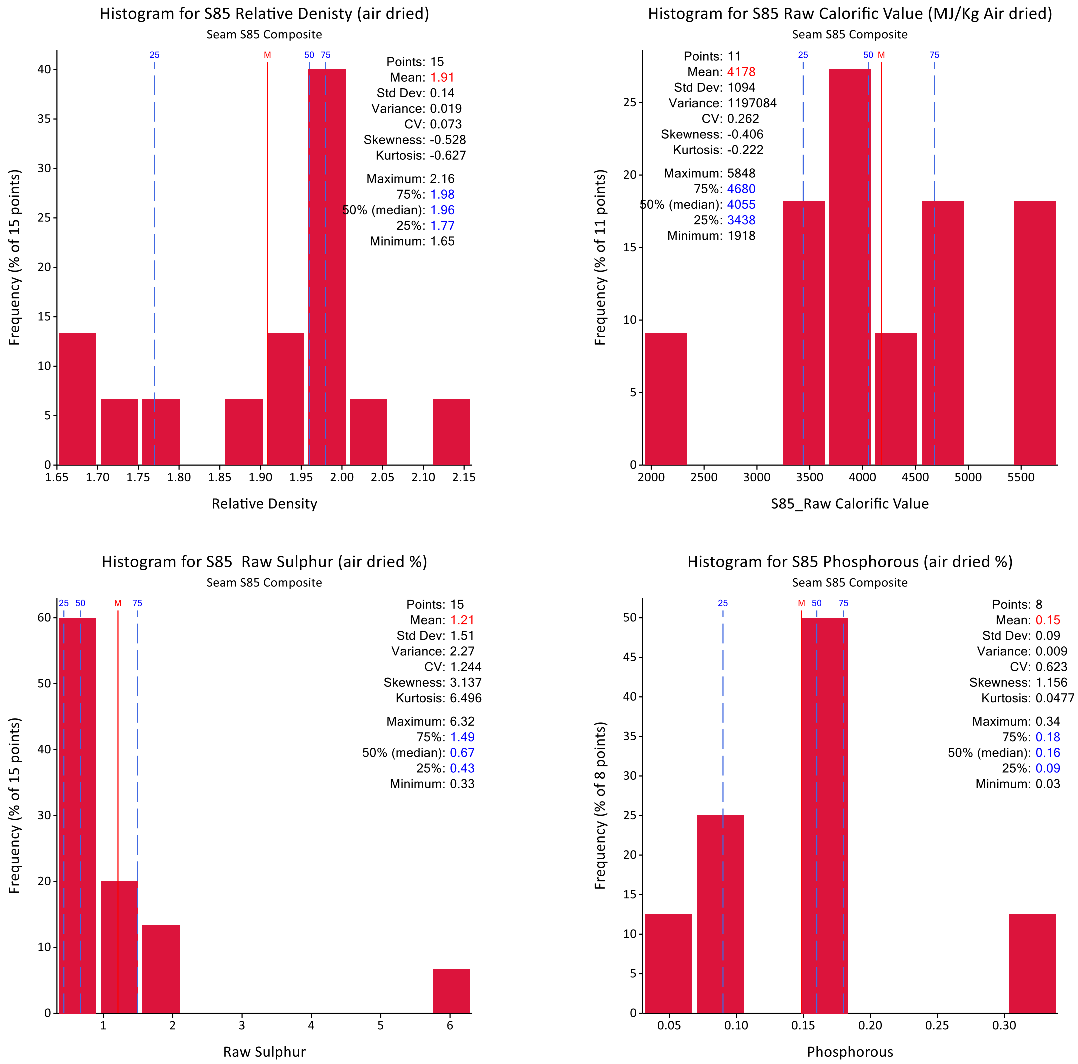
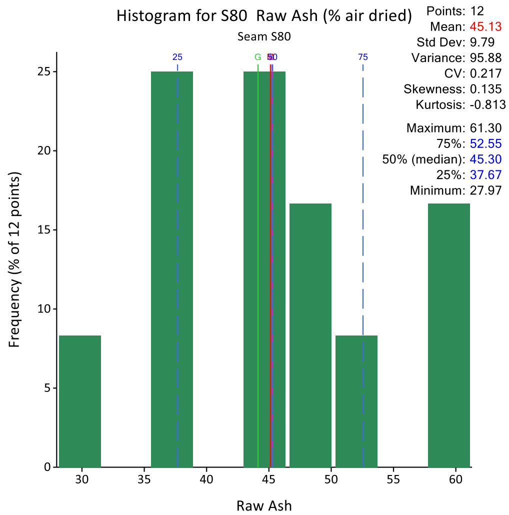
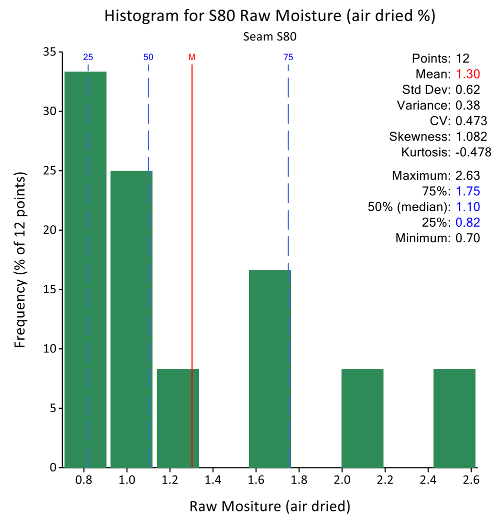
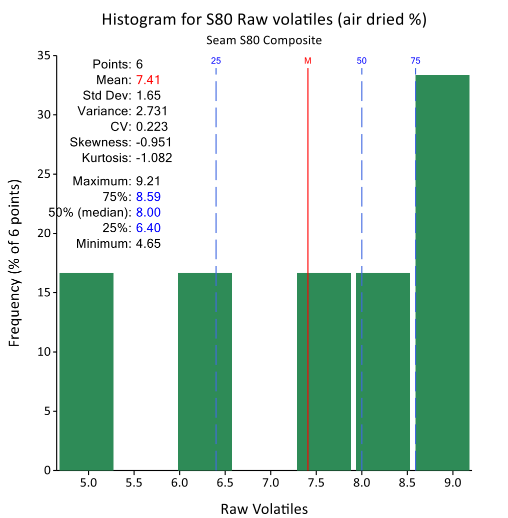


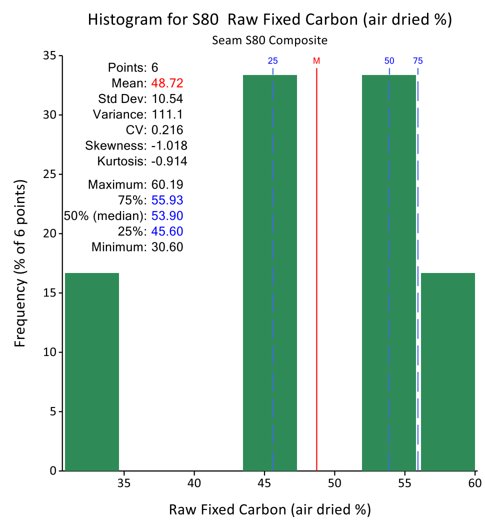
FIGURE 4.10: HISTOGRAMS FOR PROXIMATE COAL QUALITY PARAMETERS, S85

Seam S80


Histogram for S80 Raw Ash (% air dried)
Seam S80
Points: 12
Mean: 45.13
Std Dev: 9.79
Variance: 95.88
CV: 0.217
Skewness: 0.135
Kurtosis: -0.813
Maximum: 61.30
75%: 52.55
50% (median): 45.30
25%: 37.67
Minimum: 27.97
Frequency (% of 12 points)
Raw Ash


Histogram for S80 Raw Moisture (air dried %)
Seam S80
Points: 12
Mean: 1.30
Std Dev: 0.62
Variance: 0.38
CV: 0.473
Skewness: 1.082
Kurtosis: -0.478
Maximum: 2.63
75%: 1.75
50% (median): 1.10
25%: 0.82
Minimum: 0.70
Frequency (% of 12 points)
Raw Mositure (air dried)


Histogram for S80 Raw volatiles (air dried %)
Seam S80 Composite
Points: 6
Mean: 7.41
Std Dev: 1.65
Variance: 2.731
CV: 0.223
Skewness: -0.951
Kurtosis: -1.082
Maximum: 9.21
75%: 8.59
50% (median): 8.00
25%: 6.40
Minimum: 4.65
Frequency (% of 6 points)
Raw Volatiles


Histogram for S80 Raw Fixed Carbon (air dried %)
Seam S80 Composite
Points: 6
Mean: 48.72
Std Dev: 10.54
Variance: 111.1
CV: 0.216
Skewness: -1.018
Kurtosis: -0.914
Maximum: 60.19
75%: 55.93
50% (median): 53.90
25%: 45.60
Minimum: 30.60
Frequency (% of 6 points)
Raw Fixed Carbon (air dried %)

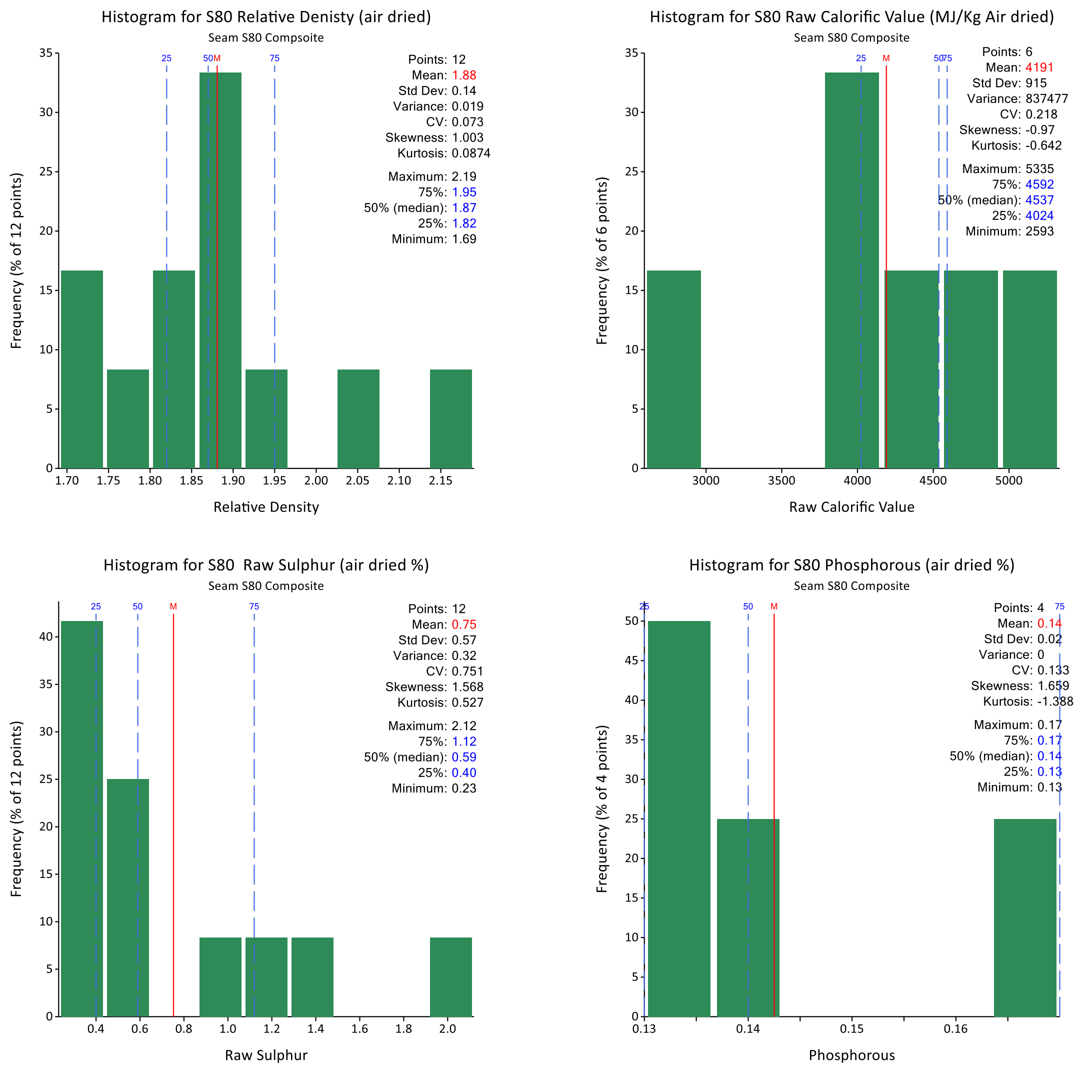
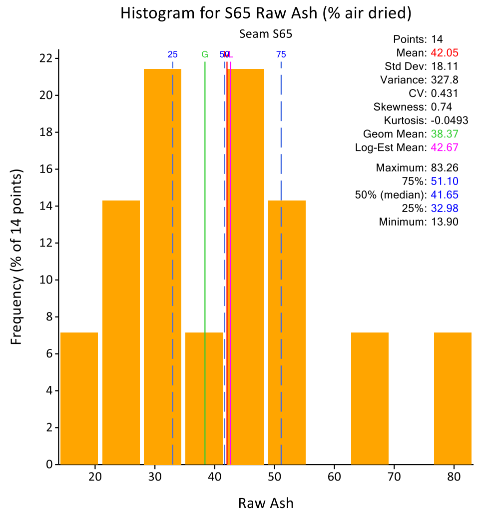
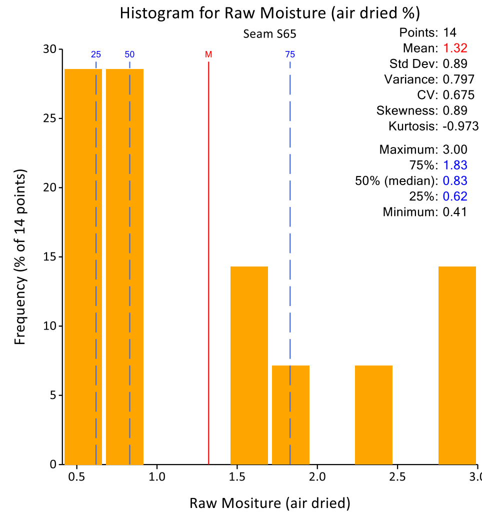


FIGURE 4.11: HISTOGRAMS FOR PROXIMATE COAL QUALITY PARAMETERS, S80

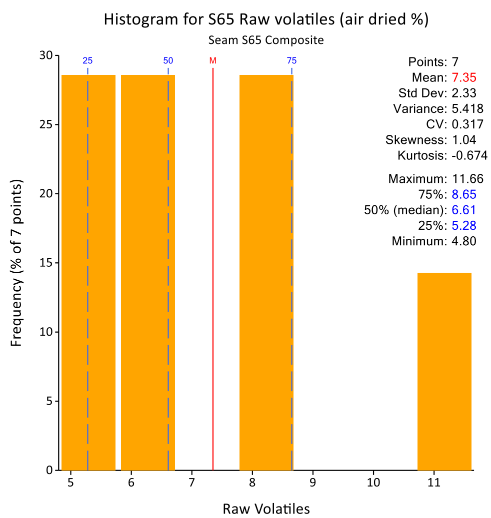
Seam S65



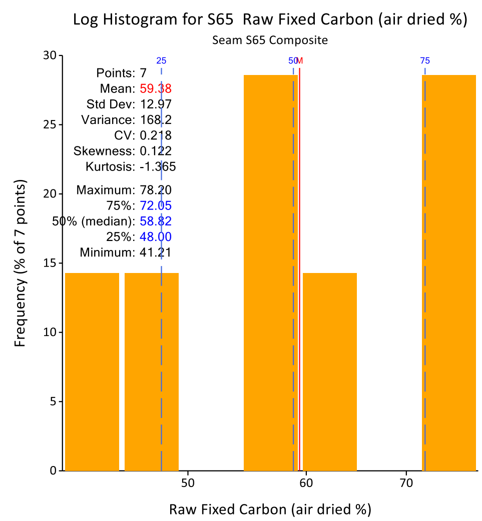
Histogram for S65 Raw Ash (% air dried)
Seam S65
Points: 14
Mean: 42.05
Std Dev: 18.11
Variance: 327.8
CV: 0.431
Skewness: 0.74
Kurtosis: -0.0493
Geom Mean: 38.37
Log-Est Mean: 42.67
Maximum: 83.26
75%: 51.10
50% (median): 41.65
25%: 32.98
Minimum: 13.90
Frequency (% of 14 points)
Raw Ash



Histogram for Raw Moisture (air dried %)
Seam S65
Points: 14
Mean: 1.32
Std Dev: 0.89
Variance: 0.797
CV: 0.675
Skewness: 0.89
Kurtosis: -0.973
Maximum: 3.00
75%: 1.83
50% (median): 0.83
25%: 0.62
Minimum: 0.41
Frequency (% of 14 points)
Raw Mositure (air dried)



Histogram for S65 Raw volatiles (air dried %)
Seam S65 Composite
Points: 7
Mean: 7.35
Std Dev: 2.33
Variance: 5.418
CV: 0.317
Skewness: 1.04
Kurtosis: -0.674
Maximum: 11.66
75%: 8.65
50% (median): 6.61
25%: 5.28
Minimum: 4.80
Frequency (% of 7 points)
Raw Volatiles



Log Histogram for S65 Raw Fixed Carbon (air dried %)
Seam S65 Composite
Points: 7
Mean: 59.38
Std Dev: 12.97
Variance: 168.2
CV: 0.218
Skewness: 0.122
Kurtosis: -1.365
Maximum: 78.20
75%: 72.05
50% (median): 58.82
25%: 48.00
Minimum: 41.21
Frequency (% of 7 points)
Raw Fixed Carbon (air dried %)

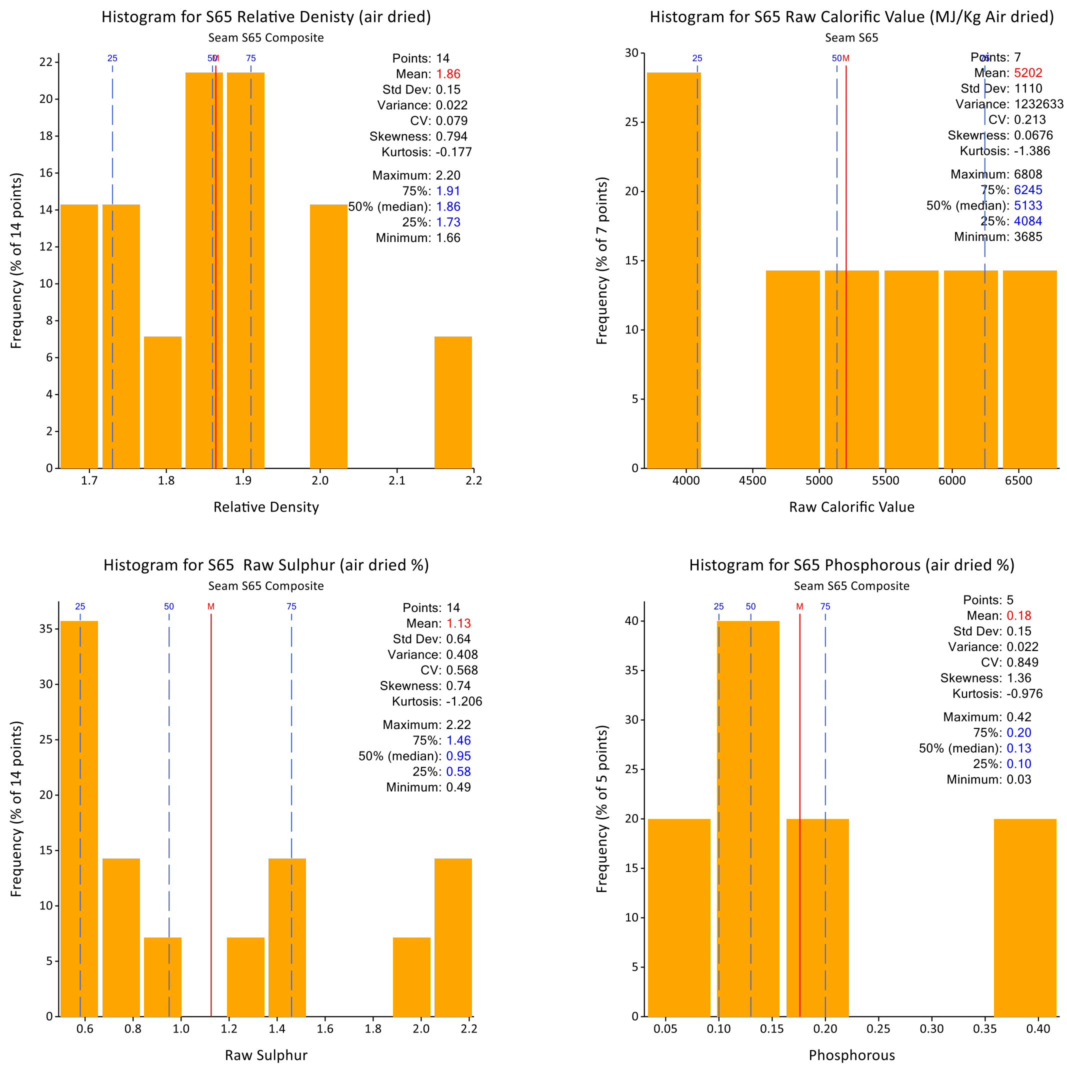
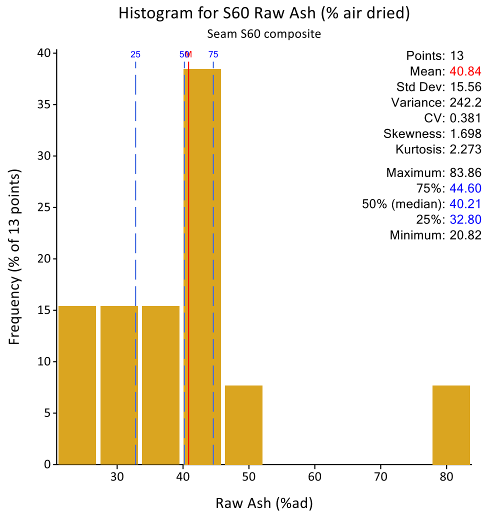
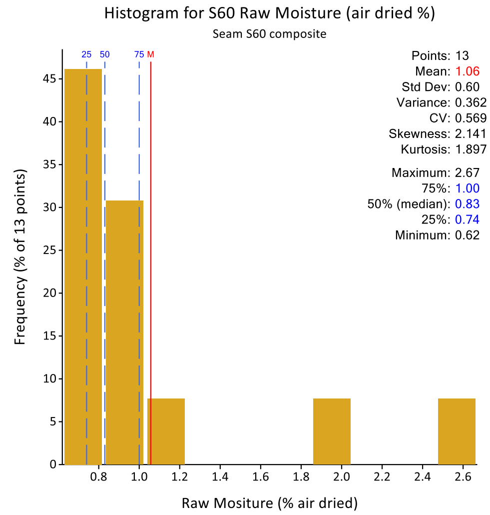
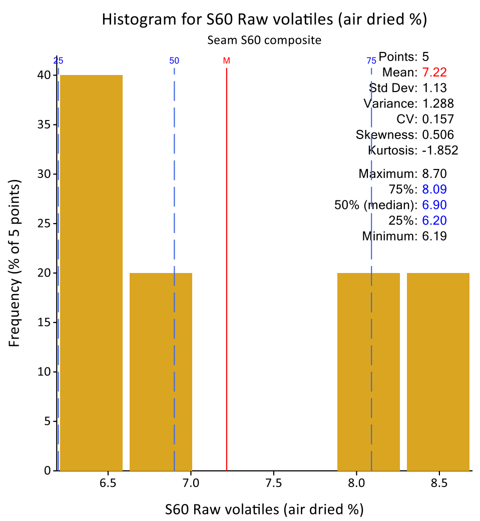


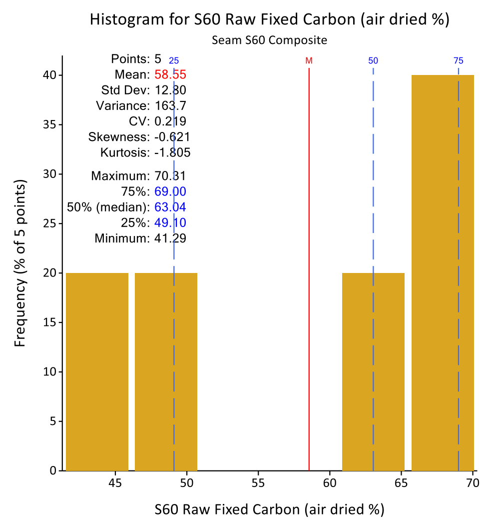
FIGURE 4.12: HISTOGRAM FOR PROXIMATE COAL QUALITY PARAMETERS, S65

Seam S60


Histogram for S60 Raw Ash (% air dried)
Seam S60 composite
Points: 13
Mean: 40.84
Std Dev: 15.56
Variance: 242.2
CV: 0.381
Skewness: 1.698
Kurtosis: 2.273
Maximum: 83.86
75%: 44.60
50% (median): 40.21
25%: 32.80
Minimum: 20.82
Frequency (% of 13 points)
Raw Ash (%ad)


Histogram for S60 Raw Moisture (air dried %)
Seam S60 composite
Points: 13
Mean: 1.06
Std Dev: 0.60
Variance: 0.362
CV: 0.569
Skewness: 2.141
Kurtosis: 1.897
Maximum: 2.67
75%: 1.00
50% (median): 0.83
25%: 0.74
Minimum: 0.62
Frequency (% of 13 points)
Raw Mositure (% air dried)


Histogram for S60 Raw volatiles (air dried %)
Seam S60 composite
Points: 5
Mean: 7.22
Std Dev: 1.13
Variance: 1.288
CV: 0.157
Skewness: 0.506
Kurtosis: -1.852
Maximum: 8.70
75%: 8.09
50% (median): 6.90
25%: 6.20
Minimum: 6.19
Frequency (% of 5 points)
S60 Raw volatiles (air dried %)


Histogram for S60 Raw Fixed Carbon (air dried %)
Seam S60 Composite
Points: 5
Mean: 58.55
Std Dev: 12.80
Variance: 163.7
CV: 0.219
Skewness: -0.621
Kurtosis: -1.805
Maximum: 70.31
75%: 69.00
50% (median): 63.04
25%: 49.10
Minimum: 41.29
Frequency (% of 5 points)
S60 Raw Fixed Carbon (air dried %)

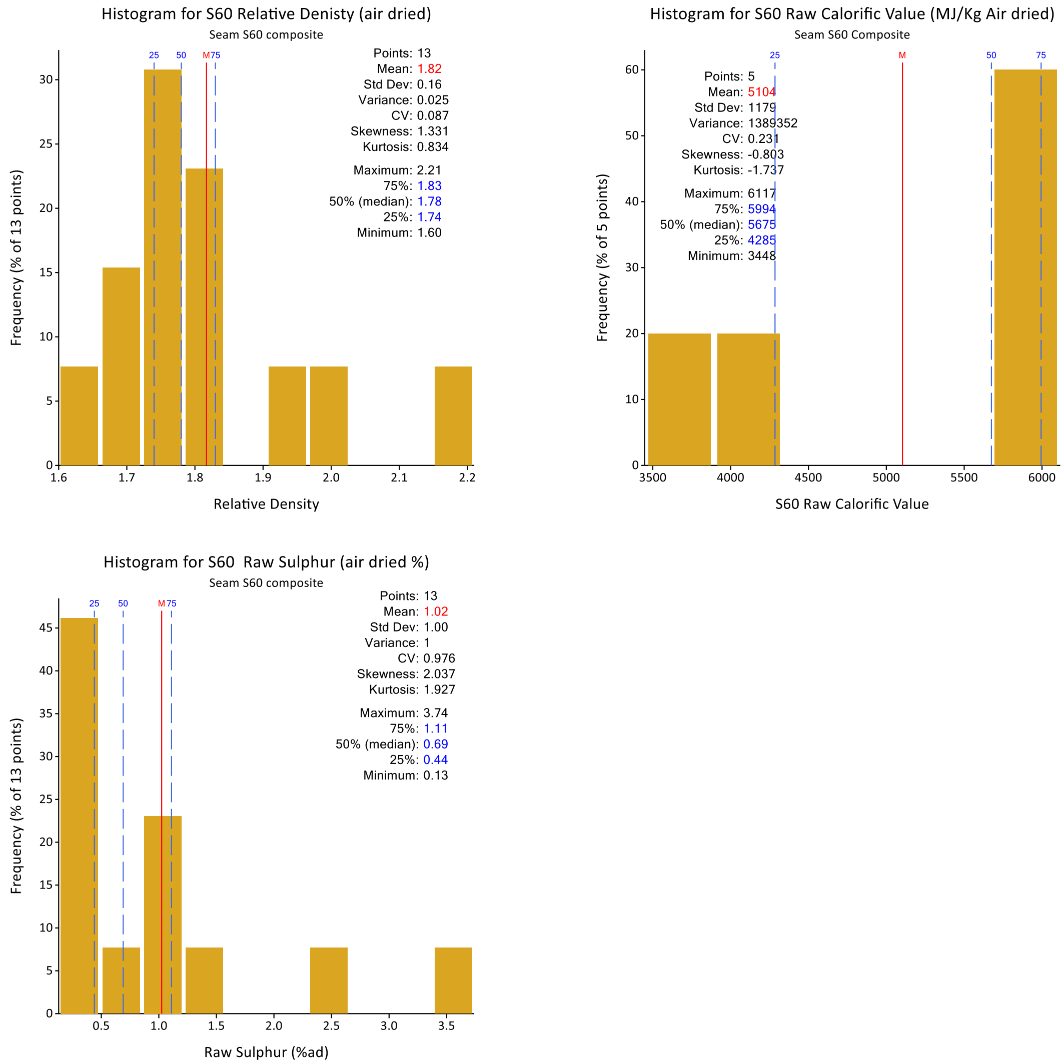


FIGURE 4.13: HISTOGRAMS FOR PROXIMATE COAL QUALITY PARAMETERS, S60

Seam S55

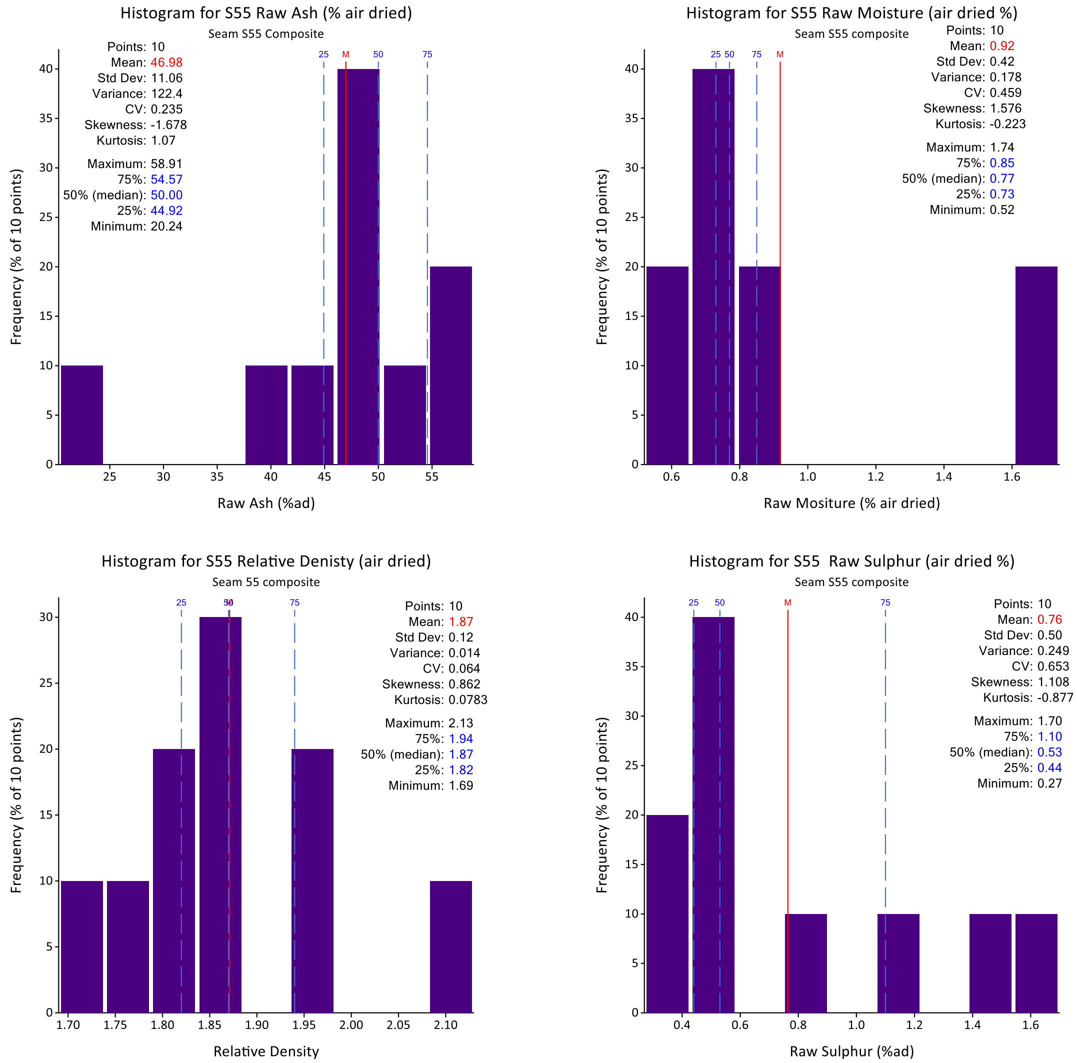


FIGURE 4.14: HISTOGRAMS FOR PROXIMATE COAL QUALITY PARAMETERS, S55

Seam S50

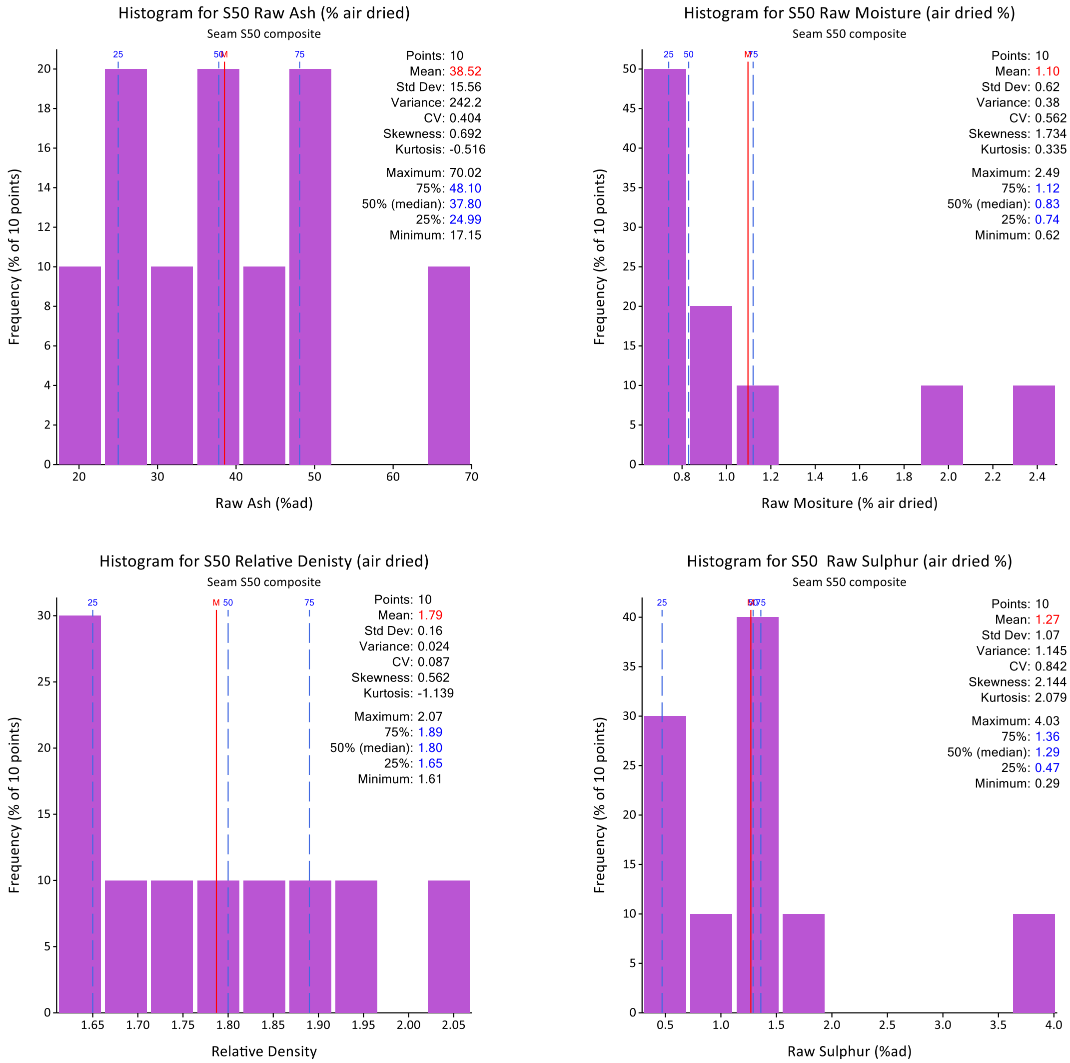


FIGURE 4.15: HISTOGRAMS FOR PROXIMATE COAL QUALITY PARAMETERS, S50

4.5. Structural Geology

The sediments of the Bowser basin have undergone two major deformational events, the first of which was of the highest intensity. Compression from the northeast and the southwest occurred during the uplift of the Coast Crystalline Belt. Locally the result of this F1 deformation can be observed in the northwest-southeast trending Beirnes Synclinorium (Figure 4.16 and Appendix 13) and thrust faulting that is more intense in the southern portion of the Groundhog Coalfield than in the north. The southwest limb of the synclinorium dips gently, bringing coal seams in the area closer to surface near the outer most extent of the limb. Evidence for shearing of the coal seams in this portion of the synclinorium is minimal. The northeast limb however, is overturned and associated with extensive cleavage and shearing in the coal seams as the limb approaches the Skeena River. Cleavages related to F1 deformation are well developed in fine grained lithologies near the fold axes.

Northwest-southeast compressional F2 deformation is coaxial to that of F1, forming shallow, open northeast-southwest trending folds that affect the plunge of F1 folds by approximately 5^{o}. F2 folds vary in wave length from 100m to 700m and vary in amplitude from 100m to 200m. Flat laying thrust faults resulting from the F2 deformation event are thought to be related to the hanging walls of drag folds and have displacement visible along bedding surfaces.

Bustin and Moffatt (1983) suggested that the style of deformation in the Bowser Basin is related to lithology. This hypothesis is supported in the way that the higher, more competent, massive beds of the Devil's Claw and Upper McEvoy units are characterized by broad, open, low-amplitude folds while the relatively thin-bedded, fine-grained lower McEvoy and Currier units are characterized by high amplitude, shorter wavelength folds that tend to be disharmonic with the overlying units.

The Groundhog Thrust Fault is the principle fault within the Groundhog Coalfield. Striking approximately 310^{o}, with an unknown dip, the fault extends from Currier Creek northwest outside of Atrum's property. Along the fault, rocks of the McEvoy Formation are commonly thrust over those of the Currier Formation. The front of the fault is serrated with multiple lobes of McEvoy Formation rock protruding over Currier Formation rocks.

Approximately 6.5 kilometres west of the Groundhog thrust fault lies the Upper Currier Creek normal fault. Striking approximately 315^{o} to 340^{o}, with a believed near vertical dip, the fault extends north from the headwaters of Currier Creek.

Historic reports and associated maps suggest multiple anticlines and synclines trending northwest-southeast within the Beirnes Synclinorium, but additional mapping to confirm previously reported measurements is needed.

Following the 2013 field exploration and drilling program it was apparent that the structure of the coal field can be very complicated in localised zones as a result of the two phases of deformation, this made correlation of seams particularly difficult, however, a much greater understanding of the structural environment is now known and with a seismic program in early 2014 a clear understanding of the NW of the field area is expected.

A structural report was generated as the result of field work carried out by Dr. Michael Cooley in September 2013. This report is attached (Appendix 11).

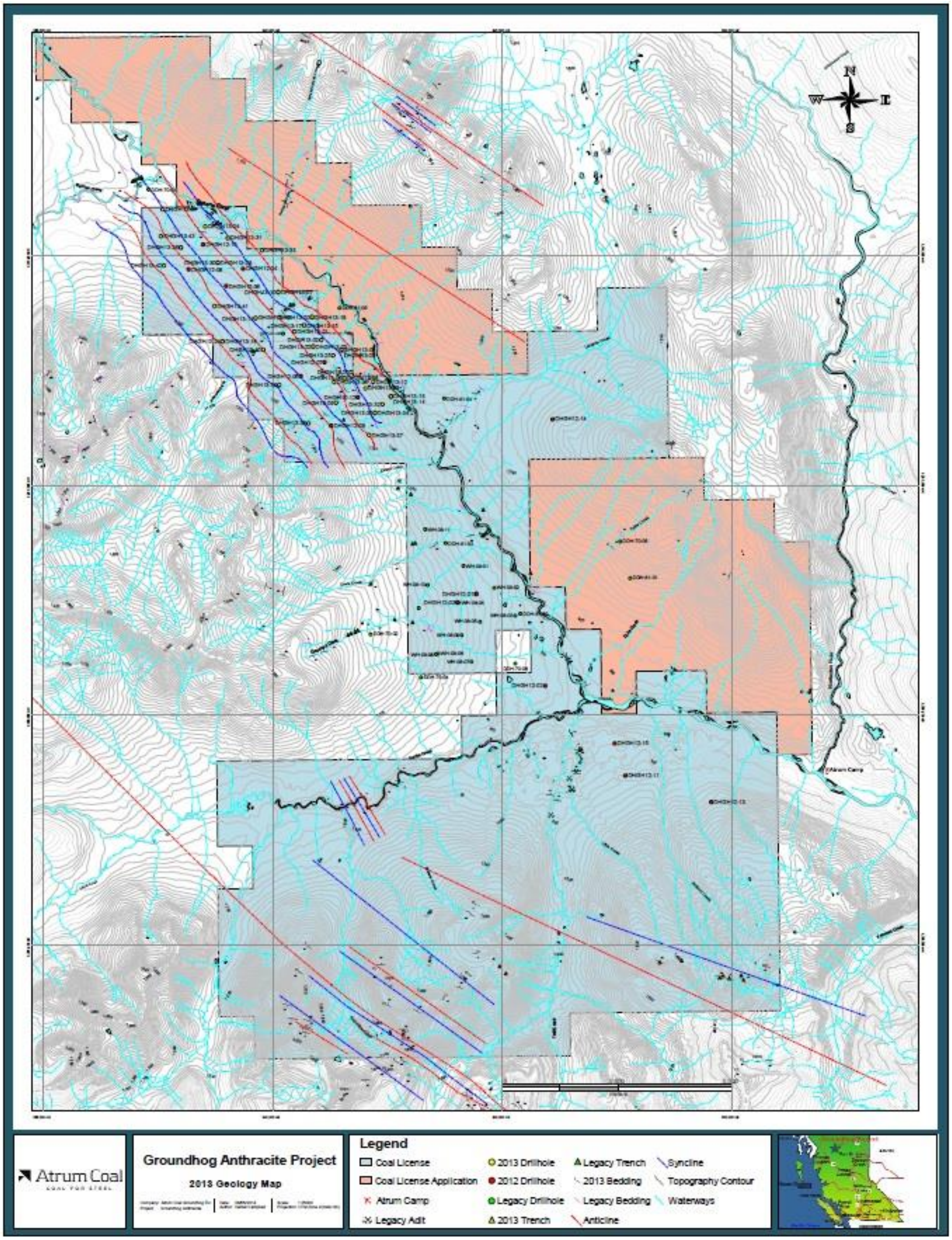


FIGURE 4.16: STRUCTURAL GEOLOGY OF THE GROUNDHOG ANTHRACITE PROJECT

4.6. Deposit Type

The definition of “Deposit Type” for coal properties is different from that applied to other types of geologic deposits. For coal deposits this is an important concept because the classification of a coal deposit as a particular type determines the range of values that may be applied during the estimation of reserves and resources.

As specified in Geological Survey of Canada (GSC) Paper 88-21, which is a reference for coal deposits as specified in NI 43-101, coal “Deposit Types” are either surface mineable, underground mineable, non-conventional or sterilized. All of the deposits of interest at Groundhog in this report refer to the surface mineable coals. In addition to “Deposit Types” the GSC Paper 88-21 also refers to “Geology Types”, which are a definition of the amount of geological complexity, usually imposed by the structural complexity of the area. The classification of a coal deposit by “Geology Type” determines the approach to be used for the resource estimation methodology and the limits to be applied to certain key estimation criteria.

The identification of a particular deposit type for a coal property defines the confidence that can be placed in the extrapolation of data values away from a particular point of reference. The classification scheme of the GSC is similar to many other international coal reserve classification systems but it has one significant difference. This system is designed to accommodate differences in the degree of tectonic deformation of different coal deposits in Canada. Four classes are provided for that range from the first, which is for deposits of the Plains type with low tectonic disturbance, to the fourth which is for Rocky Mountains type deposits such as that of Byron Creek, which is classed as "severe". The second class is referred to as "moderate"; the gently to moderately dipping but only moderately faulted strata of the Panorama properties are typical of this class. The Mount Klappan Anthracite deposit to the north is classified as “complex” due to the tight folds, steep and overturned limbs and common faults. However, portions of that property that are not so deformed are also considered “moderate”.

MMTS classified Groundhog as structurally moderate, but recent exploration has shown that at least portions of the deposit are likely complex structurally.

A copy of geological maps and cross sections can be found in Appendix 13.

5. 2013 Exploration Program

5.1. Drilling Program

All exploration work was undertaken between June and November 2013. The field program consisted of drilling approximately 8000 metres in 64 diamond drill cored holes, all of which were located on the coal licences outlined in section 3. Table 5.1 and 5.2 are a drillhole summary, including collar survey information. The exploration program was designed to increase the certainty of the location of coal measures within approximately 300 to 350m of surface throughout the north-west of the coal licences. The drilling program was guided by drilling and coal quality results from the 2012 drilling program and focused almost entirely on the 70 seam in the north-western area of the property. The entire 2013 drill program was operated by air only access, where drill pad construction, rig movement and drill crews were all supported by helicopter. All 64 core holes were drilled using wireline core retrieval system then described, photographed, sampled for coal and geophysically logged. Most core was HQ (63.5 mm diameter) and core recoveries typically were greater than 90%. There were 6 locations where PQ or PW was used to twin an existing HQ hole to gather a bulk sample for coal quality testing. Many of the holes were drilled from a common pad to either gain a larger bulk sample or drill an inclined hole to gain better understanding of the geological structure. For each of the exploration programs conducted between 1995 and 1998. An SRS 300 helicopter portable hydraulic drill was used to complete the drilling program. Driftwood Diamond Drilling of Smithers, BC completed all the diamond drilling requirements.

TABLE 5.1: HQ DRILL HOLE SUMMARY AND COLLAR SURVEY TABLE

Drill Hole ID	Date Started	Date Completed	Easting	Northing	Elevation	Total Depth (m)	Dip	Azimuth	Core Diameter	Casing Depth	Unconsolidated Material Depth
DHGH13-01	24-Jun-13	27-Jun-13	537600	6311000	1026.33	391.88	-90.0	0.0	HQ	3.87	4.0
DHGH13-02	24-Jun-13	26-Jun-13	541054	6308159	1074.14	189.07	-90.0	0.0	HQ	3.77	4.3
DHGH13-03	27-Jun-13	29-Jun-13	541493	6307945	1037.93	236.62	-90.0	0.0	HQ	4.88	15.2
DHGH13-04	28-Jun-13	30-Jun-13	538529	6310630	1017.59	333.87	-90.0	0.0	HQ	3.16	3.2
DHGH13-05	29-Jun-13	29-Jun-13	541497	6307950	1036.75	64.78	-60.0	53.0	HQ	4.12	16.2
DHGH13-06	30-Jun-13	3-Jul-13	541553	6307322	1087.77	380.60	-90.0	0.0	HQ	1.60	16.0
DHGH13-07	30-Jun-13	4-Jul-13	540119	6309201	1061.01	470.65	-90.0	0.0	HQ	6.37	13.5
DHGH13-08	3-Jul-13	4-Jul-13	541553	6307325	1087.21	89.93	-59.6	251.3	HQ	5.00	10.7
DHGH13-09	4-Jul-13	6-Jul-13	541377	6306793	1135.47	248.74	-90.0	0.0	HQ	6.68	7.1
DHGH13-10	4-Jul-13	5-Jul-13	540115	6309200	1061.29	59.74	-60.4	244.0	HQ	5.73	11.0
DHGH13-11	5-Jul-13	8-Jul-13	539626	6308631	1108.69	355.34	-90.0	0.0	HQ	n/a	8.6
DHGH13-12	6-Jul-13	7-Jul-13	542189	6307253	1015.79	101.86	-90.0	0.0	HQ	2.80	12.3
DHGH13-13	7-Jul-13	8-Jul-13	542571	6306930	974.53	64.62	-90.0	0.0	HQ	1.22	7.0
DHGH13-14	8-Jul-13	9-Jul-13	542573	6306933	973.08	58.67	-60.3	249.9	HQ	4.42	18.6
DHGH13-15	9-Jul-13	10-Jul-13	540681	6308475	1074.72	84.84	-90.0	0.0	HQ	4.07	4.1
DHGH13-16	9-Jul-13	10-Jul-13	539628	6308635	1108.83	81.56	-49.2	245.9	HQ	1.32	9.6
DHGH13-17	10-Jul-13	10-Jul-13	540683	6308479	1074.33	77.52	-50.5	243.9	HQ	4.80	7.5
DHGH13-18	10-Jul-13	14-Jul-13	538906	6308128	1199.04	439.84	-90.0	0.0	HQ	3.82	9.5
DHGH13-19	11-Jul-13	11-Jul-13	540859	6308652	1049.63	68.94	-90.0	0.0	HQ	4.75	5.0
DHGH13-20	11-Jul-13	12-Jul-13	540856	6308656	1049.73	98.47	-49.1	256.9	HQ	3.07	6.0
DHGH13-21	12-Jul-13	13-Jul-13	540469	6308342	1085.37	139.00	-90.0	0.0	HQ	6.90	6.9
DHGH13-22	13-Jul-13	14-Jul-13	540879	6308015	1094.95	124.06	-90.0	0.0	HQ	3.20	7.0
DHGH13-23	14-Jul-13	15-Jul-13	540878	6308016	1094.84	56.39	-71.0	245.8	HQ	2.75	7.6
DHGH13-24	14-Jul-13	15-Jul-13	538906	6308128	1199.04	56.14	-59.9	333.7	HQ	2.80	5.2
DHGH13-25	15-Jul-13	16-Jul-13	541316	6307824	1078.34	67.06	-90.0	0.0	HQ	3.75	3.8
DHGH13-26	15-Jul-13	16-Jul-13	537993	6310167	1062.18	102.12	-90.0	0.0	HQ	2.75	3.8
DHGH13-27	16-Jul-13	17-Jul-13	541701	6307453	1059.89	88.00	-90.0	0.0	HQ	1.77	2.7
DHGH13-28	17-Jul-13	18-Jul-13	538801	6309840	1076.26	65.29	-90.0	0.0	HQ	1.26	8.2
DHGH13-29	17-Jul-13	19-Jul-13	542015	6307105	1052.24	115.97	-90.0	0.0	HQ	2.90	2.9
DHGH13-30	18-Jul-13	18-Jul-13	538801	6309844	1076.23	14.33	-80.0	230.0	HQ	1.52	5.2
DHGH13-31	18-Jul-13	19-Jul-13	539023	6310380	1037.14	56.90	-90.0	0.0	HQ	1.42	5.1
DHGH13-32	19-Jul-13	20-Jul-13	542390	6306760	1036.47	103.83	-90.0	0.0	HQ	4.77	33.7
DHGH13-33	19-Jul-13	20-Jul-13	539762	6310110	1030.41	68.89	-90.0	0.0	HQ	2.75	6.3
DHGH13-34	21-Jul-13	22-Jul-13	542225	6306574	1068.75	136.91	-90.0	0.0	HQ	4.32	8.2
DHGH13-35	22-Jul-13	23-Jul-13	542225	6306574	1068.75	55.10	-69.4	237.2	HQ	4.47	20.0
DHGH13-36	23-Jul-13	24-Jul-13	541336	6307238	1111.27	83.29	-90.0	0.0	HQ	1.80	8.0
DHGH13-37	20-Aug-13	22-Aug-13	542097	6306092	1114.85	166.43	-90.0	0.0	HQ	4.27	4.3
DHGH13-38	23-Aug-13	26-Aug-13	540779	6306344	1211.35	218.15	-90.0	0.0	HQ	5.40	5.4
DHGH13-39	26-Aug-13	30-Aug-13	540139	6307183	1175.10	323.89	-90.0	0.0	HQ	4.86	4.9
DHGH13-40	30-Aug-13	2-Sep-13	539791	6307948	1114.48	208.48	-90.0	0.0	HQ	7.87	10.9
DHGH13-41	2-Sep-13	6-Sep-13	538728	6308897	1139.61	272.66	-90.0	0.0	HQ	n/a	3.3
DHGH13-42	7-Sep-13	8-Sep-13	537630	6309775	1102.52	78.33	-90.0	0.0	HQ	3.05	7.0
DHGH13-43	8-Sep-13	9-Sep-13	537561	6310416	1046.48	56.58	-90.0	0.0	HQ	4.65	5.0

TABLE 5.2: PQ DRILL HOLE SUMMARY AND COLLAR SURVEY TABLE

Drill Hole ID	Date Started	Date Completed	Easting	Northing	Elevation	Total Depth (m)	Dip	Azimuth	Core Diameter	Core Logged
PQ13-31-1	19-Aug-13	19-Aug-13	539022	6310376	1037.13	21.50	-90.0	0.0	PQ	Y
PQ13-31-2	20-Aug-13	21-Aug-13	539022	6310376	1037.13	18.00	-82.0	220.0	PW	N
PQ13-31-3	21-Aug-13	22-Aug-13	539022	6310376	1037.13	18.00	-90.0	0.0	PQ	N
PQ13-31-4	22-Aug-13	22-Aug-13	539022	6310376	1037.13	18.00	-90.0	0.0	PQ	N
PQ13-26-1	23-Aug-13	24-Aug-13	537995	6310169	1061.90	62.00	-90.0	0.0	PQ	N
PQ13-26-2	25-Aug-13	26-Aug-13	537995	6310169	1061.90	66.50	-81.0	128.8	PQ	Y
PQ13-26-3	27-Aug-13	29-Aug-13	537995	6310169	1061.90	69.00	-90.0	0.0	PQ	N
PQ13-26-4	29-Aug-13	30-Aug-13	537995	6310169	1061.90	63.50	-82.0	220.0	PQ	N
PQ13-26-5	31-Aug-13	1-Sep-13	537995	6310169	1061.90	38.00	-90.0	0.0	PQ	N
PQ13-13-1	2-Sep-13	2-Sep-13	542574	6306933	972.78	42.50	-90.0	0.0	PQ	N
PQ13-13-2	2-Sep-13	3-Sep-13	542574	6306933	972.78	44.00	-82.0	220.0	PQ	N
PQ13-13-3	4-Sep-13	5-Sep-13	542574	6306933	972.78	43.50	-88.0	234.4	PQ	Y
PQ13-13-4	6-Sep-13	8-Sep-13	542574	6306933	972.78	45.00	-90.0	0.0	PQ	N
PQ13-08-1	8-Sep-13	10-Sep-13	541555	6307328	1086.45	46.50	-90.0	0.0	PQ	Y
PQ13-08-2	10-Sep-13	11-Sep-13	541555	6307328	1086.45	40.50	-85.0	220.0	PQ	N
PQ13-19-1	13-Sep-13	14-Sep-13	540853	6308659	1049.90	65.81	-90.0	0.0	PQ	Y
PQ13-19-2	14-Sep-13	15-Sep-13	540853	6308659	1049.90	64.50	-82.0	220.0	PQ	N
PQ12-01-1	15-Sep-13	15-Sep-13	544430	6302631	1005.39	30.00	-90.0	0.0	PQ	N
PQ12-01-2	15-Sep-13	16-Sep-13	544430	6302631	1005.39	27.00	-82.0	220.0	PQ	N
PQ12-01-3	16-Sep-13	16-Sep-13	544430	6302631	1005.39	27.00	-90.0	0.0	PQ	N

Drill Holes were named to reflect the drillhole type, the Project, the year and the hole number. As an example: DHGH-13-01

- DH – Diamond Drill Hole
- GH – Groundhog Project
- 13 – 2013
- 01 – Hole #1

All holes were logged with a slim-line gamma-density tool which was lowered through the drill stem to obtain at least one complete geophysical log of the hole. Detailed logging (1:50 Scale) was undertaken only over significant coal seam intervals. Whenever possible, exploration drill-holes were also logged open hole. In the later stages of the project dipmeter, sonic and acoustic televiewer were also used.

In general, all holes were logged through the drill stem to obtain a gamma density log at 1:100 and 1:200 scale, a neutron log at 1:100 scale and an expanded scale gamma density at 1:50 scale. Copies of the downhole geophysical logs are included in Appendix 2.

All cores collected were descriptively logged in detail (Appendix 3) by geologists on site. Once described and measured, the coals and selected host rock samples were bagged and labeled for subsequent analysis. Core was logged and stored on site to the north of the Kluatantan Airstrip.

5.2. Trenching Program

Trenches were dug by hand by a team of two under the direction of a geologist. The objective of the trenching program was to prove coal seam thicknesses, test structural hypotheses in the area, and sample for coal quality. Table 5.2 provides the list of trenches, and their location, completed in the 2013 exploration program.

TABLE 5.3: TRENCH SUMMARY TABLE

Trench ID	Trenching Date	Easting	Northing	Trench Length (m)	Trench Width (m)	Trench Depth (m)	Azimuth	Seam Thickness (m)
GH-TR-13-01	24-Jul-13	539564	6307919	2.14	1.00	6.64	116	1.44
GH-TR-13-02	24-Jul-13	540276	6308831	1.8	1.00	1.8	290	1.5
GH-TR-13-03	25-Jul-13	544570	6303906	1.25	1.50	13.49	138	1.04
GH-TR-13-04	25-Jul-13	546684	6299262	1.5	0.80	1.5	20	0.38
GH-TR-13-05	25-Jul-13	546711	6299263	1.2	1.00	1.1	25	0.28
GH-TR-13-06	25-Jul-13	546685	6299244	1.4	0.80	1.6	22	0.65
GH-TR-13-07	28-Jul-13	548423	6294615	1.3	0.70	4.4	76	0.7
GH-TR-13-08	28-Jul-13	548903	6294655	0.5	0.70	0.6	103	0.45
GH-TR-13-09	28-Jul-13	549729	6294284	1.9	0.40	1.95	33	1.75
GH-TR-13-10	29-Jul-13	549940	6294270	5.7	0.85	5.7	349	5.25
GH-TR-13-11	30-Jul-13	549805	6294325	3	0.80	2.3	219	1.5
GH-TR-13-12	30-Jul-13	550199	6294334	1.5	6.00	0.7	252	0.3
GH-TR-13-13	30-Jul-13	550251	6294234	2.2	0.60	2.3	235	1.65
GH-TR-13-14	31-Jul-13	545076	6294376	3.25	1.50	3.03	257	2.69
GH-TR-13-15	31-Jul-13	544943	6294530	2.9	0.65	2.51	209	1.91

Trenches were named to reflect the Project, the trench, the year and the trench number. As an example: GH-TR-13-01

- GH – Groundhog Project
- TR – Trench
- 13 – 2013
- 01 – Trench #1

Once the trench location was identified by the geologist, trenches were typically dug according to topography, with the trench dug horizontally into the slope. Digging continued until the floor of the seam was inarguably breached. As such, trench depths vary greatly. Trenches had typical widths of 1 m and an average depth of 3 m. A total of 15 trenches were dug and logged. Trenches were logged and described by the geologist on site (Appendix 4), after which coal was collected for quality analysis. Seams with a thickness greater than 25 cm were sampled. Fresh coal was exposed and sampled without contamination from the roof, parting, or floor. Representative samples were taken along the strike of the exposed seam.

6. Coal Quality

The evaluation of coal quality for the 2013 exploration programs is based upon the analytical results of core obtained from drill-holes, and from bulk samples collected from the Groundhog Property. The primary purpose of the coring programs was to obtain sufficient samples of significant coal seams for reliable determinations of the raw and some clean quality characteristics of the Groundhog Property.

The 2013 laboratory testing was more comprehensive than in 2012, samples were not only tested for coal quality, but also for environmental analysis, mineral properties and geotechnical parameters. Typically, specific lab analyses on core samples were performed by ALS Laboratories in Burnaby, Vancouver, British Columbia however some samples went to Loring Laboratories Ltd. of Calgary, Alberta. Most samples collected were representative of selected coal units and their associated internal partings. Roof and floor samples were also collected for most significant seams but were not analysed.

In total 1216 core samples were collected from the 2013 drilling program, of which 216 individual ply samples were analyzed for raw coal quality (Appendix 5). Coal Quality Certficates from ALS are included in Appendix 5 for each individual sample ply. From the initial ply samples, 80 composite samples were made to represent some potential product intervals and basic size and washability work was done on these composites (Appendix 6).

Samples were all weighed and air dried, selected samples (individual plies and composites) were then designated one of four analytical flow paths for analysis based on the mass of material available for testing (PQ Major Ply, HQ Major Ply, HQ Small Ply or Basic) (Appendix 7).

Analysis focused on the shallow coal seams (mainly Seam 70 or above) in the NW portion of the project where initial bulk sample work is anticipated). Analysis of HQ Major Ply and HQ Small Ply, HQ Basic and PQ Major were done by the process outlined in their respective flow charts. Clean Coal Composites were compiled where yield /ash SG cuts warranted (the clean coal composites were compiled under the direction of Xstract/Calibre with the intent of having sufficient definition and information to feed into a PFS). Sample analysis was completed on a prioritized basis to ensure more critical area results were received first. To date, 216 samples have been analyzed (see attached spreadsheet for breakdown Table 1):

- 55 HQ Small ply samples, 15 of which had clean coal composites (CCC) analyzed
- 46 HQ Major ply samples, 28 of which had clean coal composites (CCC) analyzed
- 66 HQ Basic analysis samples
- 9 PQ Major ply samples
- 13 Trench samples (Basic Analysis)
- 27 Gas Content samples (Basic Analysis)

Sample analysis flowcharts, quality review and compositing recommendations were the responsibility of Xstract/Calibre

In addition to the coal quality program, 11 samples were selected for petrographic analysis which was performed by VanPetro of Vancouver, BC (Appendix 8), a subset of 5 samples was then analysed by ALS with an XRD (Appendix 9). 31 geotechnical samples were collected over the summer and 16 of these were selected for rock strength testing by Golder Associates of Vancouver, BC (Appendix 10). A total of 20 gas content samples were collected from multiple seams at three separate locations to characterise the ventilation requirements of potential mining operations (Appendix 12).

[redacted]

[redacted]

[redacted]

7. Resources

Atrum coal has had 3 JORC (Joint Ore Reserves Committee, which is the Australian Code for Reporting Exploration Results, Mineral Resources and Ore Reserves) Compliant resource estimates completed on Groundhog since August 2012. The first two estimates were completed by Moose Mountain Technical Services based entirely on historic data, prior to Atrum's exploration and the most recent estimate was completed by Xstract Mining Consultants based on historic data and Atrum's 2012 drilling results.

- The first Resource Estimate was completed by Moose Mountain Technical Services, dated November 20, 2012 was completed on the original Groundhog Licence blocks acquired by Atrum (Moose Mountain Technical Services, November 20, 2012).
- The second Resource Estimate was completed by Moose Mountain Technical Services dated January 3, 2013 was completed on the original Groundhog Licence blocks acquired by Atrum, plus the extension coal application lands subsequently acquired by Atrum (Moose Mountain Technical Services, January 3, 2013).
- The third and most current resource report was completed by Xstract Mining Consultants effective April 2013 was completed on the original plus extension lands, plus utilizing the 2012 exploration drilling information (Xstract, April, 2013)

The following is an excerpt from the Xstract Resource Estimate Report outlining the methodology and resource.

7.1. Resource Estimate

[redacted]

[redacted]

The summary coal resource table for reporting under the JORC Code, 2004, is shown in Table 7.1.

7.2. Resource Classification

The following resource classification criteria were adopted:

- Points of observation for resource classification purposes were defined as cored drill hole intersections of seams with 80% or better core recovery and coal quality composites (at least raw coal moisture, ash and total sulphur) that pass all QA/QC checks. Interval correlations and thicknesses must also be supported by down-hole geophysics.
- The resource is classified as Measured if the distance between valid points of observation is less than 500 m (effective maximum 250 m radius around points of observation).
- The resource is classified as Indicated if the distance between valid points of observation is greater than 500 m and less than 1,800 m (effective maximum 900 m radius around points of observations). This is in accordance with guidelines contained in the GSC Paper 88-21 and recommended for Geology Type "moderate" structural complexity.
- The resource is classified as Inferred if the distance between valid points of observation is greater than 1,800 m and less than 4,000 m (effective maximum 2,000 m radius around points of observation).
- At least two intersecting points of observation radii were required for classification (i.e. no isolated drill holes allocated areas of influence).

TABLE 7.1: OVERALL SUMMARY OF CUMULATIVE COAL RESOURCES INCREASING WITH DEPTH (AIR-DRIED TONNES)

Depth	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	TOTAL (Mt)
<50 m	2	61	91	154
<100 m	7	168	240	415
<200 m	13	388	592	993
<300 m	16	521	883	1420
<400 m	16	553	998	1567

8. Cost Incurred

Details of costs incurred for work conducted in the 2012 exploration program is provided within the Cost Summary Report Appendix 13. The summary presented represents the total expenditure to date relating to Groundhog exploration activities.

9. Conclusions

Significant resources of high rank Anthracite coal have been identified within the Groundhog Property limits currently held by Atrum Coal Groundhog Ltd. The primary value of the Groundhog Property is that of a PCI (pulverized coal injection) product for the steel making industry and as a specific high carbon anthracite product. Additional drilling, surface mapping & trenching and ground geophysics (shallow seismic) are required to increase the confidence level of the current resources.

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