ASSESSMENT REPORT TITLE PAGE AND SUMMARY

TITLE OF REPORT: Bingay Main Coal Property Report 2011-2012 Technical Assessment Report

TOTAL COST: $2,506,934

AUTHOR(S): Edward J.Nunn, P.Eng.; Richard Munroe, P.Geo.

SIGNATURE(S):

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S): CX-12-4/Feb.11,2010

STATEMENT OF WORK EVENT NUMBER(S)/DATE(S): 3225459 to 3225460, Feb.11, 2010

YEAR OF WORK: 2011-2012

PROPERTY NAME: Bingay Main Metallurgical Coal Project

COAL LICENSE(S) AND/OR LEASES ON WHICH PHYSICAL WORK WAS DONE:
374190, 414014, 417302

COAL LICENSE(S) IN PROJECT AREA ON WHICH NO PHYSICAL WORK WAS DONE OVER THE CURRENT REPORTING PERIOD: N/A

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

BC MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN: 082JSE011

MINING DIVISION: Kootenay Land District, Fort Steele Mining Division

NTS / BCGS: 82J/01W, 82J/02W, 82J/07W, 82J/016W

LATITUDE: 50° 11' 53"

LONGITUDE: 114° 58' 37" (at centre of work)

UTM Zone: ZONE 11 EASTING: 644385 NORTHING: 5562611

OWNER(S): Centermount Coal Ltd.

MAILING ADDRESS: 1055-1140 West Pender Street, Vancouver BC V6E4G1

OPERATOR(S) [who paid for the work]: Centermount Coal Ltd.

MAILING ADDRESS: 1055-1140 West Pender Street, Vancouver BC V6E4G1

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

Bingay Creek, Elk Valley Coalfield, Metallurgical Coal, Mist Mountain Formation, Elkford, syncline structure, Jura-Cretaceous, Moose Mountain Sandstone

REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS:

Bingay Creek Coal Property Assessment Report, 5 June 2006, File No. 895

[redacted]

TYPE OF WORK IN THIS REPORT	EXTENT OF WORK (in metric units)	ON WHICH CLAIMS	PROJECT COSTS APPORTIONED (incl. support)
GEOLOGICAL (scale, area)		NONE	
Ground, mapping			
Photo interpretation			
GEOPHYSICAL (line-kilometres)		NONE	
Ground			
Magnetic			
Electromagnetic			
Induced Polarization			
Radiometric			
Seismic			
Other			
Airborne			
GEOCHEMICAL (number of samples analysed for …)		NONE	
Soil			
Silt			
Rock			
Other			
DRILLING (total metres, number of holes, size, storage location)			374190, 414014, 417302
Core		2777.42m, 19 holes	
Non-core		1485.27m, 11 holes	374190, 414014, 417302
RELATED TECHNICAL			374190, 414014, 417302
Sampling / Assaying		430 samples	
Petrographic		44	374190, 414014, 417302
Mineralographic		386	374190,414014,417302
Metallurgic			
PROSPECTING (scale/area)		NONE	
PREPATORY / PHYSICAL			
Line/grid (km)		NONE	
Topo/Photogrammetric (scale, area)		NONE	
Legal Surveys (scale, area)		NONE	
Road, local access (km)/trail		NONE	
Trench (number/metres)		Long: 483m, wide:1,5m	374190, 414014, 417302
Underground development (metres)		NONE	
Other			
		TOTAL COST:	**$2,506,934**

Coal Quality information, parts of the Summary and Conclusion, Appendix I,II, VIII, IX, and X of the 2011 Appendices, and Appendix I, VI, VIII, and IX of the 2012 Appendices 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

Bingay Main Coal Project

2011-2012 Technical Assessment Report

Kootenay Land District, Fort Steele Mining Division
British Columbia

NTS: 82J/01W and 82J/02W and 82J/07W and 82J/016W

Latitude: 50° 11’ 53” N
Longitude: 114° 58’ 37” W

Tenure Numbers:

374190, 414014, 417302

Prepared for:
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May 30, 2016

Contents

Appendix 1: Time Line folder of reports filed by month and year for ease of reference

2011

February - Notice of Work Amendment

2011 Geological Report of Work submitted by Gwyneth Cathyl- Bickford

March - Special Oxidized sample report by Ryan

April - List of samples sent to China for Bingay Main Coal analysis

List of samples for activated carbon analysis

July - Elk Valley Labs report on the Evaluation of Carbonization by Pal Sharma

SGS assay report 10168-1 on fixed carbon etc.

August - GEMCOM Report on the Geological and Block Modeling of the Bingay Creek Coal Deposit III

September - Centermount Drilling Notice of Supervision

November - ACME Labs Whole Rock Analysis VAN11005007.1

December - WSA Engineering Ltd Report on the Preliminary Geotechnical Study of Bingay

Watterson Geoscience Inc. Hydrogeological Investigation Report

SGS Coal Quality Analysis Certificates on 4, 10, 12, 12R, 20 and blend samples

2012

January - Walgren Soils Testing- Durability Testing on Sandstone Report

February - Norwest Corp. 2012 Bingay Creek Geological Model Report

April - ACCESS Geochemical Characterization Report for Bingay Hill

June - Drill Hole 2R ash test report

July - John Payne Petrographic Report on Bingay Rock samples

October - Seismic Reflection Investigation Report by Hansen and Candy

Trench sample Report by Spring MacAskill

Bingay Drill Hole Detail May- Oct 2012

2011 Appendices:

2012 Appendices:

Figures

Tables

Map

1.0 Summary

This report presents a technical assessment of the known geology and coal resource base of the Bingay Main area of southeast British Columbia, Canada, based on the exploration work conducted by Centermount Coal Ltd. from the start of 2011 to the end of 2012. The company recently filed a comprehensive report covering the exploration activity on the same property in 2010 with reference to the earlier work performed since 1903. That most recent report should be used in conjunction with the data generated in the 2011- 2012 period as much of it comes as follow up work from the 2010 program.

The Bingay Main exploration area, as presently considered, is bounded to the west by longitude 115°00' W and to the south by latitude 50°10' N. The exploration area is further bounded to the east by the west bank of the Elk River and to the north by latitude 50°15' N. The Bingay Main coal property was formerly known as the Bingay Creek Coal property until 2009. Applications were underway by Centerpoint Resources Inc. (owns 55% of Centermount Coal Ltd.) for coal licences from adjoining Bingay area properties. Three additional property areas are noted in this report (Bingay A, B and C). They are shown in Figure 3-2 below.

The combination of the historical and current work (up to the end of 2012) has allowed for a much more substantial determination of coal resources of immediate interest for surface and underground coal mining within the Bingay Main coal property. New drilling and trenching was conducted in mid-March 2016 to test out much of the structural theory and prove coal quality and volume estimates developing in the pre-2016 exploration efforts. All of the work following this 2011-2012 report will be report upon by others at some future date.

The Bingay Main property lies within the Southern Rocky Mountains of south-eastern British Columbia, Canada. Bingay A coal licence application adjoins Bingay Main directly to the north. Bingay B and C coal licence application border Bingay Main directly to the south. Several other coal exploration properties and active coal mines (including the Greenhills and Fording River mines) are situated near to Bingay Main.

These properties and mines constitute the known Elk Valley coalfield. The Bingay Main property consists of four contiguous parcels of Crown coal exploration licences totalling 1157 hectares, originally issued by the British Columbia Ministry of Energy, Mines and Petroleum Resources to other parties, and subsequently transferred to Centermount Coal Ltd. In comparison with most coal properties in British Columbia, exploration access to Bingay Main is convenient, by virtue of its location adjacent to the all-weather Elk River Forest Service Road. The branch roads and trails within the property allow for east and west movement across the license areas off the main forest road.

The closest railway is the Fording River branch of the Canadian Pacific Railway, located about 30 kilometres south-east from Bingay Main. The railway provides access to Canadian coal-shipping ports in westernmost British Columbia. Access to this rail system is possible with fairly easy trucking or the construction of a rail branch line.

No fee simple mineral lands are known to exist at Bingay Main. However, privately held mineral lands do exist to the east and south-east of the property. These are identified as the Greenhills Block of fee simple coal lands covers coal beds which come to the ground surface along the western slopes of chain of high hills known as the Greenhills Range. These fee simple lands are not part of the Bingay Main coal property and are neither owned nor optioned by Centermount Coal Ltd.

Prior to 2011, a total of 74 boreholes are known to have been drilled within the Bingay Main coal licences, commencing in 1983 and continuing until 2010. Additional work was carried out subsequent to the 2011-2012 programs and those holes and data sets are the subject of this reporting.

Of those known 74 boreholes, 57 encountered potentially-mineable coal. The other 17 boreholes include those which failed to reach the bedrock surface or which were abandoned at a shallow depth owing to drilling difficulties. It was later indicated that some of the holes had been drilled in previously unknown shear zones crossing the property suite. Some encountered older, non-coal-bearing rocks, lying outside the bounds of the Elk Valley coalfield.

The exploration programs have identified that the property contains at least 32 coal beds, whose true thickness ranges from 0.3 to 16.2 metres. Of these coals, 24 typically are at least 1-metre-thick, inclusive of contained bands of rock. Cumulative thickness of these coals is 62.6 metres, within an overall coal-bearing rock thickness of 460 metres; coal thus forms about 13.6% of the coal-bearing rocks at Bingay Main.

The Bingay Main coals are normal banded coals, consisting of alternating bright and dull bands, generally associated with thin and thick partings of rock. Most of the rock partings within the coal beds consist of variably-carbonaceous mudstone, with less-frequent partings of siltstone, ironstone and sandstone. Most of the rocks which lie between the coal beds at Bingay Main are siltstone, interspersed with sandstone and mudstone, with minor bands of limestone and ironstone. The coal-measures are folded into a tight synclinal down fold, along whose sides the coal beds approach the ground surface. New petrographic work commissioned in 2010 to Vancouver Petrographics was an attempt to define marker beds and identify new horizons. That work is detailed in this report. Further petrographic work has been suggested to the company and is being considered.

Coals lying within 12 metres of the ground surface are inferred to be oxidised, and are thus principally conceived to be of value as feedstock such as for the production of activated carbon, perhaps the bottom six meters being suitable for use in pulverised coal injection (PCI) into blast-furnaces, or as thermal coals.

Coals at least 1-metre-thick and lying between 10 and 600 metres below the ground surface are recognised to be of interest as coking coals (ASTM ranked medium to high volatile A bituminous). Extensive analytical work was conducted on these coals, which show variable but generally acceptable propensity to provide a clean coal product containing less than 10 percent ash and a low average sulphur content.

[redacted] The Geological Model was prepared by Gemcon Software International (issued in December 2010) under the direction of Edward Nunn, P. Eng. of Centermount Coal Ltd. This coal resource was estimated down in some zones to a zero thickness. Further geological modelling and recalculation of resources will be based on a minimum thickness of 60 centimetres. This reporting author (Munroe) had no involvement in any of the resource estimates. Any volume or tonnage values reported in this or additional reports are from others. Any values stated in this report come from those other researchers.

The following information was reported upon in the 2010 report but it is important to re-state the reasons for the COMPLEX rating of the Bingay deposit.

GSC Paper 88-21 is the "Standardized Coal Resource/Reserve Reporting System for Canada". In this document, coal deposit geology is classed into four categories — low, moderate, complex and severe. The author of the Bingay Main Coal Property Geological Report has classified the Bingay Main coal deposit as “Complex" which is defined by Paper 88-21 “Deposits that have been subject to relatively high levels of tectonic deformation. Tight folds, some with steeply inclined or overturned limbs, may be present, and offsets by faults are common.”

Based on all that is known on the property it must be described in the **COMPLEX** category of coal deposits. The Geological Survey of Canada Paper 88-21 is entitled, “A Standardized Coal Resource/ Reserve Reporting System for Canada”. In that report the classification guide for complex deposits is found on page 5. It notes that, in part, a complex deposit is as follows:

“Deposits in this category have been subjected to relatively high levels of tectonic deformation. Tight folds, some with steeply inclined or overturned limbs, may be present, and offsets by faults are common. Individual fault- bounded plates do, however, generally retain normal stratigraphic sequences, and seam thicknesses have only rarely been substantially modified from their pre-deformational thickness.”

This type of scenario was clearly evident in 2010 and continues to be the case today at the Bingay location. Distinct boundaries are present and even with the deformation; small bedding details remain in many sequences. There were even distinct dinosaur foot prints located on some vertical pit exposures. A severe category deposit has been subjected to extreme levels of tectonic deformation. The Bingay deposit has not reached that level of distress and remains in the complex category.

Further analytical work and further drilling, along with other supporting studies, were recommended in the Geological Report by C.G. (Gwyneth) Cathyl-Bickford P.Geo. Lic. Geo, in her report released in 2011 for the Bingay Main coal property, in which she regarded it as being a property of merit. Much of that work was followed up on and will continue into 2016. With respect to the tonnage estimates suggested by Bickford in 2011, this was not a signed off value in 2010. It was a work in progress as the senior author (Bickford) only made a bank cubic metre (BCM) calculation and it was then expressed as a tonnage value by initial calculation. A regression analysis was done on the ash content and using specific gravity relationships of the ash, the BCM was converted to tonnage. In the later years, (2011-2012) more follow up work was done on that aspect. Appendix 1 of this report contains a host of reports pertaining to the additional work in the 2011-2012 periods by the company and its consultants.

The reader is invited to examine the Appendix to better understand the scope of new reporting materials available. Each pertinent exploration related report was placed into time filed folders for ease of locating them. Many reports that were either too preliminary in nature to report on at this time, or not related to exploration activity have been left out of the folder. The missing non-exploration reports tend to explain some of the large time gaps in the date files. Gaps are also present as some of the reportable tests and analysis has taken many months to complete. Resource speculation activity based on incomplete or too preliminary data is dangerous to everyone. A series of computer generated resource models and the requisite checks and re-checks must be done before further tonnage numbers are reported.

The model was also cut off in 2010 as winter set in. Additional drilling planned in 2010 was done to the north in 2011 b y the writer (Munroe). This allowed for new information on the model but no relevant geological data was produced in that drilling series. This was due to the fact that the diamond drill holes, attempted along the ridge line north west of the main Bingay Hill zone (West of and high above the main Forest Service Road (FSR) were drilled into major north/south trending fault zones along the escarpment. These faults (or fracture lines) appeared to be generated as the frontal fracture zone of the Borgeau Thrust Fault. The entire Bingay project continues to be a work in progress and will be reported upon each time new data or modeling becomes available. New exploration work is slated to begin in mid- March 2016 under new permitting,

The gas tests that were concluded in 2010 are similar to other Elk River area coal fields. This data set was presented in the appendix IV sections of the 2010 report. Additional gas tests were conducted and are reported in that document.

Unfortunately, some of the sample location records and actual assay certificates are not available in the company records. In some cases, the samples would have been taken by assorted consultants for their reports as average representations and location information was not collected. In some cases, the assay certificate was not submitted with the consultant's report. Attempts are on going to locate these files.

2.0 Introduction and Terms of Reference

At the request of Edward J Nunn, P. Eng., Vice President of Centerpoint Resources Inc., this report was prepared to present the new body of 2011-2012 geological information to the BC government's Geological Services branches. The geology and coal resource base of the Bingay Main area was reported on in the Geological Report by C.G. (Gwyneth) Cathyl-Bickford P.Geo. Lic. Geo, which was submitted by Cathyl-Bickford in 2011. A copy of that report was filed with the government and continues to act as a mainstay reference.

The exploration work conducted during the summer and autumn of 2010 was extensive and led to larger discoveries on and around the property. The Bingay Main coal property was formerly known as the Bingay Creek Coal property prior to 2005. The name was changed in the Company reporting to better distinguish the property from adjoining properties.

There was an extensive body of work that was developed by the company and its consultants from 2011 to 2012. Many reports came in at various times based on lab wait times and some were follow up reports from work started in 2010. It was difficult to disperse the data in the normal reporting manner without losing context and some important aspects of the progress on the project were getting "lost in the data". As a result, the writer has taken all of the data sets and filed them into a time sequenced appendix (Appendix 1). This allows the reader to find the report being referenced by referring to the information date tag. This is especially important when some consultants issued multiple reports over several years.

A great deal of work was done by the company in preliminary studies involving geological modeling, ground chemistry and potential waste analysis. However, this work does not qualify as exploration activity under the reporting rules so it cannot be expanded upon in this report. This type of data will be presented in a future pre-feasibility study within Bingay Hill's mine development process. A lot of the work is also of a preliminary nature so it cannot be accurately reported on.

Much of the follow up work was done to clarify exploration derived questions or to address new discoveries noted in the 2010 report. Large volumes of assay and test results are important to have available in the report but are better added as reference to the main report. Since the main stay information on the deposit's structural and depositional nature were well laid out in the 2010 report the writer has decided to maintain much of that original reporting in this document.

This saves the reader from having to constantly flip back to the 2010 report to follow the information flow. References to updated test results and advances on the knowledge base for the deposit have been inserted into the 2010 report framework for ease of reference and readability. This process allows the reader to better understand where an otherwise stand alone document would fit into the general report flow. Each consultant report tried to advance the knowledge base and advance the project at the same time. The direct value of that follow up report carries much more weight when it is properly included in the ongoing report flow matrix.

2.1 Reliance on Other Experts

The 2010 exploration programme for Centermount Coal Ltd.'s Bingay Main project was led by President Edward (Ted) Nunn P.Eng. He is fully responsible for the resource estimates contained in this current assessment report. The writer (Munroe) makes no representations as to resource value or any tonnage estimates.

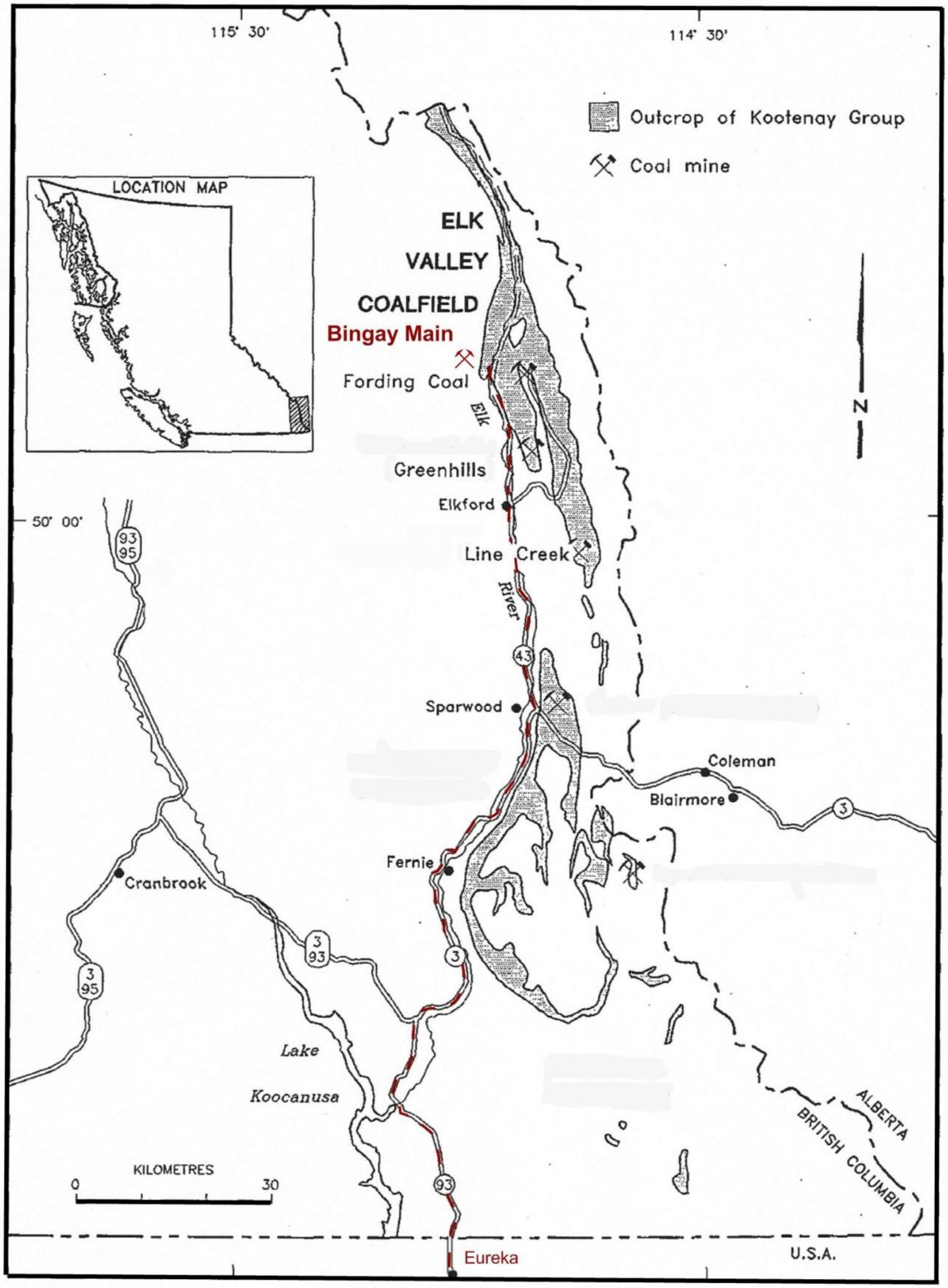
The other main participants in the 2011-2012 work were, coal bed gas geologist Dr. Barry Ryan P.Geo., structural geologist Richard Munroe FGAC, P.Geo., surveyor Robert Simmerling P.Eng. and environmental advisors Sylvie Masse R.P.Bio. and Dr. Ico de Zwart R.P.Bio. Involved in the trench analysis and logging was Spring MacAskill, P.Geo.. A seismic reflection study was done by Ralf Hansen and Cliff Candy. John Payne conducted a petrographic report on a selection of the Bingay strata. Dan Watterson continued his analysis of the water quality and hydrology of the Bingay Hill Deposit. Coal quality testing was also done by Elk River Labs by Dr. Pal Sharma.

Particular thanks are again due to the continuing support of Mr. William Shenfield of Iron Creek Exploration Ltd. In addition, Peter Jones, and Mr. David Grieve of the British Columbia Ministry of Energy, Mines and Petroleum Resources have always, when requested, provided great support in the development of the geological information data base.

3.0 Property Description and Location

The Bingay Main property lies within the Southern Rocky Mountains of south-eastern British Columbia, Canada (as shown on **Figure 3-1: Project Location map).** The map shows the outline of the Bingay Main coal property, and depicts the areas of licensed lands. The Bingay Main property consists of four north-trending parcels of Crown coal exploration licences totalling 1157 hectares, originally issued by the British Columbia Ministry of Energy, Mines and Petroleum Resources, and subsequently transferred to Centermount Coal Ltd. The property is bounded to the east by coal mining leases held by Elk Valley Coal Corporation, to the north and south by coal licence applications (designated as 'Bingay A', 'Bingay B' and 'Bingay C') held by Centerpoint Resources Inc., and to the west by vacant Crown mineral lands.

The Bingay Main exploration area, as presently considered, is bounded to the west by longitude 115°00' W, to the south by latitude 50°10' N, to the east by Elk River, and to the north by latitude 50°15' N. The area of present interest for coal exploration lies within a rectangle bounded by 43 to 45 easting, and 61 to 69 northing (grid references are to UTM NAD 83). NTS map sheet 82J/2 covers the Bingay Main area at 1:50,000 scale with topographic contours at 100-foot (ca. 30-metre) intervals. TRIM map sheets 082J.015, 082J.016, 082J.025 and 082J.026 cover the area at 1: 20,000 scale. The nearest incorporated settlement to Bingay Main is the Town of Elkford, whose urban core lies 21 kilometres south by road from the Bingay Main property.



File: bingayroadmap-3.srf
Date: 2004 Dec. 16 Revised: 2010 Dec.23
Drawn: C.G. Cathyl-Bickford, P.Geo.(BC) Lic.Geol.(WA)
Modified after Grieve, 1992, Scale: as shown

Centermount Coal Ltd.
Bingay Main Coal Project

Figure 3-1: Project Location Map

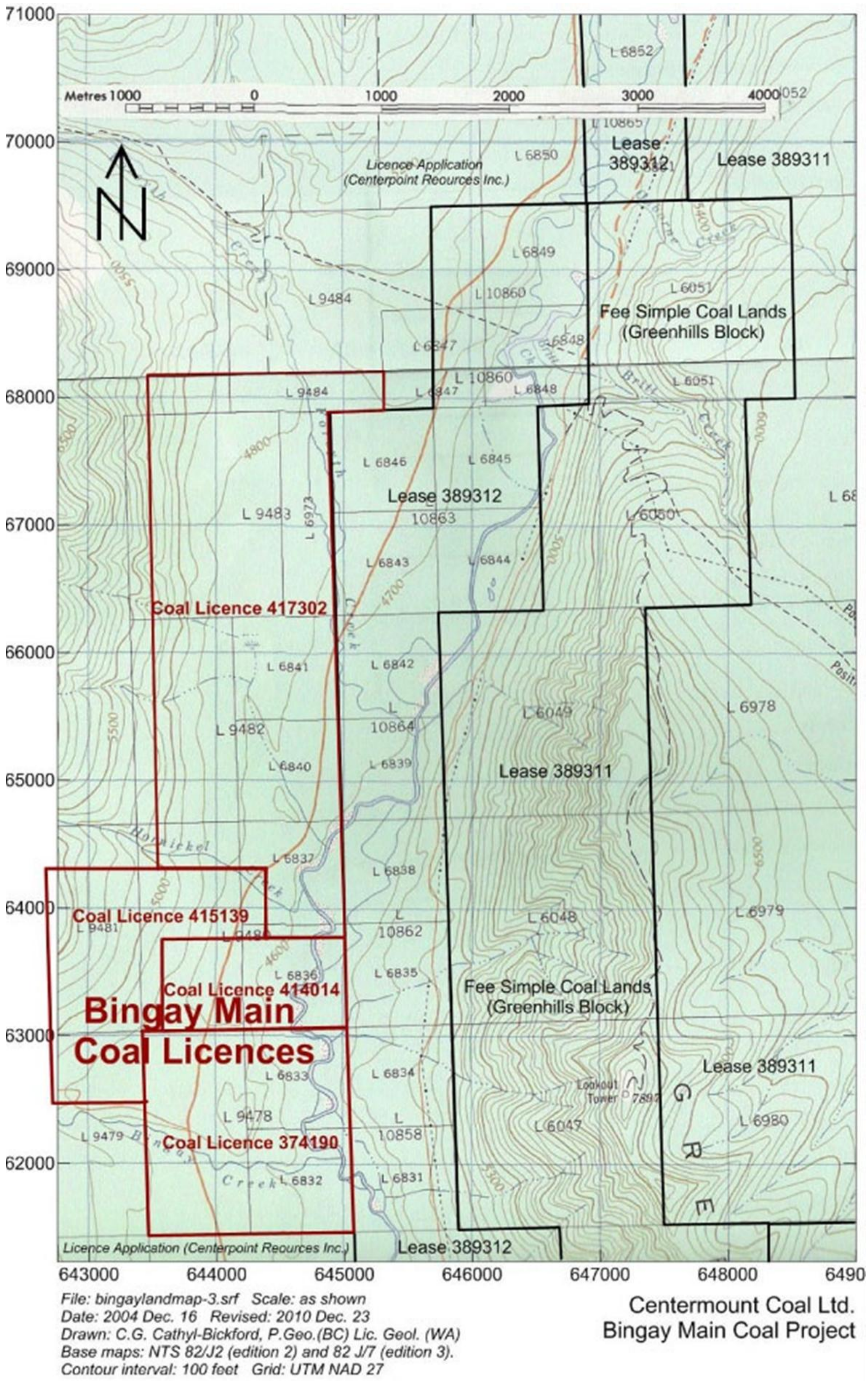


Figure 3-2: Coal License Map

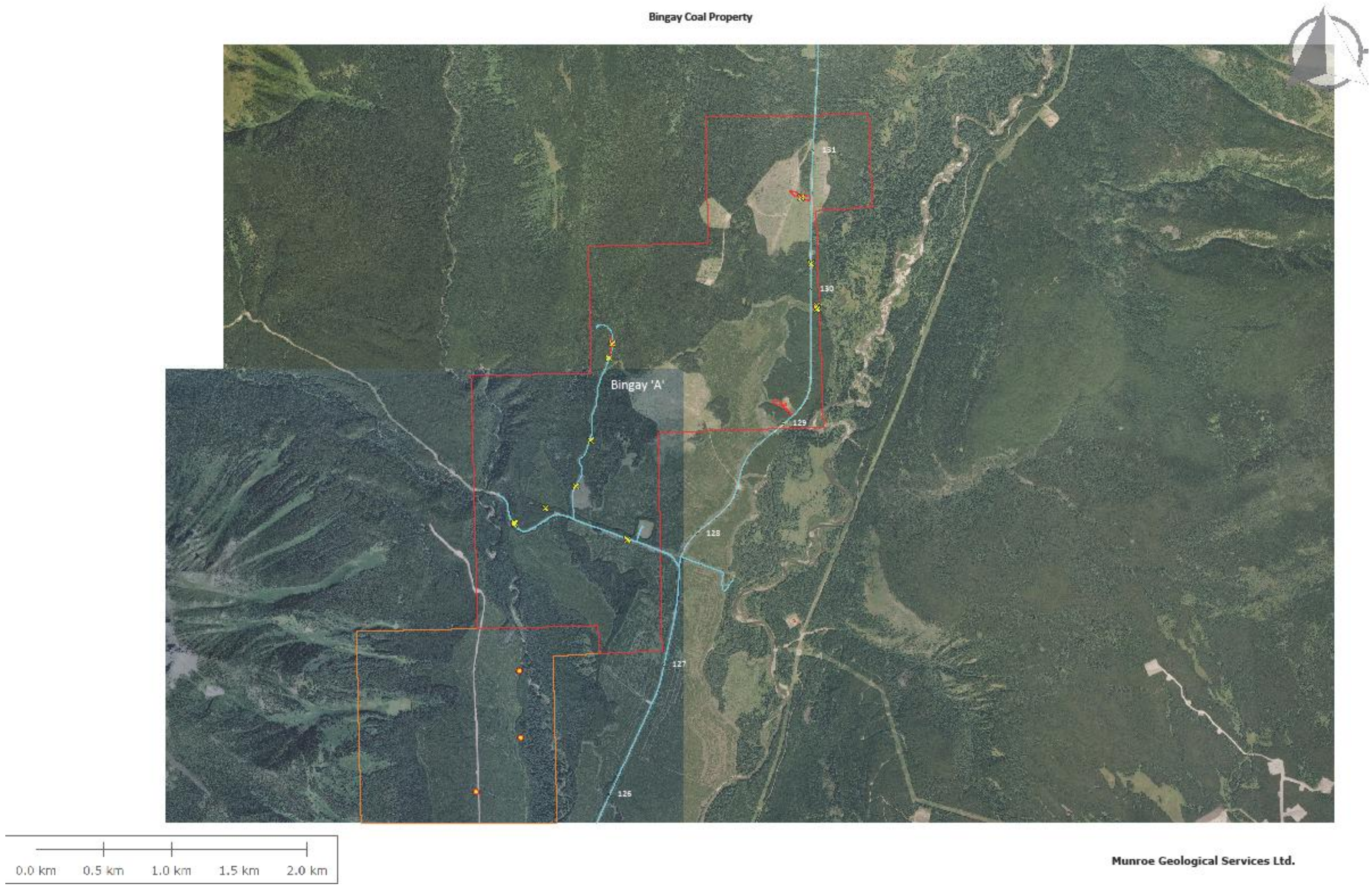


Figure 3-3: Bingay A Area shown in red outline

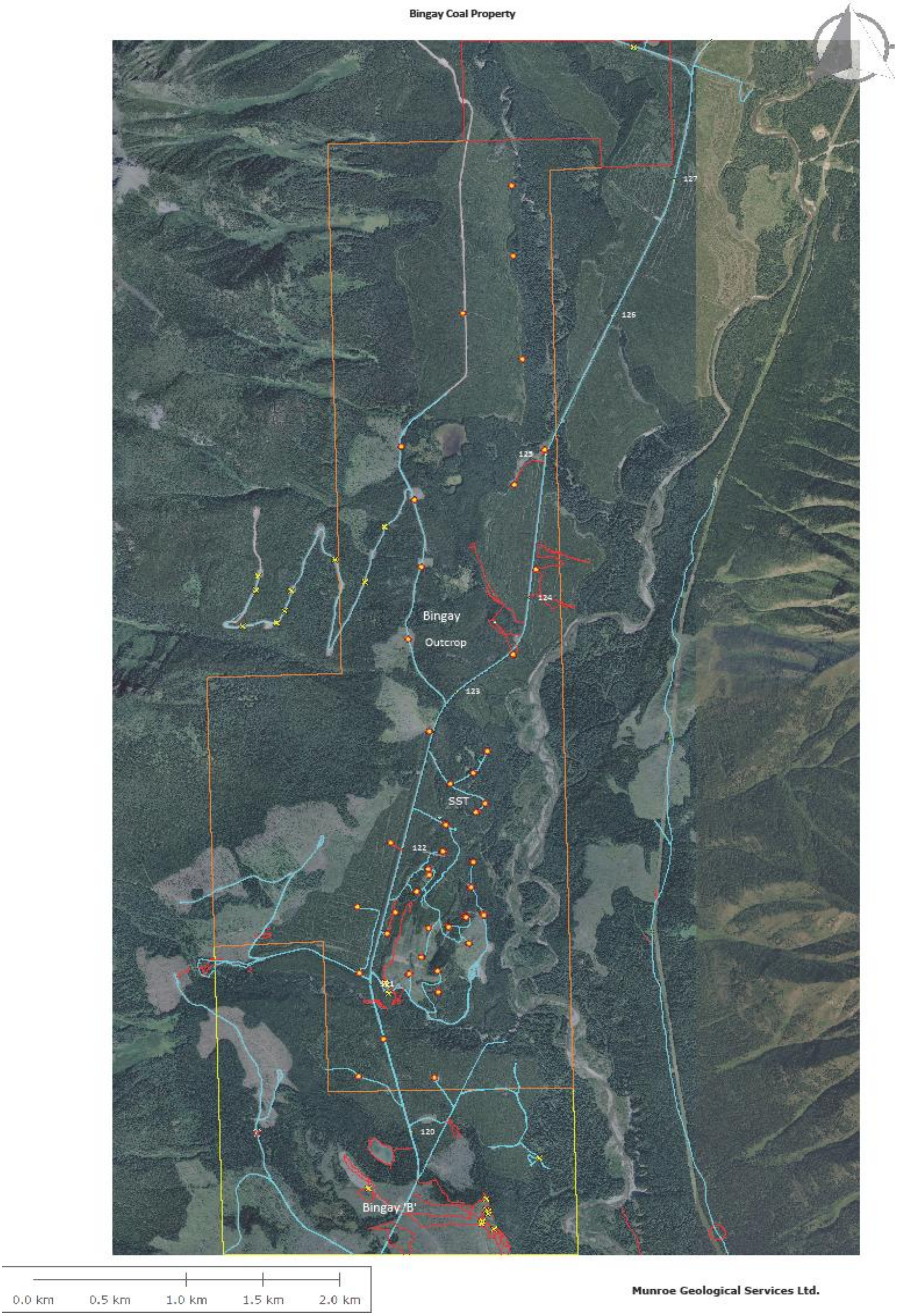


Figure 3-4: Bingay Main Area – shown in orange outline

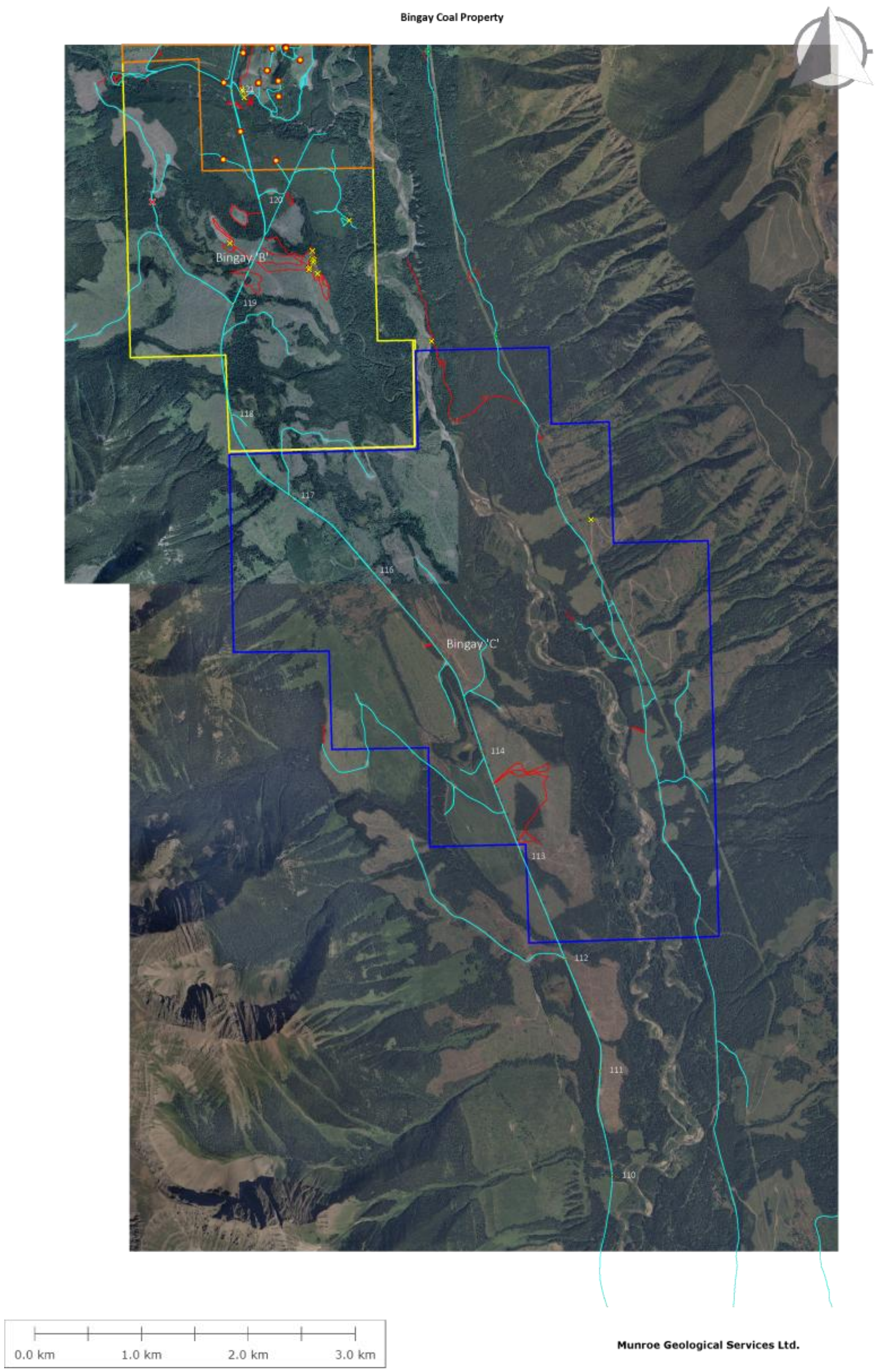


Figure 3-5: Bingay B (shown in yellow outline) & C Area – shown in dark blue outline

The Bingay Main property comprises the coal licences listed in **Table 5-1** and shown in red on **Figure 3-2.** All of the coal licences are held in good standing as noted in the database maintained by the Province of British Columbia, at *http://www.empr.gov.bc.ca/Titles/MineralTitles/Coal/Pages/Search.aspx*) by Centermount Coal Ltd. The coal licences are contiguous, with no known in holdings of alienated coal rights.

The four coal licences listed in **Table 5-1** were originally staked by Hillsborough Resources Limited and subsequently transferred to Centermount Coal Ltd. No further coal licence applications have been made by Centermount within the Bingay Main area. The Company's existing coal licences are, however, bounded to the north and south by coal licence applications made by Centerpoint Resources Inc. (Bingay A, B and C). Coal licence boundaries at Bingay Main are defined according to the outlines of the various district lots, or according to unit boundaries of the provincial petroleum and natural gas grid, and as depicted on the official outline maps of the licences. The four coal licence numbers have been changed to two tenures due to a titles processing error by the company. The new tenure numbers will be cross referenced to the original four in future reporting. There is no change in the property control or outline, only the tenure numbers and refinement from four to 2 tenure areas.

4.0 Accessibility and Infrastructure

Exploration access to Bingay Main is fairly convenient, by virtue of its location adjacent to the all-weather Elk River Forest Service Road, and the presence of branch roads and trails within the property.

Bingay Main is served by the Elk River forest service road, as shown on **Figures 3-1 to 3-5.** This road is administered by the provincial Ministry of Forests as a multiple-use public road, upon which industrial and recreational traffic may travel. Local hunters, hikers and fishermen/women occasionally use the road to access recreational areas farther up the Elk River Valley.

The Elk River road is maintained by Tembec Industries Inc., who only maintained the parts of the road which they wish to use for log-haulage. During the 2010 exploration program, this has meant that the entirety of the road between the Bingay Main coal property and Elkford is occasionally graded, but it does have local potholed sections owing to heavy truck traffic. Significant time and cost was expended by Centermount to maintain and upgrade the roads in this area. The road is easily travelled by pickup trucks and heavier load vehicles. Passenger car travel is not recommended. Should the Elk River road be used in the future for coal haulage, it would require major re-surfacing. Adequate supplies of gravel are present within the Bingay Main property. The bridges on the road are of sufficient strength for logging trucks, but will require levelling or resurfacing to support more frequent high-speed use by coal trucks.

The Bingay Main coal property lies at kilometre post 121 on the Elk River road, roughly 22 kilometres north of the business core of Elkford. Two side roads branch off eastward from the main road: the southern road follows the south face of Bingay Hill and gives access to the recently-logged flatlands east of the hill. The northern road climbs over the west limb of the syncline and gives access to Hillsborough's test pit on the Bingay No.10 coal bed. Total driving distance from the centre of the property to Elkford is 22 to 27 kilometres, depending on the starting point within the property and the route chosen to reach the Elk River road.

Elkford is served by paved provincial highways. Highway 43 runs northward from Sparwood, and Highway 3 connects westward to Fernie and Cranbrook, and eastward to Alberta. Driving time to Bingay from Vancouver is 14 hours from Vancouver (via the southern Trans-Provincial route along Highways 1, 3 and 43), 5 hours from Calgary (via the Black Diamond route along Highways 2, 22X, 22, 3 and 43), and 2.5 to 3 hours to Eureka, Montana.

The closest railhead to Bingay Main is about 30 kilometres away near Elkford, on the Fording River branch of the Canadian Pacific Railway. Coal shipments from Bingay Main could also access the Burlington Northern railhead at Eureka, Montana (as shown on **Figure 3-1.** This railhead is situated about 168 kilometres from Bingay Main, via Highways 43, 3 and 93. The closest all-weather airport is located in Cranbrook, with scheduled service available to Vancouver and Calgary, in western Canada.

The Bingay Main property lies within the dry cool subzone of the Montane Spruce continental bio-geoclimatic zone (Medinger and Pojar, 1991; Braumandl and Curran, 1992). Characteristic of this subzone is a temperate climate of continental type, with long, cold, relatively dry winters with light snowfall, and short, warm, dry summers. Minimum temperatures are –25 to –35 Celsius with reports from nearby Lower Kananaskis Lake being -52C during the winter of 1992 (Bickford)

Cold temperatures are generally confined to brief 'polar outbreak' periods in January and February. Maximum normal temperatures are 33 to 38 Celsius, typically found during extended periods of clear weather in mid- to late-summer.

Snowfalls or freezing rain may occur at any time between mid-September and mid-May, with the bulk of snow falling in mid-March and early April. Snowfalls up to 40 cm are possible in a single intense mid-winter storm when cold polar air is over-ridden by moist maritime air, but these snowfalls rapidly compact and ablate, and snow cover seldom accumulates to depths greater than 60 cm.

Continuous snow cover is usually gone by the end of April, with isolated drifts remaining in sheltered and shaded areas. In the extraordinarily warm winter of 2004-2005, snow cover was mostly gone in mid-March, and the Elk Valley had been barren of snow for much of the winter. Summers are warm and showery, with occasional afternoon thunderstorms. During dry summer weather, temperatures may exceed 30 Celsius.

Surface water supply is available from Bingay Creek and Elk River, and ample supplies of groundwater are available from the gravelled flats west of Elk River and north of Bingay Creek. Owing to fisheries concerns, industrial water supply will probably have to be abstracted from groundwater sources. Near-surface groundwater quality is unknown in detail, but anticipated to be acceptable for industrial use.

Substantial quantities of gravel, suitable for road-building, are present within the property. During the autumn 2004 and year-2010 drilling programmes, road gravel was taken from cuts along one of the access roads within the property. Roads and trails built in the spring of 2005 were mostly constructed from native gravelly soils. The size-consist and grading of these gravel sources were adequate for road-building.

Timber suitable for incidental use (such as stakes, fence posts, short utility poles and cribbing) is present within the Bingay Main property. The Elk River Valley contains an energy-transport corridor along its eastern side. This corridor is occupied by a high-voltage above-ground power line. All-weather roads extend along both sides of the river. On the west side of the river, the Elk River forest service road bisects the Bingay Main coal property.

Access to the Bingay Main coal property is regulated under the *Mines Act*, which allows for the reactivation and reconstruction of existing roads, as well as construction of new roads or exploration trails. Vehicular access to the area west of the Elk River road and north of Bingay Creek is restricted by the Ministry of Environment, in the interests of protecting wildlife species. Surface rights at Bingay Main are held by the Crown, with forest tenures held by Tembec Industries, Inc. Access to and within the coal property requires the negotiation of an annual road use agreement with Tembec.

Three-phase electrical power is available on the eastern side of Elk River, via the 138-KV KAN-ELK tie line connecting the British Columbia power grid to Trans-Alta Utilities' Kananaskis power plants. No power lines are presently in place on the west side of the river, and it is unlikely that any sub-transmission lines will be extended into the Bingay Main property within the near future. A portable generator set was used to service Centermount's exploration camp during the summer and autumn of 2010.

Reverse-circulation drilling rigs and PQ diamond-drills capable of drilling to depths of 600 to 800 metres are readily available in British Columbia and Alberta. Heavy industrial and construction equipment, including excavation and road-building equipment, is available from the Crowsnest Pass area as well as from towns in southern Alberta. Drilling supplies are available from distributors in Alberta and British Columbia. Diamond drilling is the preferred method of exploration in this deposit.

Machine shops, industrial suppliers, and freight terminals are available in Elkford, Sparwood and Cranbrook. Owing to the well-established open-pit coal-mining industry in the Elk Valley, necessary equipment and supplies for mining, earth-moving and blasting can be obtained locally.

Bingay Main has no landline telephone or internet service. Cellular-telephone and wireless Internet services are provided by Telus and by Bell Canada, from terminal sites situated atop the Greenhills Range, east of Elk River. Cellular coverage is fair to good throughout the Bingay Main property, with the exception of topographically-isolated areas such as creek bottoms. During the summer and autumn of 2010, Centermount used satellite dishes to obtain television and Internet signals.

The Bingay Main property lies within the Elk River valley, which traverses along the southern Canadian Rocky Mountains. The Elk River valley is one of a series of contiguous valleys extending from Michel, British Columbia to Banff, Alberta. Both sides of the valley are bounded by mountain ranges. To the west are the rugged carbonate-rock peaks of the Western Front Ranges, and to the east are the more subdued sedimentary-rock ridges of the Greenhills Range.

The Elk River itself is a broad, braided, gravel-bedded river which is choked by numerous gravel bars and bounded by beaver-dammed side-channels. Some of these side-channels are partially filled with mossy wetlands. Bingay Creek is an incised, partially rock-bound meandering to braided stream which flows into Elk River from the west. Both rivers follow large structural fault zones which are muted by the glacial overburden.

No bridges cross the Elk River between Elkford and Aldridge Creek (well north of Bingay Creek), but the river is shallow enough to be forded by people and animals with some difficulty due to its swift and very cold current. Bingay Creek is crossed by one bridge which carries the Elk River forest service road traffic. The creek can be forded easily in places by people and animals, except during the spring freshet. Steep cliff faces formed by near vertical shears are a great hindrance to travel in some locations.

Elevations within the Bingay Main property range from about 1380 to 1490 metres above mean sea level. The lowest elevations are found along the course of Elk River, and the highest elevations are found on Bingay Hill.

Soils of the Elk River valley were mapped at a regional scale by the British Columbia Soil Survey (Lacelle, 1990) and at a more detailed scale within the Bingay Hill area by Schori Consultants Inc. (Schori, 2005). Soil cover is generally quite thin at Bingay Hill and along the ridges which flank the northern slopes of the hill. Soil materials mostly consist of coarse-grained colluvium and regolith, mixed with large talus blocks below prominent sandstone ledges. Isolated swales near the hill are floored by wet, organic-rich silty muck; other than these areas, organic-rich top soils appear to be patchy and generally very thin.

The lowland flats flanking Bingay Hill to the east and west are floored by extensive gravel deposits. To the west of the hill, the gravels appear to form part of an alluvial fan, into which is incised the channel of Bingay Creek. To the east of the hill, the gravels appear to form a succession of terraces, possibly of glaciofluvial and fluvial origin.

The Bingay Main property is covered by Crown forest lands, which have been logged at various times during the past 35 years. Most of the southern half of the property was logged in the past 10 years, and it now presents easy going for cross-country traversing. Some of the logging roads have been reclaimed by means of scarification followed by scattering of wood debris; this process effectively destroys the roadbed, and makes it more practical to build new roads rather than attempt to reconstruct roads which have been reclaimed. Mountain pine beetle has caused locally-severe damage to forests in the Elk River valley, including some of the mature trees at Bingay Main. Salvage logging to recover beetle-infested trees has been in progress since 1982.

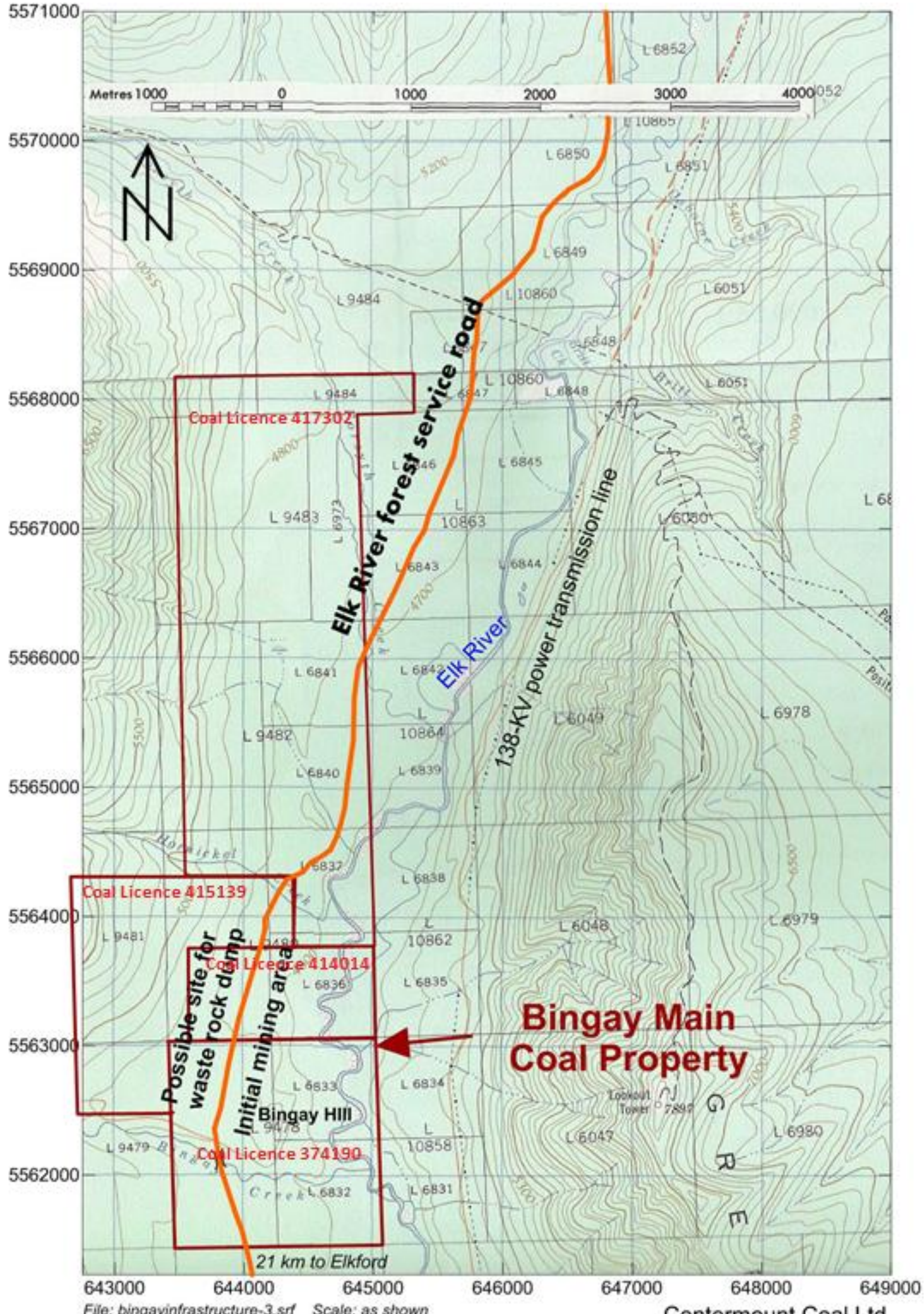
Most of the remaining forest at Bingay Main consists of closely-spaced juvenile lodge pole pine with minor white spruce, subalpine fir and occasional western larch. Small patches of sub-mature to mature pine, fir and spruce are present in wetter lowland sites within the northern half of the property. Kinnikinnick and twinberry are present beneath older forest cover, and trailing strawberry plants, roses and daisies are present along the roadside.

The Bingay Main property contains an abundance of wildlife, including moose, elk, black bear, grizzly bear, wolverine, porcupine, lynx, beaver, snowshoe hare, mule deer, marten, red squirrel and deer mouse. Birds include spruce grouse, woodpecker, common raven, Canada geese, American robin, and Steller's and gray jays. Other bird and animal species may also be present. Mosquitos and blackflies are present in the spring and summer months, although not to unbearable excess.

5.0 Mineral Tenure Information

Table 5-1: Coal Licence Details

TENURE	AREA IN HECTARES	DESCRIPTION	LICENSEE	ISSUE DATE	ANNIVERSARY DATE
374190	260	District Lot 9478 of Kootenay Land District	Centermount Coal Ltd.	18 January 2000	31 January
414014	64	NTS 082J 02 Block L Units 48, 49 save and except those portions within District Lot 9478 of Kootenay Land District and Coal Lease 389312	Centermount Coal Ltd.	15 September 2004	31 January
417302	592	NTS 082J 02 Block L Units 58, 68, 69, 78, 79, 88, 89, 98, 99 save and except that portion covered by coal lease 389312	Centermount Coal Ltd.	7 March 2006	31 January



File: bingayinfrastructure-3.srf Scale: as shown
Drawn: C.G. Cathyl-Bickford, P.Geo.(BC) Lic.Geol. (WA)
Date: 2005 May 9 Revised: 2010 Dec. 21
Base: NTS 82/J2 (ed.2) and 82 J/7 (ed.3)
Contour interval: 100 feet
Grid: UTM NAD 27

Centermount Coal Ltd.
Bingay Creek Coal Project

Figure 5-1: Infrastructure map

6.0 History

Coal licences were first filed at Bingay Main by the Elk Valley Coal and Coke Company in 1902-03, covering the lowlands of the Elk River valley along the western margin of the more extensive land-holdings of the Canadian Pacific Railway Syndicate. Employees of the railway company (who banded together as the Canadian Pacific Railway Syndicate) subsequently applied for grants of surface rights.

Those grants covered these coal lands, under the terms of the South African War Veterans' settlement programme, and the CPR filed for coal licences overtopping the Elk Valley lands in 1905. The CPR Papers (held at the Glenbow-Alberta Institute Archives in Calgary, Alberta) contain details of the legal wrangling between the two companies to secure and maintain control of the coal rights at Bingay Main.

The Elk Valley Coal and Coke Company appears to have been successful in retaining the coal rights until at least 1908, as an engineering report by Fraser (1908) details some of the company's work on its coal licences in the Elk River valley.

Coal licences at Bingay Main were held in the mid-1970s by Cominco, but subsequently dropped by that firm, as the land was again licensed to Specific Natural Resources in 1979, following the lifting of the provincial coal moratorium. Specific Natural Resources allowed their coal licences to lapse in the early 1980s, and the land was again re-staked in 1982, this time by Mr. William Shenfield of Fernie, British Columbia, in partnership with Mr. S.L. Gardner.

They sold the property to Utah Mines Ltd., who drilled the property in the late autumn of 1983. In 1986, Utah Mines abandoned their Canadian coal interests, and the Bingay Main coal licences reverted to Messrs. Shenfield and Gardner's control in May of 1987.

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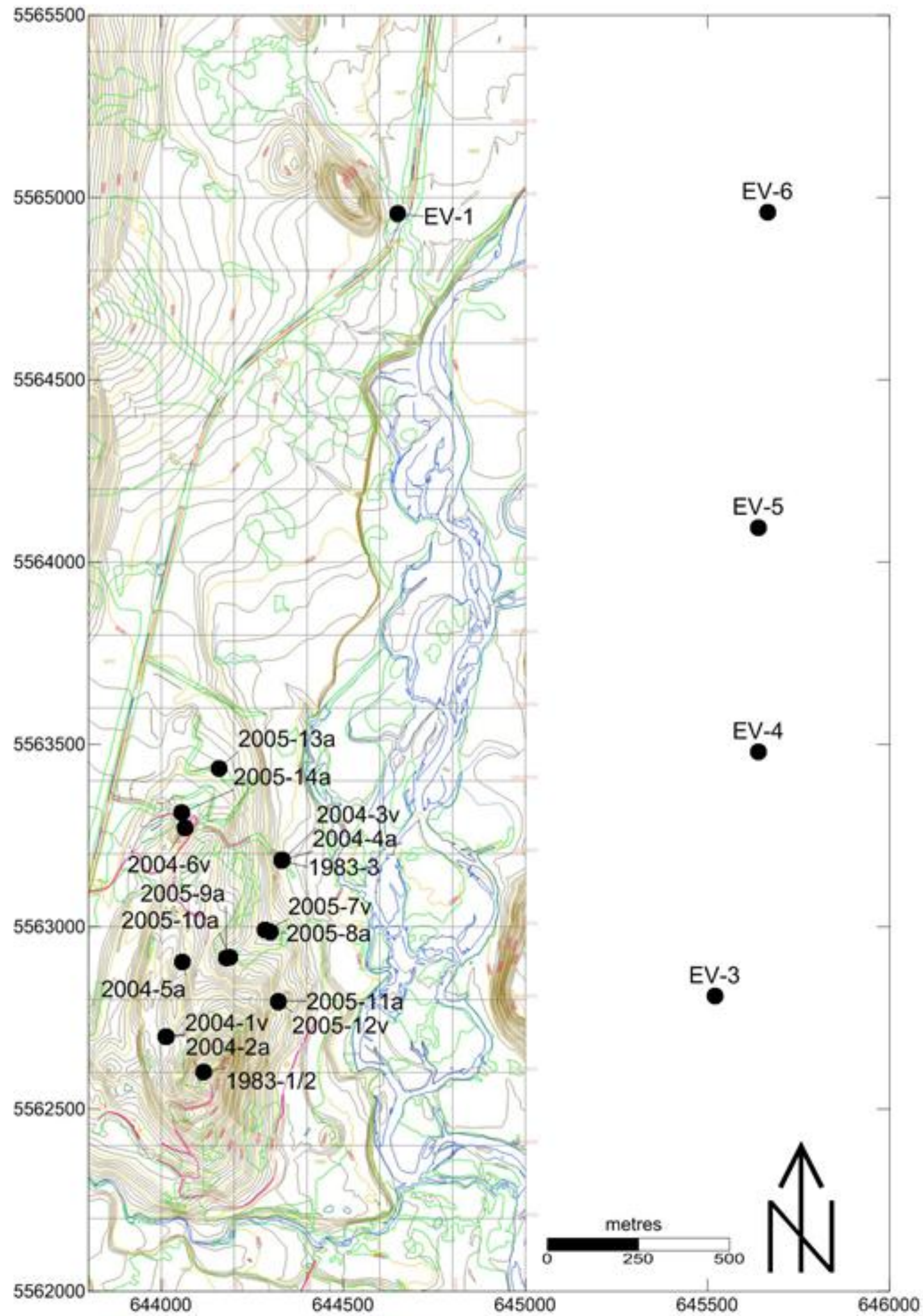
Considerable historic exploration work has been done at and nearby to Bingay Main, since the first discovery of coal along the upper Elk River valley in about 1902. Most of the work has involved diamond-drilling and rotary-drilling (by the end of 2010, totalling at least 74 boreholes within the property, and an additional 5 holes near but outside the property). A further 17 boreholes were done in 2011, followed by 13 in 2012. In addition, trenching, test-pitting and adit work has been done within the property. The area has been geologically mapped in detail by the California Standard Company in 1955 and 1956, Utah Mines Ltd. in 1983 and by the senior author in the summer of 2004 and the spring of 2005. Regional geological mapping has also been done by the provincial and federal geological surveys.



File: bingayvalleyholes-2.srf
Date: 2005 May 8 Revised: 2010 Dec 25
Drawn: C.G. Cathyl-Bickford, P.Geo.Lic.Geol.
Base map: Year-2005 McElhanney topography
Scale: as shown Grid: UTM NAD 83

Centermount Coal Ltd.
Bingay Main Coal Project
Figure **6**-1: Historic boreholes at and near Bingay Main

Table 6-1: Summary of boreholes drilled at or near Bingay Main property:

Company:	*Dates:*	*Diamond-drill holes:*	*Rotary-drill holes:*
Elk Valley Coal and Coke Company	1910	unknown (neither logs nor locations are available)	
Cominco Limited	1974		6 holes (5 of which are outside the property)
Utah Mines Ltd.	1983	3 holes	
Hillsborough Resources Limited	2004		6 holes)
	2005		8 holes)
Subtotals		3 holes, totalling 886.7 m	20 holes totalling 3074.8 m
		at least 23 holes totalling 3961.5 metres: see **Figure 6-1**	
Centermount Coal Ltd.	2010	13 holes, totalling 5109.06 m	43 holes totalling 9645.94 m [and 6 re-entries of older holes, totalling 1567.67 m
Subtotal		56 holes totalling 14755 m: see **Figure 6-3**	
	2011	11 holes, totalling 915.93m	6 holes, totalling 589.18m
Subtotal		17 holes, totalling 1505.18m: see Figure 7-2	
	2012	8 holes, totalling 1861.49m	5 holes, totalling 896.11m
Subtotal		13 holes, totalling 2757.60m: see Figure 7-3	
Total		At least 109 holes totalling 22979.28m	

Nine firms have explored within and nearby the Bingay Main property, prior to Centermount's year-2010 exploration. In order of historic precedence, they are the Elk Valley Coal and Coke Company

Limited, Canadian Pacific Railway Syndicate, California Standard Company, Imperial Oil Limited, Cominco Limited, Specific Natural Resources Ltd., Utah Mines Ltd., Iron Creek Exploration Ltd. and Hillsborough Resources Limited.

The Elk Valley Coal and Coke Company Limited dug prospect pits and trenches, and drove at least one, perhaps two or more, adits within the Bingay coal beds. Few details of this work have come to light, other than a brief report by Fraser (1908) and passing mention by Grieve (1992).

The Elk Valley Coal and Coke Company Limited may also have drilled at Bingay Main, since drill rods and pipes were found in the forest near the "400 ton adit" by William and Bob Shenfield in the 1970s (as reported by Jenks, 1979). Anderson (1984, page 6) quoted an article in the *Fernie Free Press*:

> *"In 1910, another company, the Elk Valley Coal and Coke Company, emerged and, on June 10 of that year, the Free Press reported that 20 men were on the scene and 'a diamond drill is being used for boring ... the first ... that has been taken up the Elk River." Evidence, in the form of hand trenches and coal spoil piles from this period were readily located.".*

The Canadian Pacific Railway Syndicate conducted geological mapping, dug trenches and pits, and drove several adits along the western slopes of the Greenhills Range, east of the Bingay Main coal property (Wilson, 1904; Wolfhard, 1967). According to Wolfhard, this work commenced during 1901-1903 and continued until 1910. An undated blueprint map of the 'Elk River Coal Land' (held by the Glenbow-Alberta Institute Archives in the CPR Papers, M2269, Box 199, File 1962) shows results of this work, including an observation of bedding dipping 51 degrees to the north-west near Bingay Hill.

According to the 1974 map, none of the trenches, pits or adits were driven within the present outlines of the Bingay Main coal property.

During the summers of 1955 and 1956, structural geologist Dr. G.G.L. Henderson of the California Standard Company led a programme of geological mapping within the firm's provincial petroleum and natural gas exploration permits, covering an area from the Alberta border southward along both sides of the Elk River valley to latitude 49°30'. Two progress reports accompanied by geological maps at scales of 1:31,680 and 1: 63,360 were submitted to the British Columbia government (Henderson, 1956; Bannister, 1957).

California Standard's geologists recognised the existence of Kootenay strata at Bingay Hill, and they also found Kootenay outcrops on the western bank of Elk River in Lot 6833.

During the summer and autumn of 1959, Imperial Oil Limited conducted a programme of geological mapping and seismic surveys within the Elk River Valley (Labrecque, 1959). One of Imperial's seismic lines was shot along Britt and Forsyth creeks, north of Bingay Creek. Data quality on this line was poor, and the only reflector that could be mapped was considered to be the top of the Cambrian. Imperial's geological map shows the Bingay Main area to be underlain by Triassic strata, with no recognition of the Kootenay coal-measures.

In 1967, Cominco Limited mapped the geology of their Elk River coal lands, including the lower canyon of Bingay Creek and Bingay Hill itself (Wolfhard, 1967). On a 1974 geological map which accompanies the open-filed copy of Wolfhard's report, Bingay Hill and the nearby canyon of Bingay Creek are shown as being underlain by the Rocky Mountain Group (which is considerably older than the Kootenay coal--measures).

In 1974, Cominco Limited drilled six rotary-drill holes (numbered EV-1 through EV-6) along the Elk Valley, in an effort to ascertain the extent of Kootenay coal-measures beneath the valley floor within lands which at the time were held as coal licences by Cominco (Taplin, 1974). All six holes were drilled with a reverse-circulation drilling rig, using both air and mud as a drilling medium. These six holes are distinct from the similarly-named EV-series of exploratory drill holes located further north near Elk Pass (the Elk Valley Drill Project mentioned by Graham *et al*, 1977 and Gibson, 1985).

All but one of Cominco's boreholes lie outside the present Bingay Main coal licences, but one of the holes (EV-1) was drilled within the property, along the Elk River forest service road. Of the six holes, two were drilled on the west side of the river, and the remaining four were drilled on the east side of the river. Both of the western holes failed to reach bedrock, owing to caving and sloughing of wet surficial sand and gravel. One of the eastern holes (EV-4) struck coal in the basal Mist Mountain Member; the other three holes encountered shale and siltstone (probably Fernie Formation) at the bedrock surface.

On the strength of these borehole results, Cominco dropped their coal licences covering Bingay Main.

In the summer of 1979 Mr. John Jenks, accompanied by Messrs. William and Bob Shenfield, made a geological reconnaissance of the Bingay Main coal property (Jenks, 1979). Geological mapping and photo-geological interpretation were the only work done by Specific Natural Resources.

In 1983, Utah Mines purchased the Bingay Main coal property from Mr. William Shenfield. Subsequently, Utah mapped, trenched and drilled the Bingay Main coal property, producing a substantial assessment report on the coal resources (Anderson, 1984). Utah drilled three boreholes into the Mist Mountain coal measures. One of the holes (1983-1) probably reached the Moose Mountain sandstone, but the other two holes stopped short of this marker zone. All three boreholes were drilled with a diamond-drill rig, recovering HQ core. All three boreholes were geo-physically logged, with fair to good log quality. Cores from the boreholes are presently stored at Mr. Shenfield's residence in Fernie, where they were partially re-logged by the senior author during the summer of 2004.

Utah's coal assessment report is available as an open file report (Anderson, 1984) from the provincial Ministry of Energy, Mines and Petroleum Resources.

In 1988 and 1990, Iron Creek Exploration Ltd. (under the direction of Mr. William Shenfield) conducted an extensive programme of hand and mechanised trenching of the Bingay coal beds, with particular attention being given to the No.10 coal bed and the 11-12 coal zone.

In 1994, Iron Creek applied for a bulk sample permit from the provincial Ministry of Energy, Mines and Petroleum Resources (Shenfield and Gardner, 1996). A 2500-tonne sample was approved, and 200 tonnes were taken from the No.10 coal bed in Trench No.1 during 1996 (Gardner, 2004b). In 1997 and 2002, Iron Creek conducted additional trenching in the No.10 coal bed, as well as in the 11-12 coal zone at Trench No.2, and along a roadside exposure of the No.13 coal bed to the east of Trench No.2.

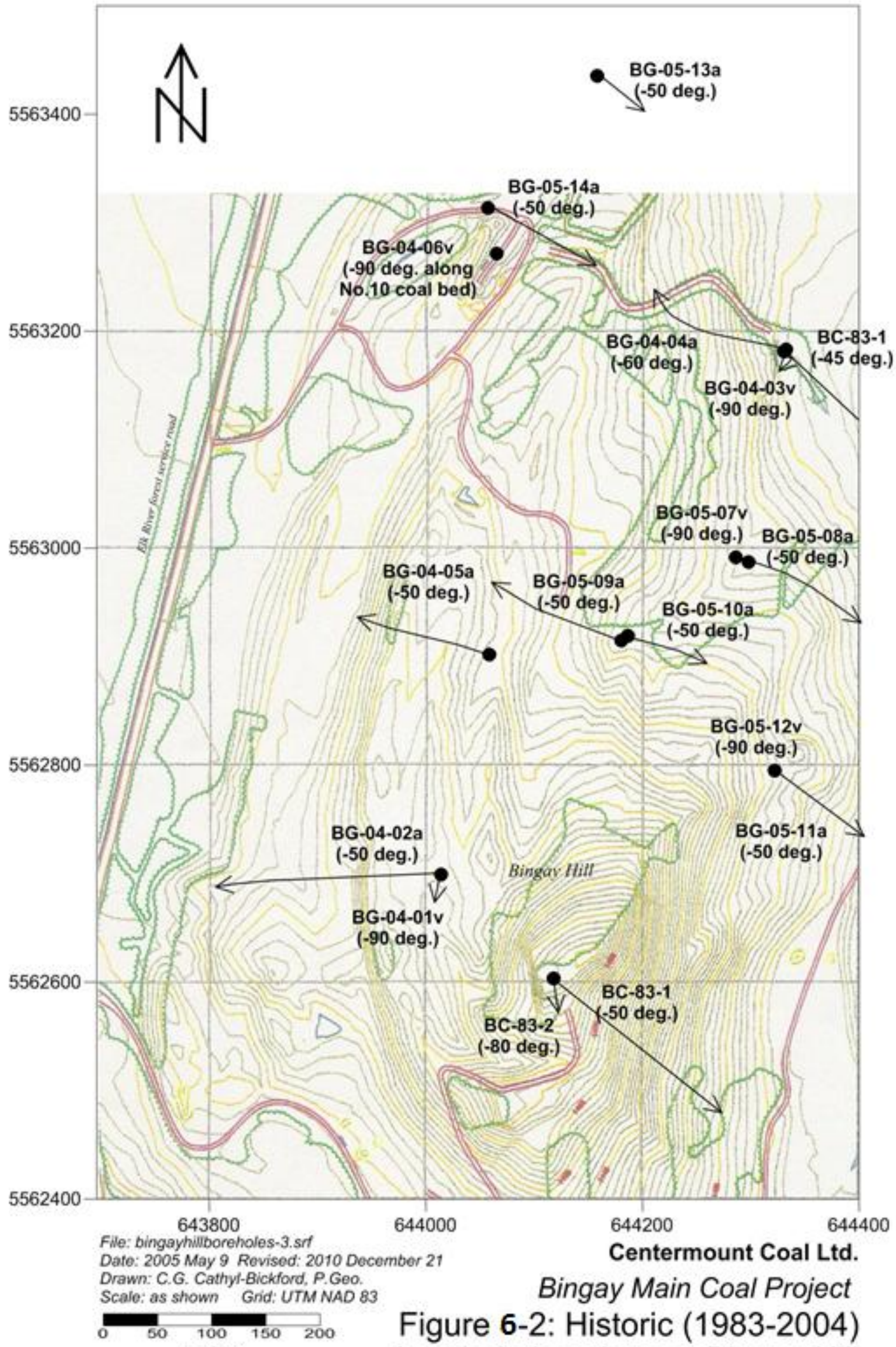
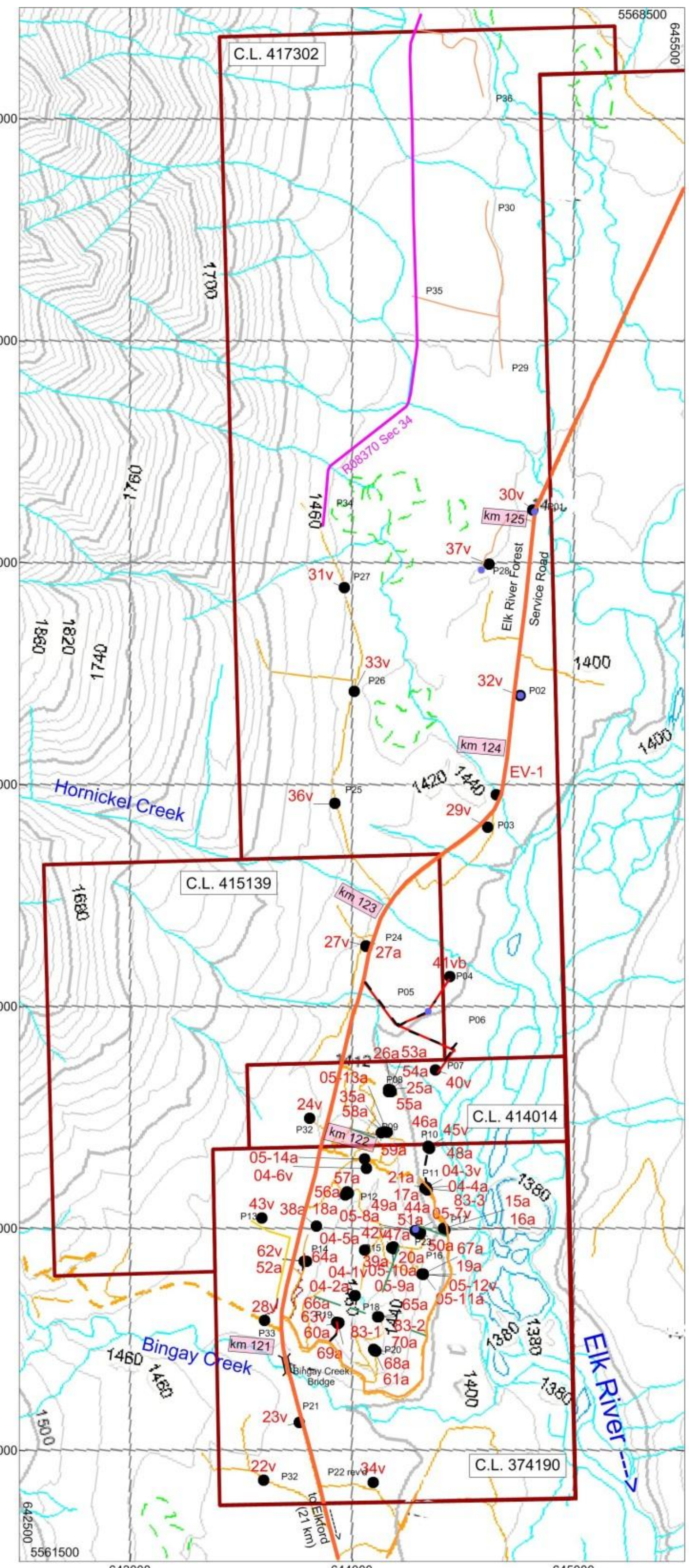


Figure 6-2: Historic (1983-2004) borehole locations at Bingay Hill

Hillsborough Resources Limited, a Vancouver-based coal mining and development company, explored the Bingay Main coal deposit in 2004 and 2005.In 2004, the company drilled six reverse-circulation boreholes at Bingay Main (Gardner, 2004b). All of these boreholes were collared within the Mist Mountain coal-measures, but drilling difficulties or planned shallow depth prevented reaching the Moose Mountain sandstones in any of the holes. Geophysical logs were run in five of the six holes. One of the holes was intentionally not logged, as it was drilled along the bedding of the No.10 coal bed in an effort to assess depth-of-oxidation of the coal.

The senior author's geological mapping of the Bingay Main coal property was commissioned by Hillsborough as part of their 2004 exploration programme. As well, Hillsborough commissioned baseline and scoping studies for their planned submission of a surface-mining development programme to the provincial Ministry of Energy, Mines and Petroleum Resources. These studies included a preliminary survey of acid rock drainage potential based on sampling of diamond-drill cores from Utah Mines' 1983 drilling programme (Morin and Hutt, 2004).

In 2005, Hillsborough drilled eight more reverse-circulation boreholes at Bingay Main. As with the previous year's work, all of the boreholes were collared within, and finished within, the Mist Mountain coal-measures. Geophysical logs were run in all of the boreholes, but in one of the holes only the near-surface strata could be logged, owing to caving of the borehole.



Drill Pads

Pad	Easting	Northing
P01	644835	5566225
P02	644745	5565405
P03	644560	5564775
P04	644430	5564120
P05	644240	5563995
P06	644501	5563907
P07	644385	5563690
P08	644190	5563605
P08	644190	5563605
P09	644145	5563370
P10	644340	5563330
P11	644330	5563170
P12	644005	5563120
P13	643600	5563000
P14	643785	5562870
P15	644180	5562920
P16	644320	5562800
P17	644420	5563010
P18	644110	5562600
P19	643930	5562580
P20	644120	5562455
P21	643760	5562140
P22	644310	5561830
P23	644286	5562986
P24	644080	5564320
P25	643920	5564960
P26	644020	5565460
P27	643960	5565930
P28	644580	5565950
P29	644670	5566870
P30	644610	5567590
P31	643660	5561840
P32	643820	5563500
P33	643600	5562580
P34	643880	5566260
P35	644280	5567190
P36	644600	5568080

UTM Grid North
(NAD83 Zone 11)

Note: year-2010 boreholes are shown without year prefix

Revised: 25 December 2010
(for inclusion in report)

Drawn: C.G. Cathyl-Bickford P.Geo.(BC) Lic.Geol.(WA)
Date: 13 June 2010 Scale: as shown Contours in metres
Base map from http://webmaps.gov.bc.ca/imfx/
UTM NAD 83 Zone 11 Drawing: bingay-property-boreholes.srf

Centermount Coal Ltd.
Bingay Main Property

Figure 6-3: Borehole location map

From 1980 until 1991, the British Columbia Geological Survey Branch conducted an extensive programme of geological, petrographic and photo-geological mapping in the Elk River coalfield, including the Bingay Main area. Two sets of preliminary geological maps (Grieve and Pearson, 1983, Grieve and Price, 1987), an open-file report with maps and cross-sections (Johnson and Smith, 1991) and a geological bulletin containing two maps (Grieve, 1992) document the results of this programme. Grieve and Pearson's 1983 mapping contains the most useful information concerning the geology of the Bingay Main area, insofar as it extends within parts of the property.

From 1915 until 1920, the Geological Survey of Canada conducted a regional mapping programme in the southern Rocky Mountains, covering the headwaters of the Elk and Highwood Rivers (Marshall, 1920; 1921). Mapping was done by J.S. Stewart, B. Rose and J.R. Marshall, and the overall geological compilation was done by J.R. Marshall. Marshall's map depicts "Kootenay Formation" at the confluence of Bingay Creek and Elk River, but his nearby cross-section shows all beds dipping to the east: it is likely that Marshall did not find the Kootenay outcrops at Bingay Creek.

In 1981 and 1982, R.A. Price, D.A. Grieve and C. Patenaude remapped the regional geology of this area, including the Bingay Main area (Price and others, 1992). On their map, they show Kootenay coal-measures and three bedding attitudes at Bingay Hill, and they show a north-plunging syncline running across the hill.

Four historical coal resource estimates have been reported for the Bingay Main coal property; two of these estimates were made by Utah Mines Ltd. (Davis, 1984), both before and after completion of their 1983 diamond-drill programme. The third and fourth estimates were made by the senior author (Cathyl-Bickford, 2004 and 2005), following completion of Hillsborough's year-2004 and year-2005 exploration programmes.

Davis' 1983 and 1984 estimates do not meet the present-day standards as mandated by Hughes et al (1989) in Geological Survey of Canada Paper 88-21, since he based his estimates on section lines with fewer control points than specified by Paper 88-21. Furthermore, the spacing between the section lines and the distance of projection beyond section lines are greater than those currently mandated.

As well, the use of the word 'reserves' in past practice does not meet the present-day standard as required under *National Instrument 43-101*, which calls for engineering input into such determinations. Therefore, the senior author considers Davis' historic estimates to have been of coal resources rather than coal reserves.

Prior to the 1983 drilling, J.D. Davis (1984, page 1) concluded:

> *"Recent information (J.Davis Oct 7/83) indicated a potential of 8 seams over approximately a square kilometer contained 'in situ' reserves of 17.445 x 10^6 tonnes of coal (@1.30 Sp.Gr.) with contained waste resulting in a strip ratio of 7.40:1 (m^3/tonne)."*

Following the 1983 drilling, J.D. Davis (1984, page 1) concluded:

"1. Diamond drill information indicates the presence of 22 coal seams of which 18 are of considerable extent and thickness (i.e.≥/1m. true - range 1.07 m - 11.08 m) to be used in a reserve calculation.

2. An updated 'in situ' deposit tonnage from 18 seams based on diamond drill results is 44.13 x 10^6 tonnes of coal (@1.30 Sp.Gr.) with contained waste (over burden and interburden) resulting in a strip ratio of 5.55:1 (m^3/tonne) Table 1.

3. Extension of the lowermost 8 seams to the northern extent could add a potential 8.2 x 10^6 tonnes and an associated amount of waste of 68.83 x $10^6 m^3$."

Following the 2004 drilling, (Cathyl-Bickford, 2004, page 9) concluded,

- *7.56 million tonnes of coal are <u>measured and indicated</u> resources of immediate interest for surface mining; and*

- *2.68 million tonnes of coal are <u>inferred</u> resources of immediate interest for surface mining.*

These resources occur within the Bingay 9-10, 11-12 and 20-21 coal zones, all of which lie within the Mist Mountain Formation of the Kootenay Group

Results from Hillsborough's year-2005 drilling programme demonstrated that more coal was available for incorporation in the resource base, owing to the recognition of thicker than expected coal zones in the middle part of the Mist Mountain Formation. In the subsequent report (Cathyl-Bickford, 2005), the following coal-resource estimate was made:

- *15.512 million tonnes of coal are <u>measured and indicated</u> resources of immediate interest for surface mining; and*

- *2.410 million tonnes of coal are <u>inferred</u> resources of immediate interest for surface mining.*

These quantities of coal represent a substantial increase over the 2004 resource estimate, which was based upon the drilling done to the end of 2004 (Cathyl-Bickford, 2004); this *increase is mainly due to the many more coal intersections measured by the 2005 drilling, which allowed more coal zones to be brought into the resource base. A modest increase is also attributable to the northward extension of drilling along the west limb of the Bingay Syncline.*

The year-2004 and year-2005 resource estimates were prepared in keeping with *National Instrument 43-101*, following guidelines laid down by Geological Society of Canada Paper 88-21. However, these estimates are now superseded by the estimate presented in **Section 19** of the present report.

No coal is known to have been produced from the Bingay Main property, other than about 400 tonnes of coal dumped on the ground at the portal of the old “400-ton adit", and 200 tonnes of coal taken from the No.10 coal bed by Iron Creek Exploration Ltd. for analytical purposes within the terms of a bulk sample permit granted by the provincial government.

The existence of significant areas of undocumented mine-workings at Bingay Main is regarded as unlikely. However, additional test pits and adits, not yet found by fieldwork, may be disclosed if additional areas of the property are cleared of trees.

7.0 Geology

The Bingay Main property covers the western margin of the Elk Valley coalfield. The coalfield is an infaulted remnant of a substantially larger body of coal-measures, correlative with the Crowsnest Basin to the south and the Highwood Pass/Mount Allen/Canmore coalfields to the north. Coal-measures at Bingay Main are hosted by the Mist Mountain Formation, part of the Jura-Cretaceous Kootenay Group (**Table 7-1)**. The Mist Mountain Formation is underlain by Jurassic rocks of the Morrissey and Fernie formations. At the crest of the Greenhills Range, east of the Bingay Main property, the Mist Mountain Formation is overlain by the younger coal-measures of the Elk Formation, also of Cretaceous age.

Geology of the Bingay Main area is known mainly from field mapping of bedrock outcrops at Bingay Hill, tied together by boreholes, road cuts and trenches along its flanks. The hill is bounded to the north-west and south-west by an extensive east-sloping apron of gravel, and to the north-east and south-east by terraced gravel deposits adjacent to the broad plain of the Elk River.

Table 7-1: Table of formations for the Bingay Main area

Quaternary

Pleistocene to Holocene

Qd	*DRIFT: Gravel, alluvium, talus and till; minor localised mucky peats.*

Jurassic and Cretaceous

KOOTENAY GROUP (Jura-Cretaceous rocks only):

Tithonian to Hauterivian?

Ke	*ELK FORMATION: Sandstone, siltstone, mudstone, **coal** (including cannel coal and alginite-rich 'needle' coal); minor conglomerate*
JKmm	*MIST MOUNTAIN FORMATION: Siltstone, variably-carbonaceous mudstone; channel-filling, well-sorted quartzose sandstone; **coal**; minor marlstone, ironstone and tonstein.*
Jmo	*MORRISSEY FORMATION: Sandstone and minor siltstone.*
Jmo2	*MOOSE MOUNTAIN MEMBER: Quartzose sandstone containing minor amounts of rock fragments; minor siltstone and gritstone; very resistant to erosion.*
Jmo1	*WEARY RIDGE MEMBER: Silty sandstone composed of quartz and rock fragments, with interbeds of siltstone; softer than overlying beds.* ,

Oxfordian to Tithonian?

JF	*FERNIE FORMATION: Interbedded siltstone and feldspar-rich silty sandstone; minor silty mudstone.*

Triassic and older

ROCKY MOUNTAIN SUPERGROUP AND SPRAY RIVER GROUP (UNDIVIDED)

Stephanian to Rhaetian?

Pre-JF	*Quartzitic and dolomitic sandstone, limestone and dolomite, mudstone and siltstone*

Within the Elk Valley coalfield, total preserved basin fill over the Precambrian cratonic rocks of North America is on the order of 10 kilometres, including sedimentary and volcanic rocks of Cambrian through Jurassic ages which together form economic basement beneath the Kootenay coal-measures. Detailed study of these older rocks is mostly irrelevant to coal exploration, except insofar as they are overthrust over the western margin of the coalfield.

The coal-measures of the Elk Valley coalfield were deposited in a rapidly-subsiding foreland basin, which lay along the north-eastern margin of the Columbian orogenic highlands. Rapid subsidence of the basin is evidenced by the abundance of detrital organic matter within the coal-measures, and the general scarcity of oxidised sediments

The Columbian highlands must have included active volcanic vents, since tonsteins (altered volcanic-ash bands) are present within the coal-measures. The Bingay Main area was either quite remote from these volcanoes, or at an unfavourable position *vis-à-vis* prevailing winds during late Jurassic and early Cretaceous time, because the tonsteins are relatively thin (generally less than 5 cm thick).

7.1 Local Geology

Interpreted bedrock geology of the Bingay Hill area is presented as **Figure 7-1** based on Bickford's fieldwork during the summer of 2004 and spring of 2005, supplemented by structural observations depicted on the California Standard Company's geological map (Henderson, 1956), and results of year-2010 drilling. **Table 7-2, 7-3, 7-4** documents the formation and member tops, interpreted by Bickford through her logs and records of boreholes drilled at and near the Bingay Main area.

Table 7-2: 2010 Bingay Coal Drilling Pad & Borehole

Pad No.	Coordinate Pad		Borehole Name	Coordinate Borehole			Note
	Norhting	Easting		Norhting	Easting	Elevation (m)	
Pad 1	5566225	644835	2010-30v	5566237	644815	1414	P1-P3 in Bingay A, No coal.
Pad 2	5565406	644745	2010-32v	5565402	644758	1408	
Pad 3	5564775	644560	2010-29v	5564809	644612	1405	
Pad 4	5564120	644430					
Pad 5	5563995	644240	2010-41v	5563983	644349	1399	
Pad 6	5563907	644501					
Pad 7	5563690	644385	2010-40v	5563714	644377	1392	
Pad 8	5563605	644190	2010-25a	5563626	644166	1407	
			2010-26a	5563617	644178	1407	
			2010-53a	5563624	644169	1407	
			2010-54a	5563624	644174	1407	
			2010-55a	5563617	644164	1407	
Pad 9	5563370	644145	2005-13a	5563434	644158	1417	
			2010-35a	5563436	644148	1417	
			2010-58a	5563437	644145	1416	
			2010-59a	5563432	644133	1417	
Pad 10	5563330	644340	2010-45v	5563371	644343	1385	
			2010-46a	5563365	644344	1388	
			2010-48a	5563361	644350	1392	
Pad 11	5563170	644330	2010-17a	5563173	644340	1387	
			2010-21a	5563185	644336	1387	
Pad 12	5563120	644005	2010-18a	5563159	643984	1429	
			2010-56a	5563617	644164	1407	2010-38a between P12-P14
			2010-57a	5563151	643971	1429	
Pad 13	5563000	643600	2010-43v	5563048	643595	1424	
Pad 14	5562870	643785	2010-52a	5562853	643786	1421	
			2010-62v	5562853	643785	1421	
			2010-64a	5562851	643794	1421	
Pad 15	5562920	644180	2010-20a	5562915	644185	1416	
			2010-39a	5562915	644185	1416	
			2010-42v	5562914	644182	1416	
			2010-47a	5562909	644188	1417	
			2010-66a	5562576	643941	1442	
Pad 16	5562800	644320	2005-11a	5562796	644321	1418	
			2005-12v	5562793	644321	1418	

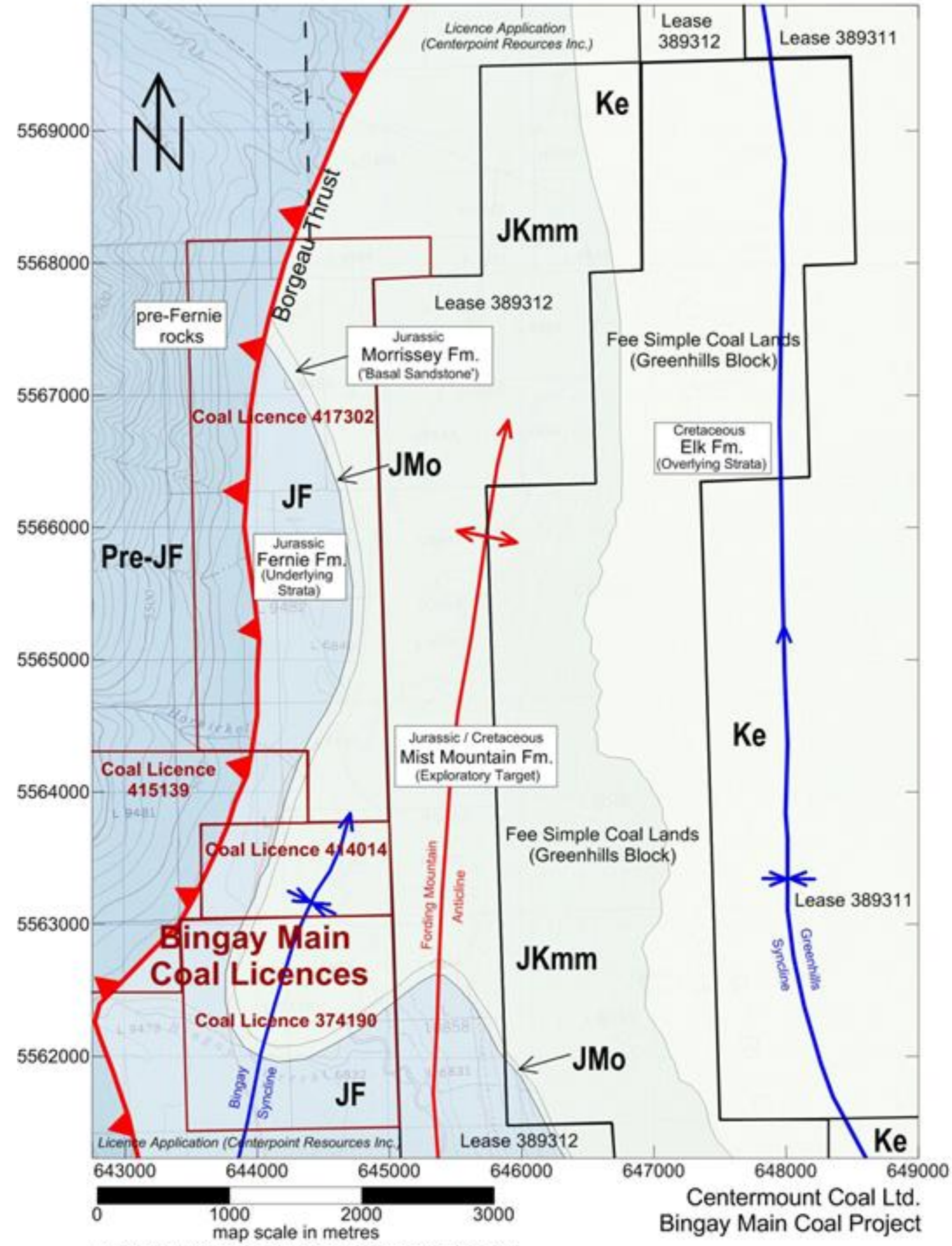
			2010-19a	5562793	644321	1417	
			2010-67a	5562795	644316	1417	
Pad 17	5563010	644420	2010-15a	5563000	644413	1389	
			2010-16a	5562993	644418	1389	
Pad 18	5562600	644110	2010-65a	5562602	644121	1489	
			2010-60a	5562577	643932	1442	
Pad 19	5562580	643930	2010-63v	5562571	643937	1442	
			2010-69a	5562576	643937	1442	
			2010-61a	5562455	644099	1463	
Pad 20	5562455	644120	2010-68a	5562449	644103	1462	
			2010-70a	5562448	644108	1462	
Pad 21	5562140	643760	2010-23v	5562127	643763	1409	
Pad 22	5561830	644310					2010-34v near P22
			2010-44a	5562979	644303	1402	
Pad 23	5562966	644286	2010-49a	5562982	644309	1402	
			2010-50a	5562977	644307	1402	
			2010-51a	5562977	644303	1402	
Pad 24	5564320	644080	2010-27v	5564274	644063	1412	
Pad 25	5564960	643920	2010-36v	5564915	643924	1429	P25-P30 in Bingay A, No coal.
Pad 26	5565460	644020	2010-33v	5565420	644011	1425	
Pad 27	5565930	643960	2010-31v	5565887	643966	1440	
Pad 28	5565950	644580	2010-37v	5565993	644618	1417	
Pad 29	5566870	644670					
Pad 30	5567590	644610					
Pad 31	5561840	643660	2010-22v	5561866	643602	1408	
Pad 32	5563500	643820	2010-24v	5563497	643810	1414	
Pad 33	5562580	643600	2010-28v	5562585	643607	1420	
Pad 34	5566260	643880					
Pad 35	5567190	644280					
Pad 36	5568080	644600					

Table 7-3 **2011 Bingay Coal Exploration Drilling Pad & Borehole**

Hole Number	Coordinates (UTM, NAD83)			-	Drill Hole		All Hole Location map	Pad Hole map
	Easting	Northing	Elevation	Depth (m)	Azimuth	Dip		
2011-1a(ka)	644365	5562645	1395.8	185.01	31.6	64	X	P16
2011-2a(ja)	644407	5562712	1395	364.85	80.4	64	X	P16
2011-3a(38a)	644301	5563567	1404	95.57	160	60	X	P8
2011-CQ01	644071.80	5563282.48	1422.05	41.0		90	X	P9
2011-CQ02	644315.17	5563016.46	1400.98	52.5		90	X	P17
2011-CQ03	644389.05	5563044.11	1386.71	27.0		90	X	P17
2011-CQ04	643854.17	5563001.79	1420.98	4.0		90	X	2010-38A
2011-CQ05	643987.47	5562702.89	1452.03	42.0		90	X	2004-2A
2011-CQ06	643992.50	5562702.90	1452.35	32.0		90	X	2004-2A
2011-CQ07	644086.09	5563305.95	1422.37	61.0		90	X	P9
2011-CQ08	643925.36	5563203.52	1423.95	11.0		90	X	P12
MW-11-1D	644050.0	5562270.0	1419.50	102.11		90	X	P20
MW-11-2D	644325.0	5562318.0	1399.50	109.73		90	X	On the road
MW-11-3D	644429.3	5562524.1	1390.50	117.35		90	X	CAMP
MW-11-4D	644344.6	5563366.4	1388.50	151.18		90	X	P10
MW-11-5D	644348.0	5562562.2	1397.50	102.41		90	X	P16
MW-11-5S	644460.0	5562760.0	1392.00	6.40		90	X	

Table 7-4 **2012 Bingay Coal Exploration Drilling Pad & Borehole**

Hole Number	Coordinates (UTM, NAD83)			-	Drill Hole		All Hole Location map	Pad Hole map
	Easting	Northing	Elevation	Depth (m)	Azimuth	Dip		
2012-01Ra	643849.0	5563464.0	1429.0	350.52	129	45	X	P12
2012-02Ra	644164.0	5563943.0	1399.0	426.72	135	50	X	P5
2012-03Ra	644336.0	5563812.0	1394.0	159.88	125	51	X	P7
2012-04Da	643430.0	5562575.0	1443.0	118.17	200	51	X	P19
2012-05Da	644110.0	5562595.0	1486.0	218.85	200	51	X	P18
2012-06Da	644120.0	5562460.0	1462.0	280.75	135	51	X	P20
2012-07Da	644005.0	5563115.0	1430.0	218.82	135	51	X	P12
2012-08Da	644312.0	5562570.0	1405.0	87.78	290	47	X	CAMP
BH12-1a	644050.0	5562270.0	1419.5	279.08	180	70	X	ROAD/P20-P21
BH12-2a	644456.0	5562789.0	1390.0	102.18		69	X	P16
BH12-3a	644470.0	5562776.0	1395.0	305.00		60	X	P16
MW12-1D	644405.0	5562369.0	1403.0	107.67			X	P9
MW12-2D	644456.0	5562790.0	1395.0	102.18			X	P16



Centermount Coal Ltd.
Bingay Main Coal Project

File: bingay-2010-regional-geology-1.srf Scale: as shown
Date: 2011 Feb. 14
Drawn: C.G. Cathyl-Bickford, P.Geo.(BC) Lic. Geol. (WA)
Base maps: NTS 82/J2 (edition 2) and 82 J/7 (edition 3).
Contour interval: 100 feet Grid: UTM NAD 27
Geology adapted from Grieve (1992)

Figure 7-1: Property-scale geology map

Figure 7-1 (ABOVE) shows bedrock geology of the Bingay Main property as understood by Bickford in 2010. This map incorporates findings from geological mapping by various workers in the area: Grieve and Pearson (1983), Grieve and Price (1987), Cathyl-Bickford (2005) and Munroe (2010b; 2010c).

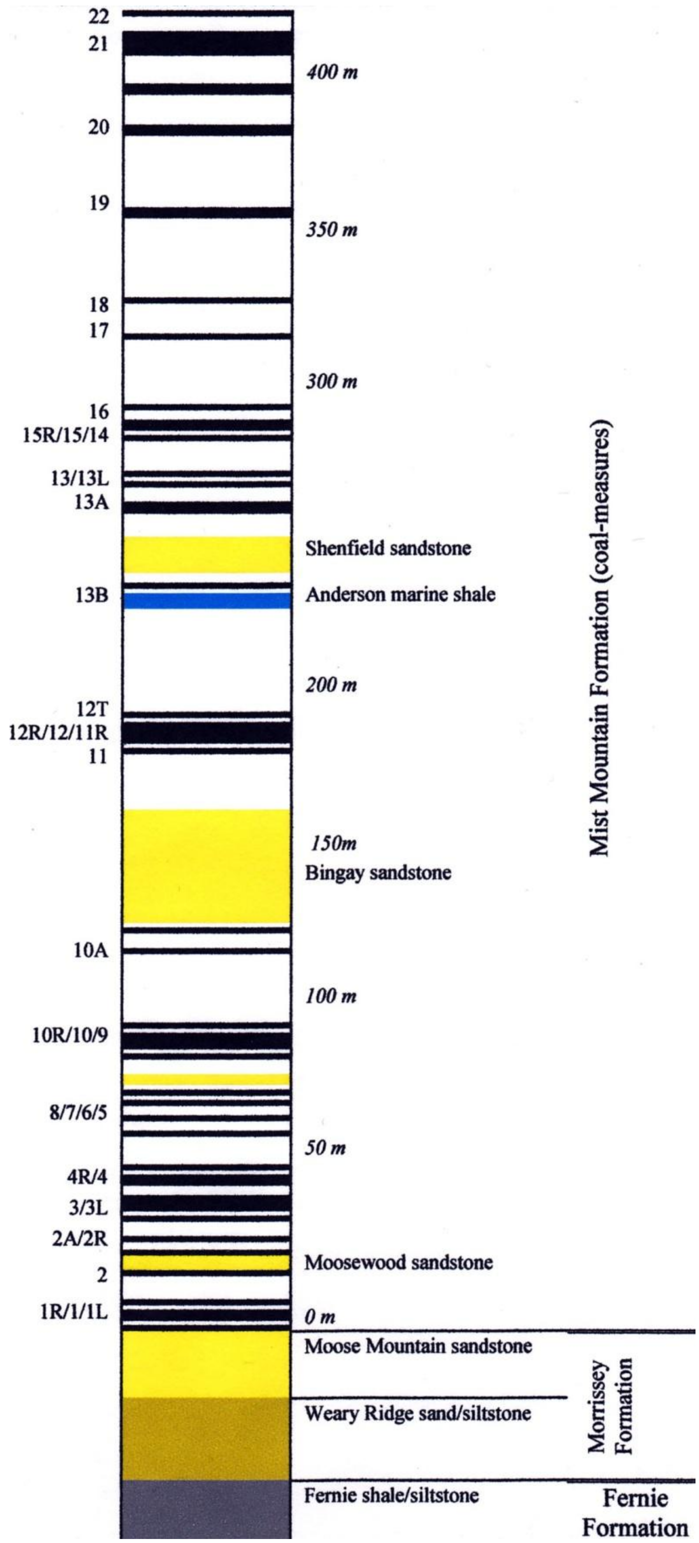
Within the Bingay Main property *per se*, the Fernie, Morrissey and Mist Mountain formations form bedrock; bounding the property to the east and west are younger and older rocks respectively.

Geological structure of the Bingay Main property is known mainly from mapping of bedrock outcrops (most extensively done by this author (Munroe) during the 2010 exploration programme, and reported by him in three stand-alone reports (*ibid*., 2010a, 2010b and 2010c) as cited in the 2010 report's references; with earlier work documented in Cathyl-Bickford's 2005 report), supplemented by dipmeter records from most of the 2004, 2005 and 2010 boreholes**. Figure 7-2** shows cross-section locations and the horizontal projection of all boreholes drilled at Bingay Hill, where the presently-recognised coal resources (see APPENDIX **VIII:** Geological Report by C.G. (Gwyneth) Cathyl-Bickford P.Geo. Lic. Geo, in 2011 ITEM 19 of this report) are located.

Table 7-5 (below) presents, in graphic form, the nomenclature and stratigraphic position of major correlatable coal beds within the Mist Mountain coal-measures, along with the positions of major sandstones and an inferred marine band.

Three major stratigraphic assemblages are present at Bingay Main, and within the Elk Valley coalfield generally. From base upwards they are 'Basement', 'Coal-measures' and 'Drift cover,' of Jurassic and older, Jura-Cretaceous and Quaternary ages successively.

Economic basement beneath the Mist Mountain Formation (essentially, the older rocks beneath which no mineable coal could be expected to be found) is formed by sandstone of the Moose Mountain and Weary Ridge members of the Jurassic Morrissey Formation, and interbedded siltstone, sandstone and mudstone of the Jurassic Fernie Formation.



Drawn: C.G. Cathyl-Bickford P.Geo. Lic.Geol., 2010 December 20.   Scale: approximate, as shown

Table 7-5: **Stratigraphic Column for Bingay Main**

The Moose Mountain Member forms prominent sandstone cliffs along the north bank of Bingay Creek, downstream from the Forest Service Road bridge. The Moose Mountain sandstones are also well-exposed along the access road which skirts the southern face of Bingay Hill, along the northern side of Bingay Creek. The two older rock-units are exposed beneath the Moose Mountain beds, within the canyon of Bingay Creek.

In the subsurface at Bingay Hill, the Moose Mountain Member has been reached in 21 boreholes, 20 of which were drilled during the year-2010 exploration programme. The contact of the Moose Mountain sandstone to the overlying Mist Mountain coal-measured has now been adequately established to be abrupt, marked by a variably-thick coal zone (the No.1 zone) directly overlying a rooted, quartzose, carbonaceous to coaly and sandy paleosol.

Outside the property, Cominco boreholes EV-3, EV-5, EV6 and exploratory gas well AECOG Mosquito d-16-D/82-J-7 all appear to have been collared in older shales or siltstones of the Fernie Formation. Cominco borehole EV-4 and exploratory gas well AECOG Mosquito d-96-L/82-J-2 both appear to have bottomed in Moose Mountain or Weary Ridge sandstone.

Coal-measures in the Bingay Main area are hosted by the Mist Mountain Formation of the Kootenay Group, of latest Jurassic to earliest Cretaceous age. Although younger coals are known from the overlying Elk Formation in the Greenhills Range (Grieve and Pearson, 1983), the Elk coals appear to have been stripped away by erosion within the Bingay Main property. During deposition of the Mist Mountain coal-measures, the Fernie Sea (the local name for the Interior Seaway) lay to the east and Northeast, and orogenically-elevated highlands lay to the Southwest.

The Mist Mountain Formation outcrops extensively on Bingay Hill, and along both limbs of the Bingay Syncline. Comparison of the drilled stratigraphic section at Bingay Main with the surface sections reported by Gibson (1985) from the Greenhills Range suggests that the upper third or quarter of the Mist Mountain has been lost to erosion at Bingay Main. The preserved true stratigraphic thickness of the Mist Mountain Formation at Bingay is about 460 metres.

Gibson (1985) proposed that the Moose Mountain sandstones might represent a coastal barrier or strandplain system, above and behind which extensive peat lands could form within the deltaic complex that comprises the Mist Mountain coal-measures. Although Gibson did not recognise any definitely marine interbeds within the Mist Mountain Formation, he did note the presence of extensively-burrowed rocks within the basal Mist Mountain. Such intensely-bioturbated strata were also noted by the senior author in the course of relogging some of Utah Mines' 1983 diamond-drill cores. The most continuous of these zones, with characteristic high gamma-log response, has been designated as the Anderson 'marine band', lying between the No.13 Lower and No.12 Rider coal beds.

The year-2004 and year-2005 geological mapping by Bickford, and the more detailed year-2010 structural mapping by the writer (Munroe, 2010a, 2010b), was focussed on elucidating the overall structure and coalbed disposition within the Bingay Syncline, only passing attention was paid to palaeocurrent indicators. Some of the coal-measures rocks (most notably the thick sandstone beds) are rippled or cross-bedded, and such features afford the possibility that more detailed fieldwork might allow for the determination of palaeocurrent directions, and hence the outlining of small-scale palaeotopographic features within the coal-measures at Bingay Main. The complex nature of the deposit continues to make that a very difficult task.

In July 2010 the writer (Munroe) was commissioned by Centermount Coal Ltd. to conduct a series of trench surveys to examine the stratigraphic sequences and determine if any additional structural data could be developed for the property. After series of trips to the property during the summer the scope of work expanded to include a more regional structural examination of the rest of the Bingay property as well as three additional adjoining properties. These additional properties were identified as Bingay A, B and C and are under the control of Centerpoint Resources Inc.

The regional examination required trips up any passable old and new logging roads, old trails and openings in logged ground. No work permits were in place so only limited truck traffic, a lot of hiking and extensive digging with hand tools was required to look for outcrop locations. Some success was achieved in locating outcrops and tracing structural ridgelines in all four properties but the resulting information suite is sparse at best. A lot more field work with permitted heavy equipment support is needed to expose possible buried near-surface bedrock highs. Some of this defining exploration is planned and permitted for the 2016 field season.

The field work was a critical element in attempting to understand the regional picture with respect to the potential for folding, faulting and shearing that is known and possible. After interviewing the government geologist, Dave Grieve, it was clear that only limited “broad brush” field examination has been done on a classical basis for this region. Detailed studies of smaller sections have not been done by recent authors. The summer work also allowed access to old coal adit and shaft sites on the property and the discovery of possible collapsed old coal workings approximately 1.5 km south of Bingay Creek. It must be understood that coal exploration on these areas was done starting in the early 1900’s but nearly all of these records are lost in time. This possible old coal working will be explored with heavy equipment in 2016 and reported upon in subsequent reports.

What appear to be extensive workings, dot the landscape in selected locations. This indicates that the potential for coal across the property is high and having a solid understanding of the structural basics for the region is critical. The valley floor and flanks are covered in thick till and fluvial sequences that mask the underlying folded, sheared and faulted bedrock strata. The use of seismic work in this region was strongly suggested to assist in defining possible bedrock features below the cover. Preliminary seismic reflection work was done by Hansen and Candy in October 2012. This work will be reported upon in the pre-feasibility report being formulated. It is not reported in this report as it was done as part of a pit modeling exercise and not for exploration purposes.

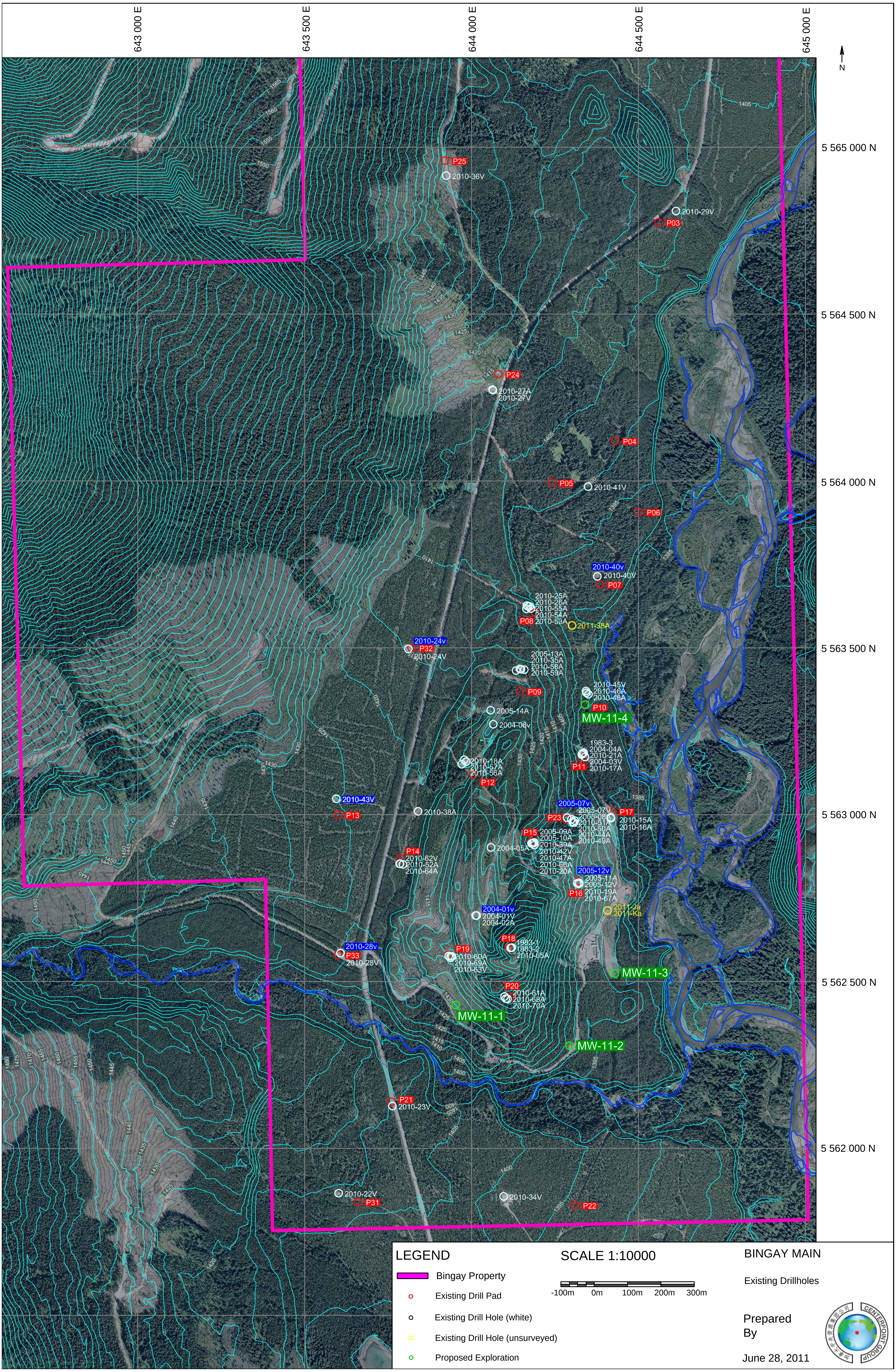
The 2010 drill program encountered several very deep unexpected intersections of glacial and fluvial cover that may be avoided in future work now that these deep features are both known and slightly understood. Another aspect to seismic and other geophysical examinations prior to drilling is the ability to potentially “see” buried fault and/or shear zones. Encountering such zones usually results in drilling difficulties and added costs.

Part of the problem with primary exploration in the Elk Valley is the inability to “wildcat” test holes and trench works as prospective bedrock areas are discovered due to permit restrictions. As a result, the 2010 report detailed possible areas of bedrock highs in the valley floor along with associated flanking coal measures and a generalized structural plan indicating major zones of interest. Much more detailed field work is still needed to better define these potential areas and new discoveries may alter this proposed plan in a significant manner. Changes in the ground knowledge base are expected in exploration and the operators must be able to adapt to these potential paradigm shifts accordingly.

Additional research is also need in archive data bases and government records to locate old air photos, permit information and mining/exploration activity in the region. It was determined by a limited search by this writer (Munroe) in Victoria, in 2010 that at least 9 old coal exploration licenses were issued on portions of the current property suite in the early 1900’s. This would indicate that a much larger body of forgotten knowledge may be hidden somewhere.

The 2010 field season work provided the opportunity to present a possible regional structural picture that will have to be correlated with the data set obtained from the current exploration drilling at Bingay Hill. The 17 drill holes done in 2011 and the 13 done in 2012 have helped in developing an updated structural model. This work is still in progress. To augment the drilling a series of trenches were dug and mapped by Spring MacAskill in October 2012. That information is contained in Appendix 1 in the October 2012 folder.

Map1 : 2011 Bingay Coal Exploration Boreholes



643 000 E
643 500 E
644 000 E
644 500 E
645 000 E
N
5 565 000 N
5 564 500 N
5 564 000 N
5 563 500 N
5 563 000 N
5 562 500 N
5 562 000 N
P25
2010-36V
2010-29V
P03
P24
2010-27A
2010-27V
P04
P05
2010-41V
P06
2010-40v
2010-40V
P07
2010-26A
2010-28A
2010-55A
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P08
2010-53A
2011-38A
2010-24v
P32
2010-24V
2005-13A
2010-35A
2010-58A
2010-59A
P09
2010-45V
2010-46A
2010-49A
P10
MW-11-4
2005-14A
2004-06v
1983-3
2004-04A
2010-21A
2004-03V
P11
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2010-18A
2010-57A
2010-56A
P12
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P23
P17
2010-15A
2010-16A
P15
2005-09A
2005-10A
2010-39A
2010-42V
2010-47A
2010-66A
2010-20A
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P14
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2010-52A
2010-64A
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2005-11A
2005-12V
P16
2010-19A
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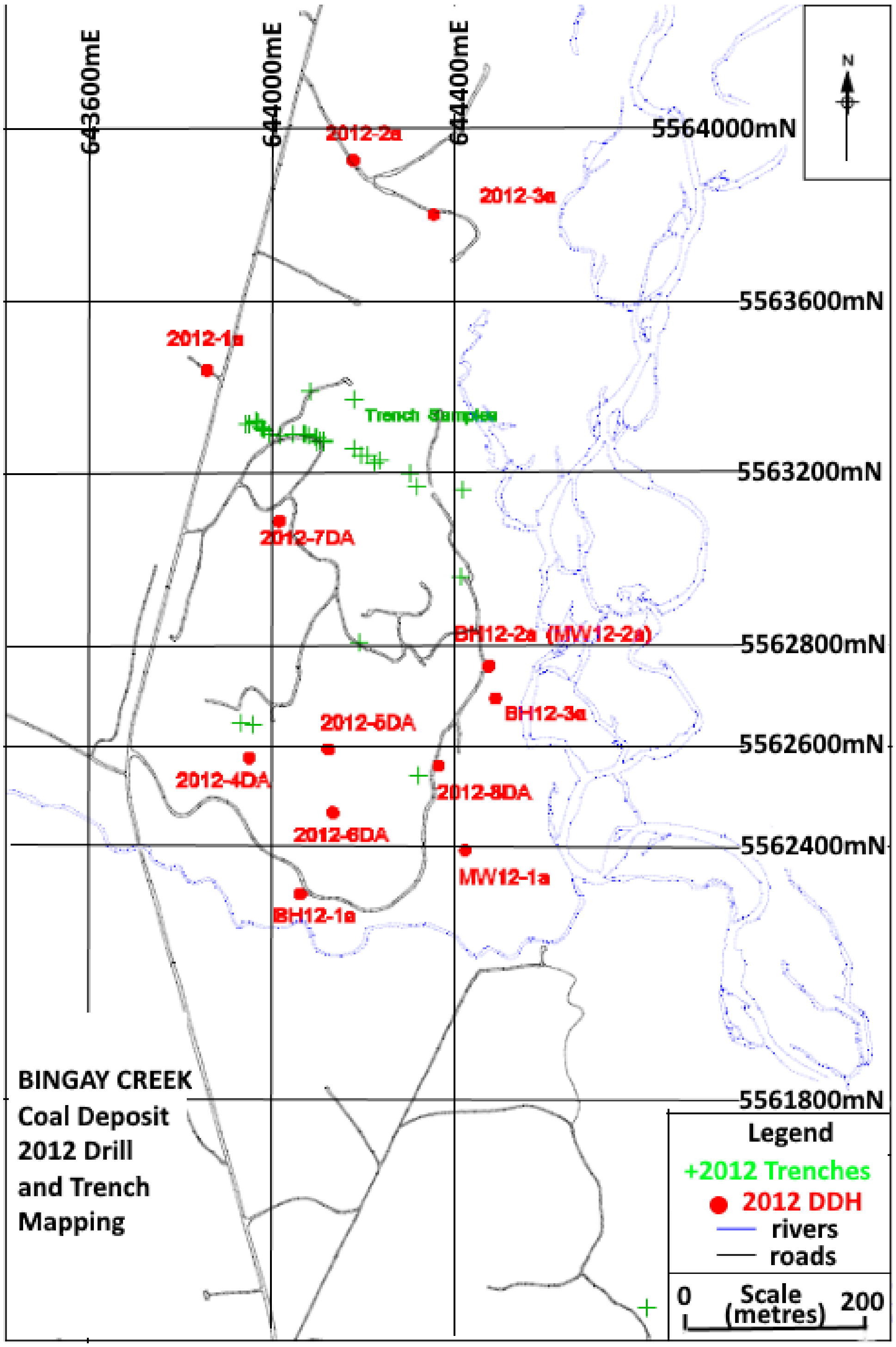
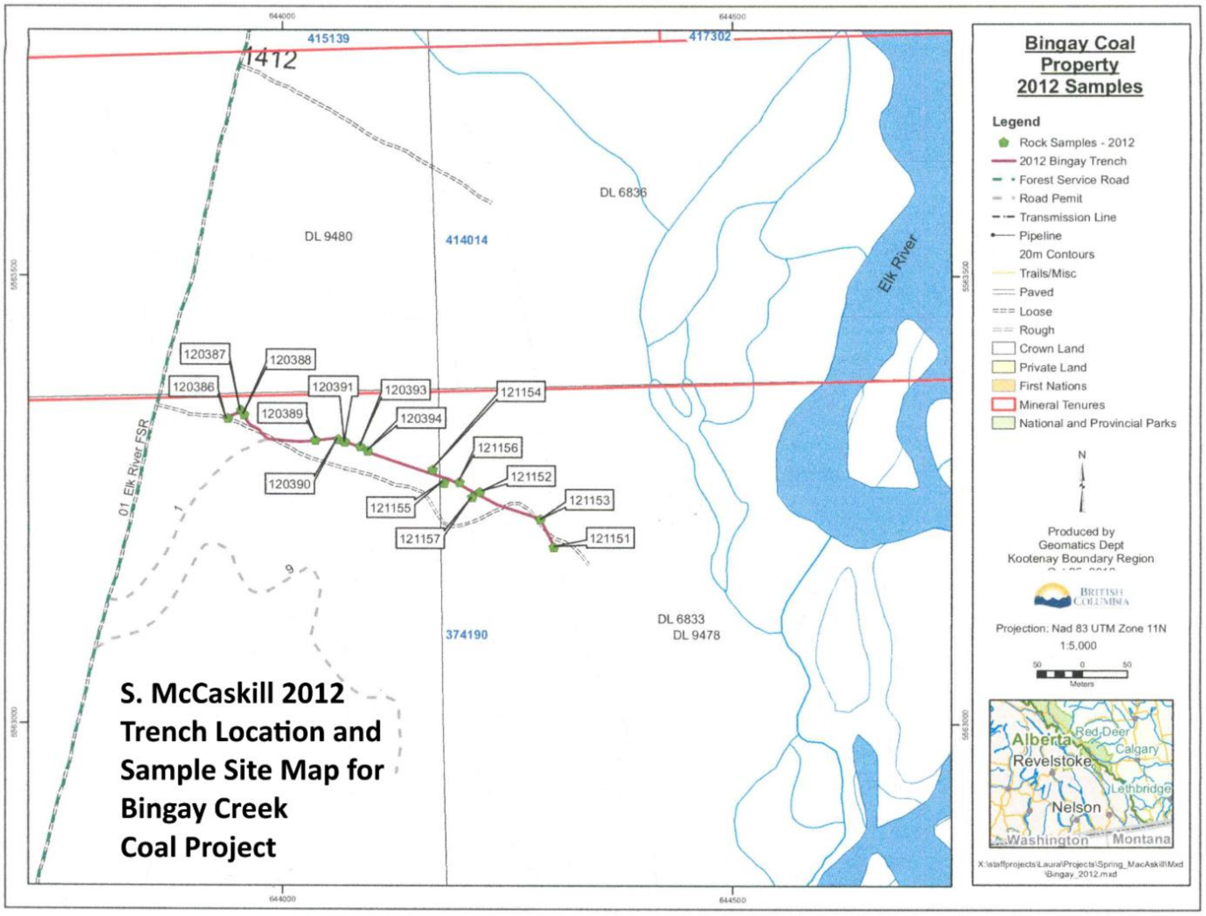
2011-Ja
2011-Ka
2004-01v
2004-01V
2004-02A
P18
1983-1
1983-2
2010-65A
P19
2010-60A
2010-69A
2010-63V
2010-28v
P33
2010-28V
MW-11-3
P20
2010-61A
2010-68A
2010-70A
MW-11-1
MW-11-2
P21
2010-23V
2010-22V
P31
2010-34V
P22
LEGEND
Bingay Property
Existing Drill Pad
Existing Drill Hole (white)
Existing Drill Hole (unsurveyed)
Proposed Exploration
SCALE 1:10000
-100m 0m 100m 200m 300m
BINGAY MAIN
Existing Drillholes
Prepared By
June 28, 2011
CENTERPOINT GROUP



Map 2: 2012 Bingay Coal Exploration Diameter Borehole & Trench Location Map

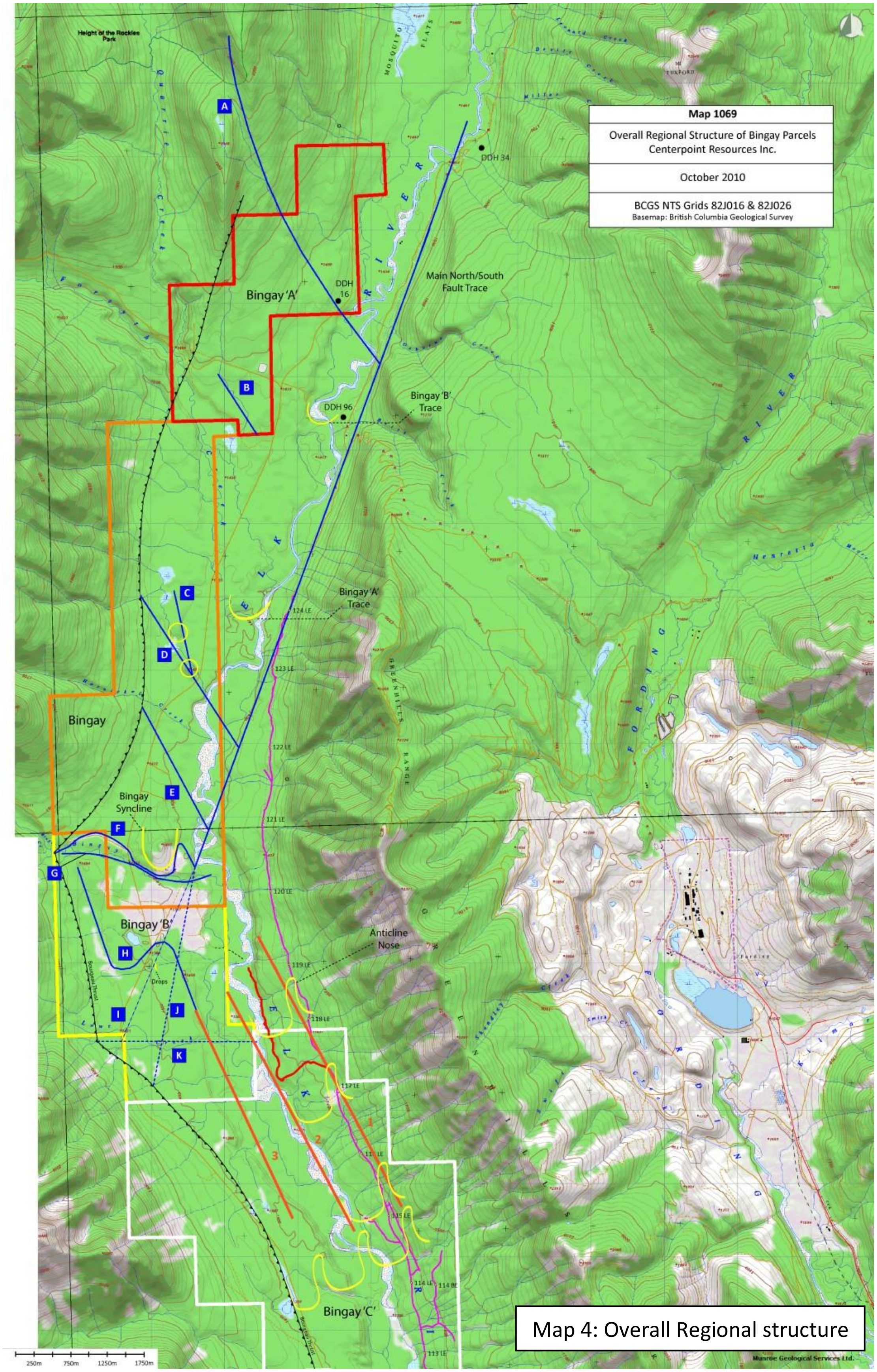


Map 3: 2012 Trench location and sample site map for Spring McCaskill program

The regional picture is centered on a possible but un-reported main north/ south fault system determined by this writer (Munroe) in 2010, that traces a line from the NNE to the SSW along the frontal base of the Greenhill Range to the east of Elk River. Corresponding "drag" features from the movement along this line appear to run the width of the Elk River Valley but are lost under the over thrusting Bourgeau Thrust fault on the west flank. The N/S fault and the Bourgeau conspire to result in a constriction zone with its apex at the core of the steep, north dipping Bingay Hill syncline.

The following map depicts the overall collage of theoretical structural elements at play in the valley study area. Each fault trace represents a separate set of vectors that work in concert with the larger system. However, each also results in the potential for subduction, flat over thrusting and block rotation as the entire valley system is examined. In general terms the main forces in the valley appear to be the eastward compression from the Bourgeau Thrust along the entire western side of the valley. Indeed, the literature indicates that the entire range to the west is the direct result on this ramp thrust moving over the valley as it moves up the arm of the large anticline. The other main element referred to earlier as the proposed vertical Main North-South fault running parallel with the base of the Greenhills Range.

However, there are distinct ``pinch points`` along the thrust that appear to be evidence of shear elements perpendicular to the Bourgeau. The three main points of interest are the Hornickel, Bingay and Lowe Creek valleys. Either perpendicular or EW/SE movement is indicated at these junctures. This is however, in keeping with the expected change in direction of the force vectors as there is deflection point right at Bingay Creek where the North South fault appears to deviate to the SSW in the order of 10 to 15 degrees. (noted as I and J on the map) This deflection meets the intersection of the Bourgeau and perpendicular Lowe Creek fault. (noted as K on the map)


Map 1069
Overall Regional Structure of Bingay Parcels
Centerpoint Resources Inc.
October 2010
BCGS NTS Grids 82J016 & 82J026
Basemap: British Columbia Geological Survey
Bingay 'A'
Bingay 'B'
Bingay 'C'
Bingay
Main North/South Fault Trace
Bingay 'B' Trace
Bingay 'A' Trace
Bingay Syncline
Anticline Nose
DDH 34
DDH 16
DDH 96
Map 4: Overall Regional structure

South of Bingay Hill is the proposed surface trace of the E/W trending Bingay Creek Fault that controls the orientation of its thalweg and may be responsible for a thrust fault that elevated the northern section of the Bingay syncline. There may actually be at least 2 sub parallel fault traces north of the creek, with resistant layers of the folded strata that form the major elevated syncline core that is known as Bingay Hill. Sharp shear line traces, apparent drag folding and clockwise bed rotation is noted in the outcrops and trenches on the east flank of this hill. The rough orientations of the effects are sub parallel with the main N/S Trench some 250 m to the east.

North of the Hill the syncline appears to plunge deeply to the north. However at two locations along the Elk River muted course changes indicate that possibly obscured synform elements are trying to come to surface. These elements could be continuations of the Bingay syncline that have been cross faulted and block dropped. In addition to these muted features there are four NNW to SSE possible fault traces that have their western edges covered by the Bourgeau over thrust and the eastern ends truncate at the main N/S fault. One of these fault trace lines bifurcates right at the location of possibly 2 thrust up blocks that follow the trace of the bifurcation wedge. These blocks rise roughly 15 metres above the flat valley floor and can be seen as mounts from kilometers away.

South of Bingay Creek there are additional possible structural elements that are hidden under the till cover. The trace of the main N/S fault line deflects slightly to the south at the Bingay cross fault (s) and crosses the eastern apex of one of two opposing synoidal loops roughly one kilometer south of the Creek. The western arm of the twin loop structure truncates at the Bourgeau Thrust while the parallel eastern arm (NW/SE) descends to the south along the valley also parallel to the Elk River trace.

It should be noted that the averaged thalweg trace of the Elk River parallels the trace of the main N/S fault north of Bingay Creek. The river course then turns N/S at the intersection of the Bingay Creek fault and the main N/S fault. It remains on the N/S flow as it passes the constriction point east of Bingay Hill and runs roughly parallel with the observed N/S shear zone traces in strata on the east side of the Hill.

The river then turns to the SSE just below the Bingay Creek intersection and parallels the trace of the eastern arm of the synoidal loop for several kilometers down the valley. This also mirrors the changes in the Western flank of the Greenhills Range.

If a line is drawn SSE from the eastern end of the synoidal loop for roughly 3 kilometers it would generally parallel the western bank of the Elk River trace. Using this line as an axis trace (NW/SE - approximately 330 degrees AZ) other corresponding features can be seen. On the eastern flank of the Elk River roughly following the centerline of the hydro line, 2 kilometers south of Bingay Hill, a steep anticline fold nose overturned to the east was mapped in the early part of the century by explorers following the Greenhills coal measures on the east valley wall. The nose also displayed float coals in the till cover. Green beds were also located in outcrop roughly 150 m above the nose elevation which indicate coal measures should be found slightly higher in the stratigraphic column.

Following the trace of the anticline down to the east side of the river additional coal float was found in the till cover between the east road and the river. At the eastern bank of the river, Fernie Formation beds are noted to dip sharply (60-68 degrees) to the east while the Green beds found some 200 m above the river dip 70 to 80 degrees to the west. This configuration has to indicate that a sharply folded syncline exists in the 750 m between the river and the green bed outcrop. With a sharply overturned anticline axis above the green beds falling to the east an over thrusting stress is most likely coming from the west (Bourgeau Thrust) and sharply folding the strata into a series of roughly parallel synclinal troughs as the anticline arches would have been eroded off by glacial and fluvial action in the valley floor.

Using a simple replication of the fold energy needed to develop the east side syncline during the compression from the west, 3 synclinal, north south trending troughs with an axis of roughly 330 degrees AZ could have been formed. The western limb of the most westerly syncline would essentially end near the foot of the Bourgeau Thrust line. This configuration would account for the coal float found on the east side of Bingay C on the trail named Bill's Road (shown in red for the road builder and locator of the float decades ago, Bill Shenfield). Possible muted sub crops seen on imagery in the area also tend to match the configuration and positioning of possible near surface bedrock formations under the till.

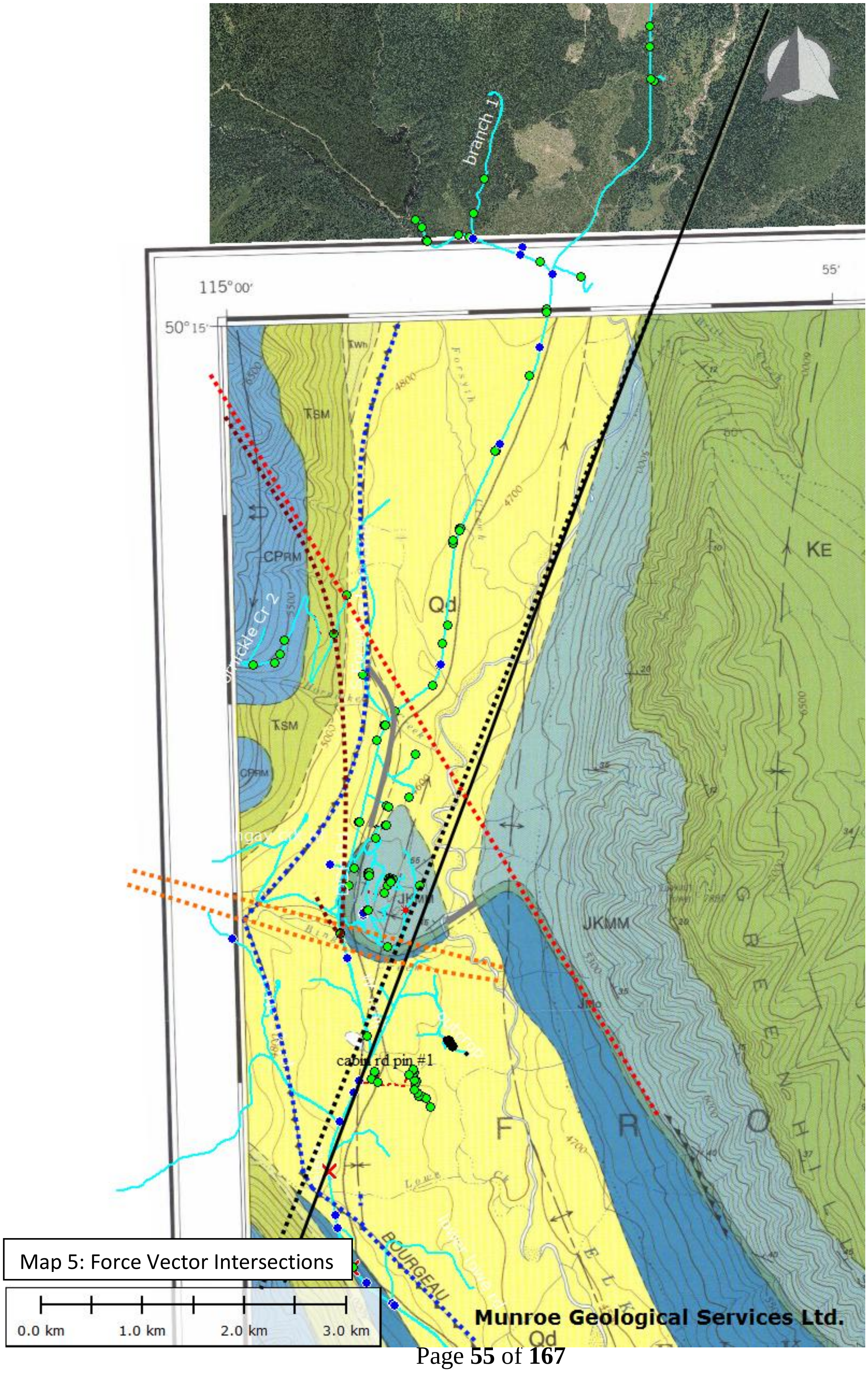
This compression model also fits the positioning of the possible sunken coal workings located 1.5 kilometers south of Bingay Creek. This area is noted as the ``drops`` on the preceding main map. An excavator will be used in March 2016 under the new permit to prove the location of coal measures in that location. Should they be found, additional near vertical coal measures should be replicated both east and west from that point along the axis to the south. The company still has no drill or excavation data on Bingay B or C to support any of this theory but several target areas that can easily be reached in 2016 will be explored now that proper permitting is in place.

The presence of any uniform stratigraphic sections north of this point is problematic as the effects of possible over thrusting from the north parallel to the Bingay Creek fault system (s) mixed with the synoidal fold axis and a stress related re-orientation of the strike of the main N/S fault all meet between the slumped areas and Bingay Creek to the north. Drilling in this section will be difficult at best to properly orient any encountered strata. This was apparently the case with three rotary holes placed at the southern end of Bingay by Centermount Coal Ltd. in 2010. Caution will be used in three holes planned for the area south of Bingay Creek in March of 2016 so as not to also hit fault zones.

Another important element to this model is found in the 1992 Geological Survey of Canada map # 1824A (Fording River) by D.A. Grieve. The writer interviewed Mr. Grieve in 2010 and determined that this general/ regional work was the most current understanding of that part of the valley. However, the sharp fold of the Morrissey Formation on the east side of the valley base, the stratigraphic folding of the bed shown wrapping around the base of Bingay Hill and continuing north to under the Bourgeau Thrust at Hornickel Creek is all accurately plotted. The configuration of this strata outline is almost a replica of the orientation of the twinned synoidal loop structural elements noted in the satellite and elevation imagery of Bingay B used by the writer to assist in the development of the current model. New computer modeling efforts were undertaken closer to Bingay Hill between 2011- 2012. Yet another model is being examined for this southern zone. Those results will be known in the summer of 2016.

This currently understood regional geological map series provides a guide to assist developing the model of how the synclinal structures were formed. The following map series attempts to provide a conceptual plan for that development.

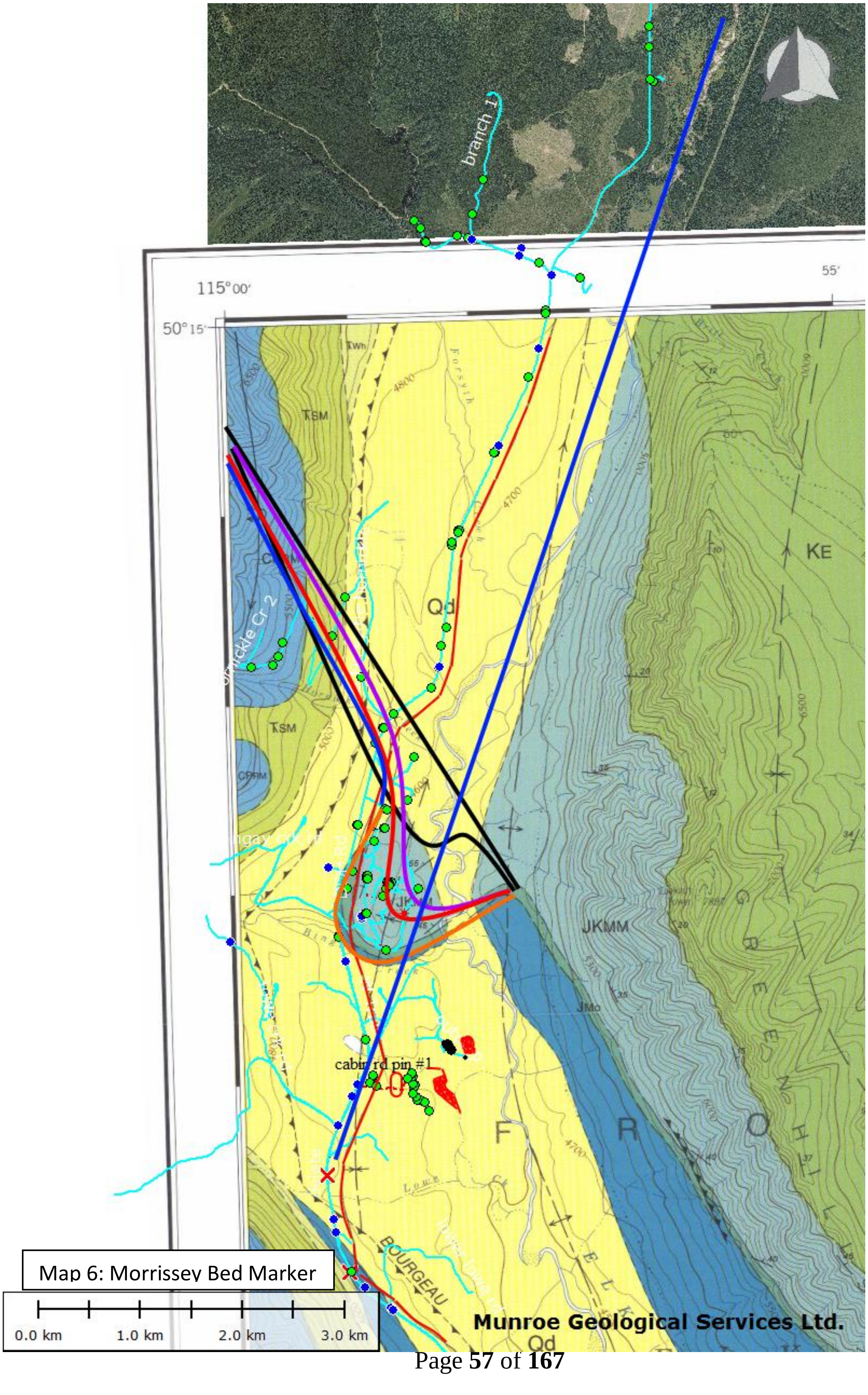
The three following images are the same base with changes in the structural framework as an overlay. The first shows the main intersections of the force vectors surrounding the Bingay Hill area. The NW to SE red dotted line follows what should have been the trace of the Morrissey Bed that runs along the base of Greenhills Range to the SE of Bingay Hill. The grey line on the map indicates the placement of the identified Morrissey beds in the field by Grieves etal. The black dotted and solid line shows the approximate trace of the proposed North-South fault. The twin orange lines show the EW orientation of the two Bingay Creek fault traces south of Bingay Hill. The Bourgeau Thrust is shown as the dotted blue line. The brown dotted line attempts to follow the track of movement that resulted in the meeting of these fault systems.



Map 5: Force Vector Intersections

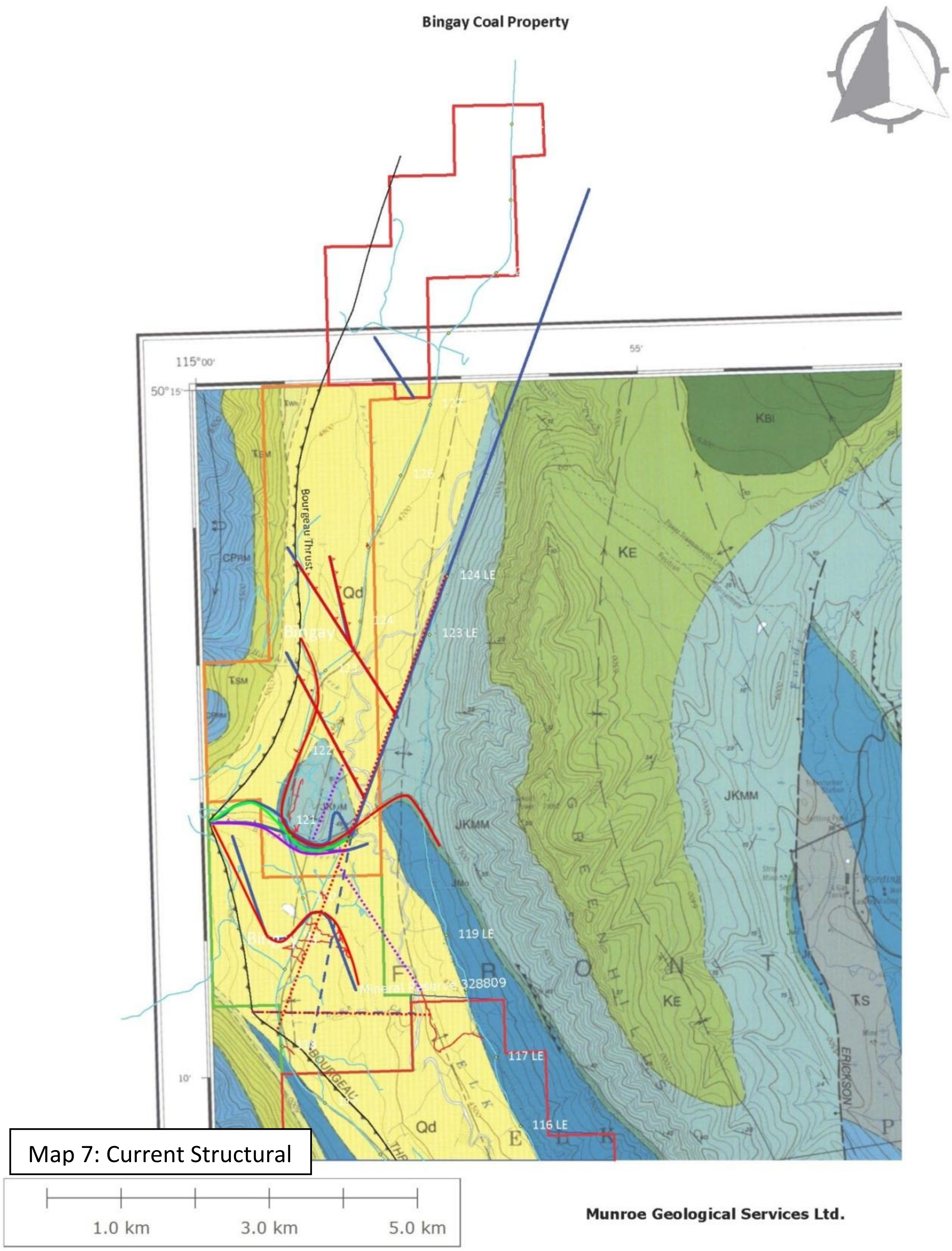
The following map shows the theoretical movement of the Morrissey bed marker as the strata became folded into the syncline and the ground west of the main North-South fault was forced south. The Bourgeau would have continued to exert eastward forces into the strata north of the Hill but then vectors would have changed between Bingay and Lowe Creek. The Bourgeau would have then changed its push slightly to the NE past the southern end of the North-South fault.

The black lines indicate the first and second positions of the fold. As the compression continued the movement would have been to the purple line, then to the red and finally to the orange line position where it is seen today.



branch 1
115°00′
55′
50°15′
KE
Qd
JKMM
Map 6: Morrissey Bed Marker
0.0 km
1.0 km
2.0 km
3.0 km
cabin rd pin #1
BOURGEAU
Munroe Geological Services Ltd.

The following map shows the proposed current state of the structural elements around the Bingay Hill area with the geological map base as a reference. It is followed by a second map showing the refined structures on the topographic map base. Again it must be stressed that a considerable amount of drilling and trenching will be required to verify any of these elements.



Map 7: Current Structural

The ground surface within the Elk River valley is mostly covered by a variably-thick drift mantle (generally a few metres to a few tens of metres thick, but locally well over 200 metres thick) of glacial, glaciofluvial, alluvial and fluvial sediments, which together occupy the 'known covered areas' mapped by Henderson (1956). Bedrock exposures are therefore confined to isolated areas where sandstone-rich portions of the Kootenay coal-measures have resisted erosion, and to the incised canyon of Bingay Creek.

The best exposures of drift are in road-cuts along the Elk River forest service road, and in the cutbanks of the Elk River. Rounded boulders of Palaeozoic quartzite form isolated large glacial erratics at the ground surface within the Bingay Main property, most notably on the southern slopes of Bingay Hill.

West and north of Bingay Hill, stratigraphy of the drift cover appears to be fairly consistent, with a near-surface gravelly alluvial-fan or fluvial-terrace deposit underlain by a sticky silty clay, which in turn is underlain by yet another extensive sheet of water-bearing gravel with sandy interbeds. The basal gravel forms a confined aquifer, which locally yields substantial flows of artesian groundwater when entered by a drill.

Computer-based structural modelling, based on subsurface data from most of the boreholes, and working in context of known and inferred bedrock geology, was undertaken during November and December by Gemcom Software International Inc. (Brandão, Barnett and Bui, 2010). Gemcom’s structural maps and several of their cross-sections were incorporated in the 2010 reporting, with annotations by Bickford. In August 2011 a GEMCOM report on the Geological Block Modeling of the Bingay Deposit was released. It was followed by a mine modeling report by Norwest Corp in February 2012. Only the GEMCOM report is included in the Appendix 1 files (August 2011) as it was an exploration effort. A newer exploration driven, structural computer software based analysis is currently underway to model the drill hole information derived from the 2011 and 2012 drilling programs.

Figures 7-3 through **7-5** present selected structural cross-sections derived from Gemcom’s modelling of the intensely-drilled Bingay Hill area. Cross-sections Nos.3, 7 and 11 correspond approximately to cross-sections B-B’, D-D’ and F-F’ from previous work (Cathyl-Bickford, 2005). **Figure 7-6** also based on a Gemcom map, shows the locations of coal intersections along boreholes which were used to generate the model. Shown in blue on this map are the mapped and inferred traces of the No.10 through No.21 coal beds, based on year-2004 and year-2005 fieldwork.

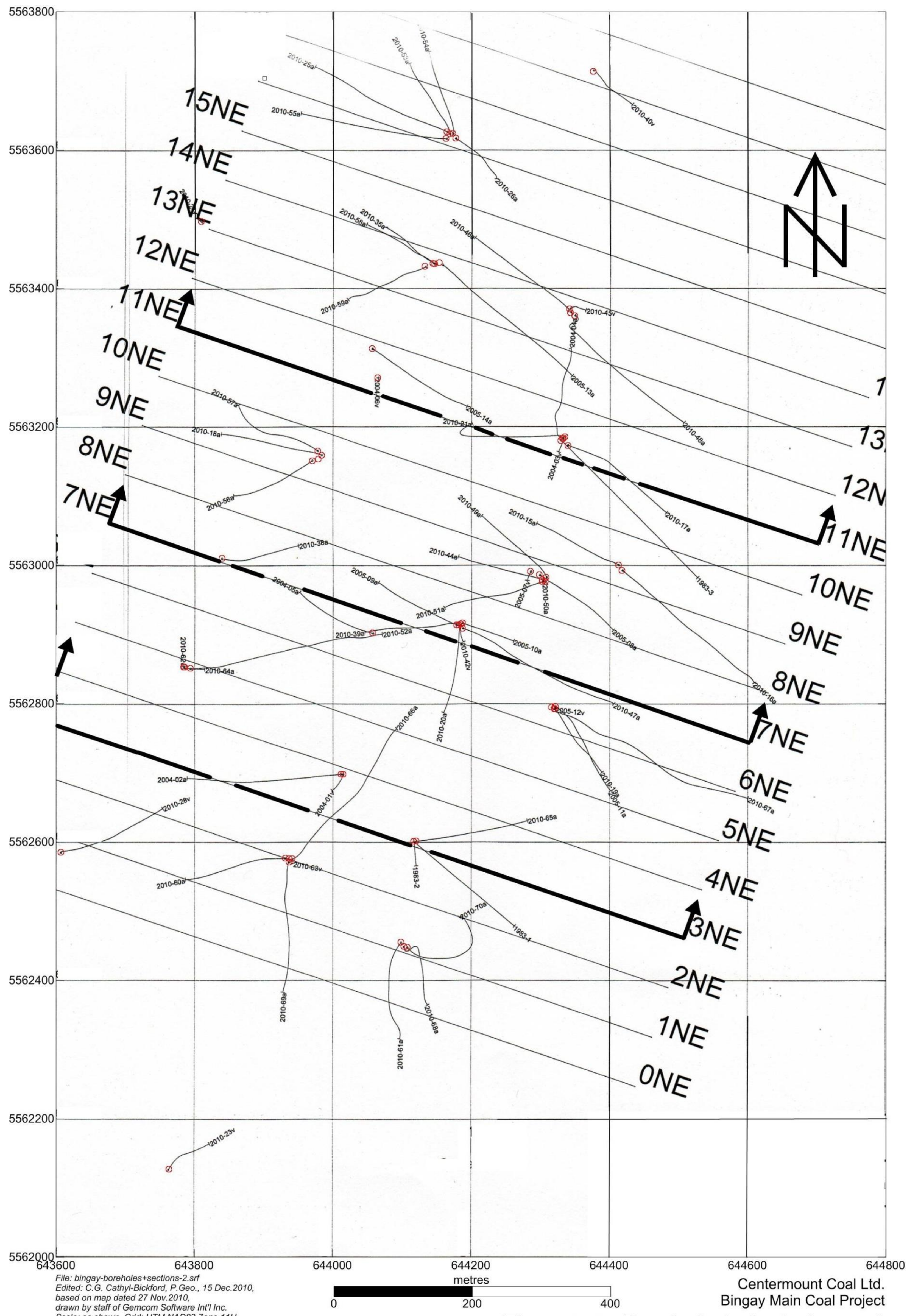


Figure 7-2: Borehole trajectories and cross-section locations at Bingay Hill

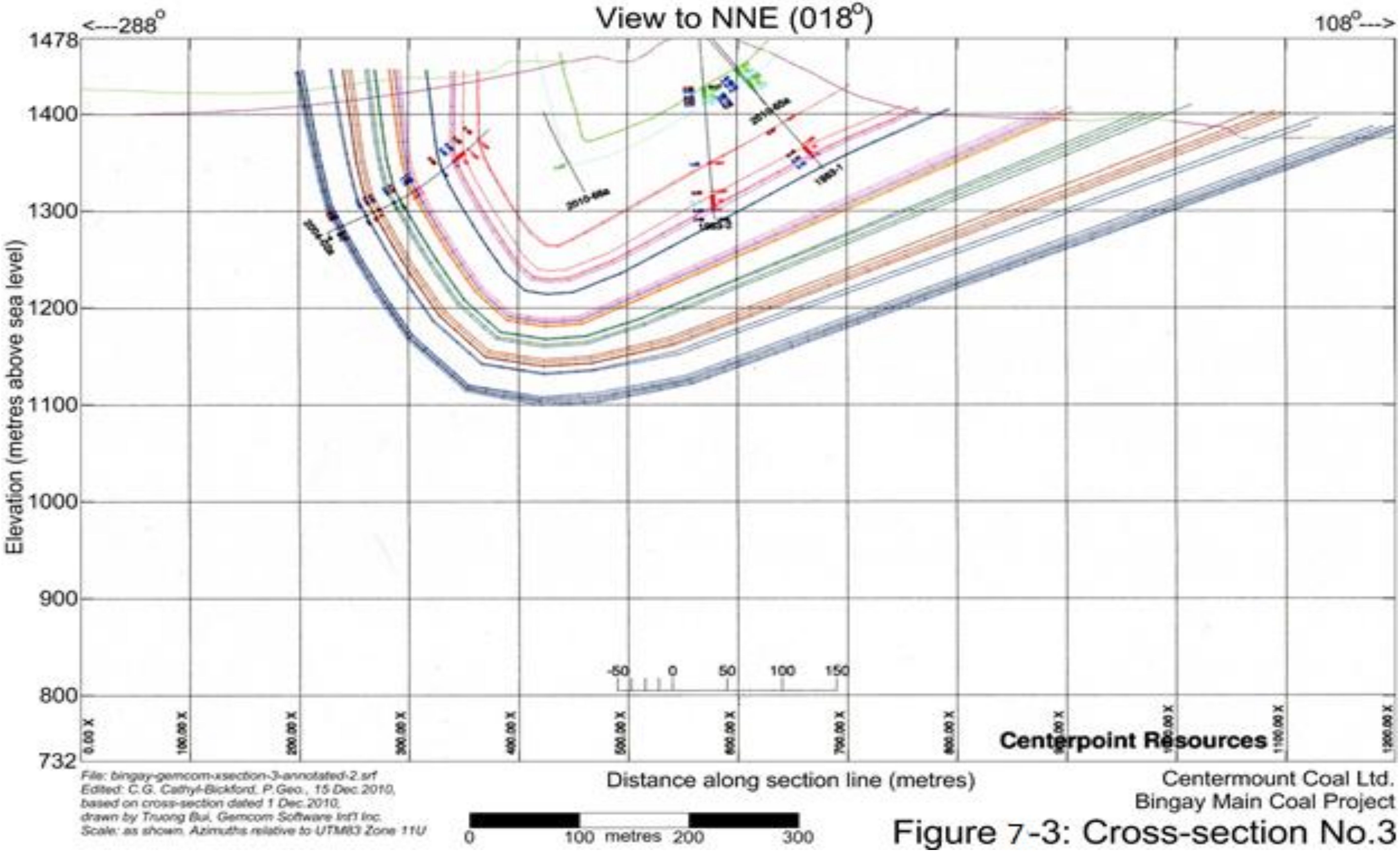


Figure 7-3: Cross-section No.3

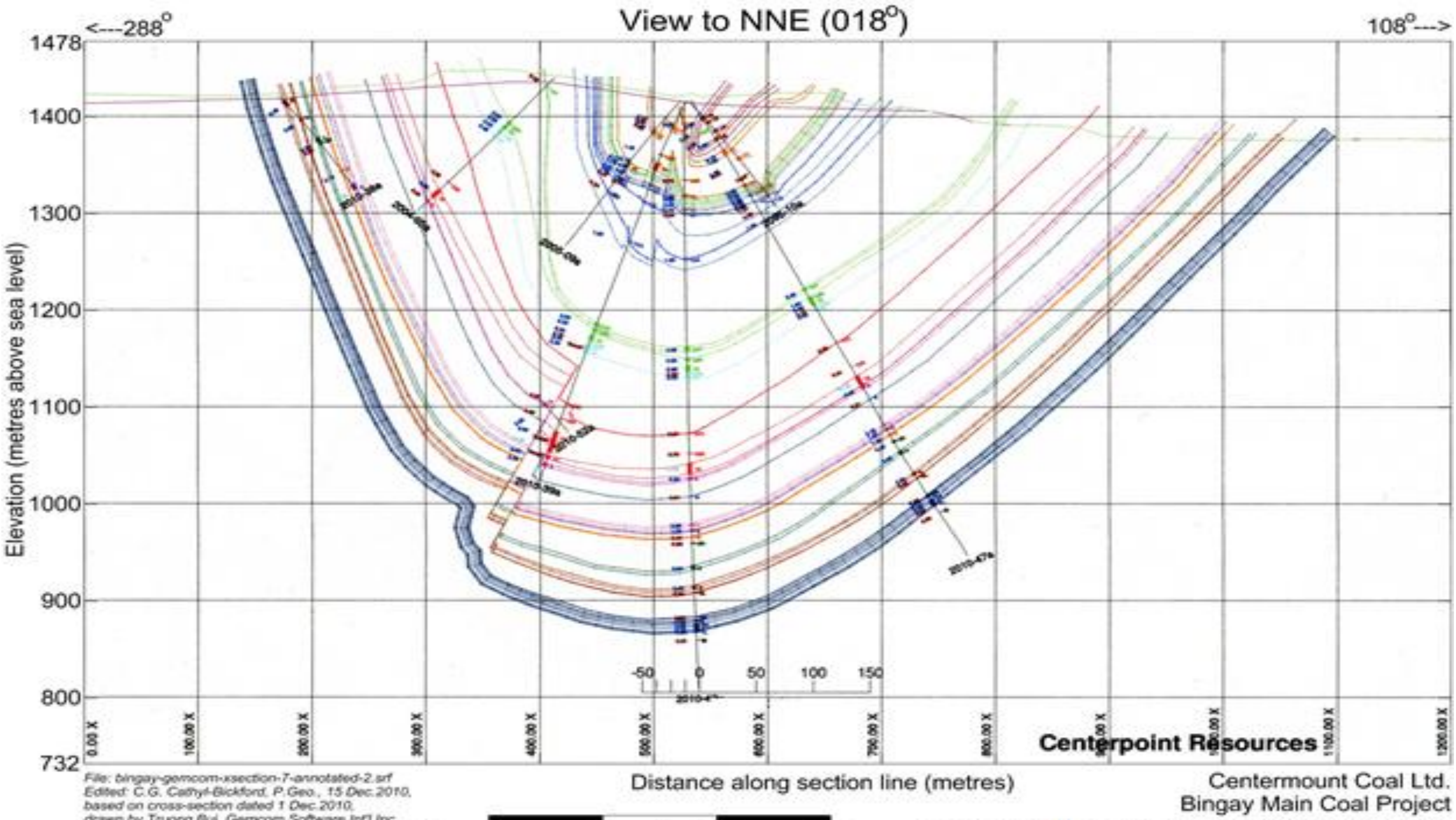


Figure 7-4: Cross-section No.7

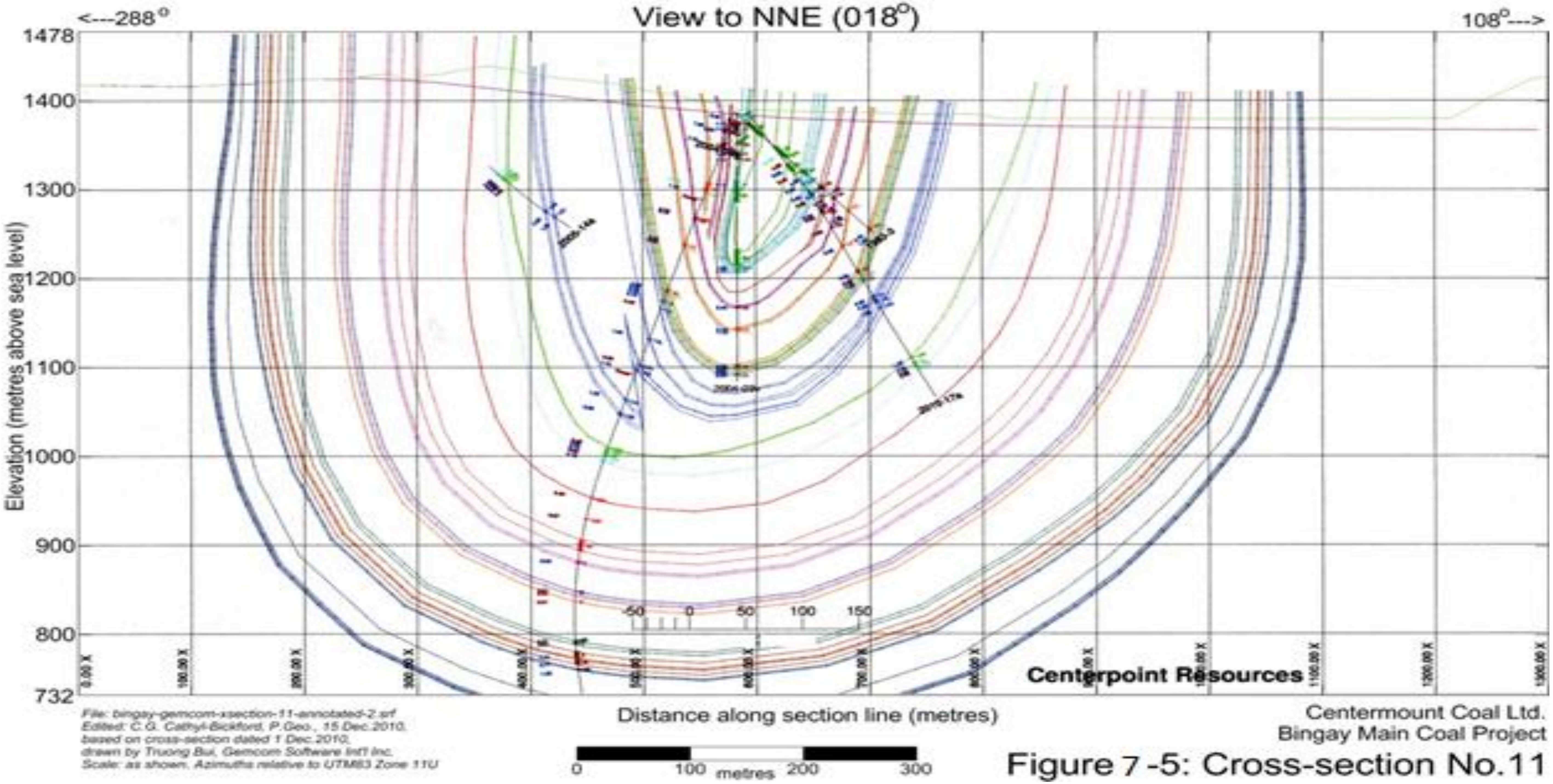
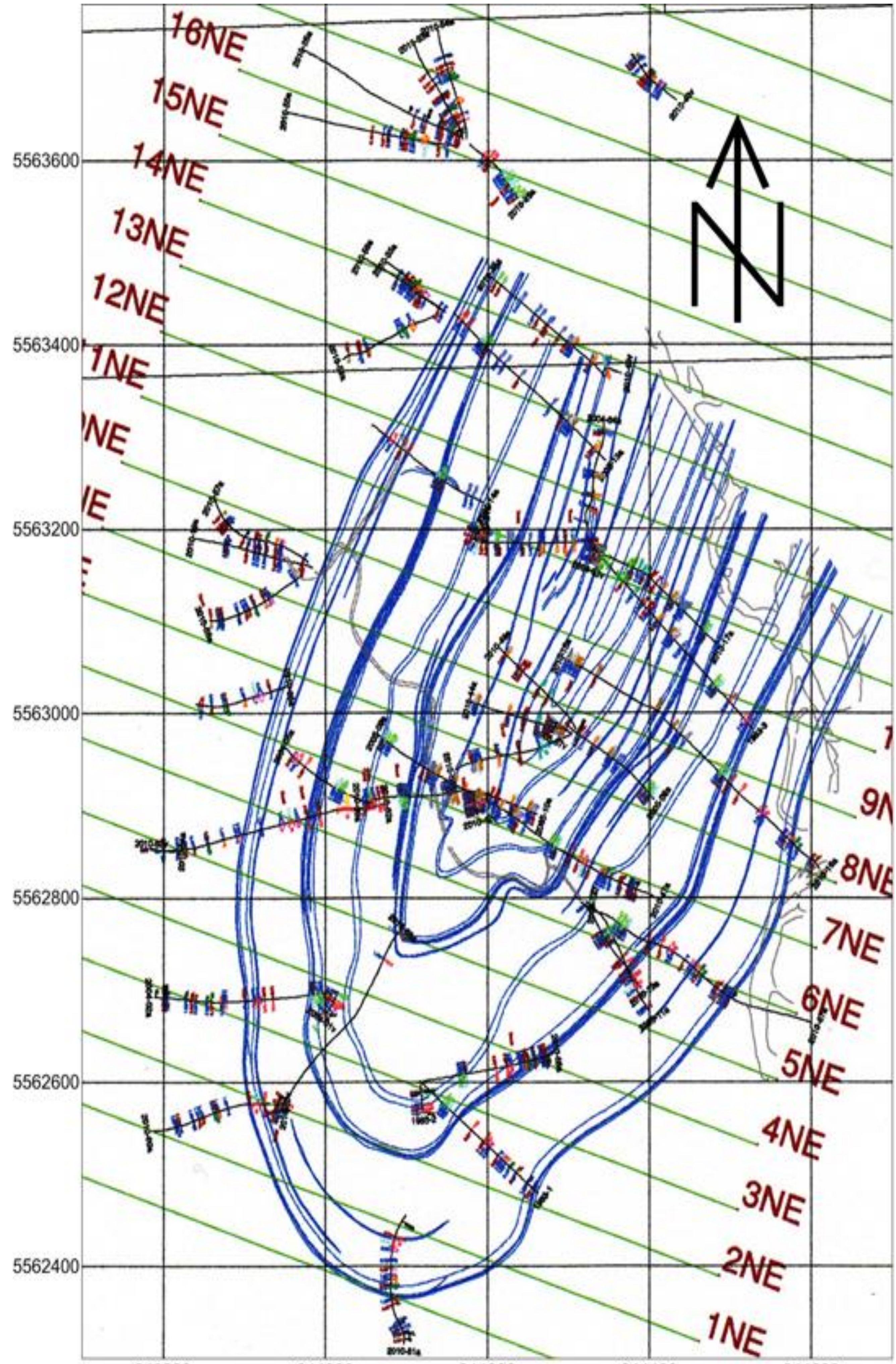


Figure 7 -5: Cross-section No.11



File: bingay-borehole-trajectories-modelled-2.srf
Edited: C.G. Cathyl-Bickford, P.Geo., 25 Dec.2010,
based on map dated 27 Nov.2010,
drawn by staff of Gemcom Software Int'l Inc.
Scale: as shown. Grid: UTM NAD83 Zone 11U

0 metres 200

Centermount Coal Ltd.
Bingay Main Coal Project

Figure 7-6: Boreholes with modelled coal intersections

Cross-section No.3 (**Figure 7-3)** shows the interpreted structure through the top of Bingay Hill. Coal zones from No.1 (depicted in dark blue) through the No.9/10 (depicted in pink) and the No.11/12 (depicted in light green) are shown dipping steeply to the east along the western limb of the Bingay Syncline, and dipping moderately to the west along the syncline's eastern limb. The major coal zones show consistent multiple-bed stratigraphy, with no interpreted internal structural repeats.

Cross-section No.7 (**Figure 7-4)** shows the interpreted structure through the north-eastern flank of Bingay Hill, along a section line 300 metres to the Northeast of cross-section No.3. Structure in this area is interpreted to be more complex, with such complexity being mainly supported by the interpreted intersection of the No.19 coal bed in overturned western limb of the Bingay Syncline by boreholes 2005-10a and 2010-47a. The eastern limb of the syncline is here interpreted to dip more steeply to the west, than was seen in cross-section No.3. Borehole 2010-38a is interpreted to gradually work its way up-section as it progresses downward, although it still appears unlikely to reach the No.9/10 coal zone if it were continued on its present course.

Cross-section No.11 (**Figure 7-5)** shows the interpreted structure another 300 metres further to the Northeast. The Bingay Syncline is now seen to be almost isoclinal in its core, with the No.21 coal bed (shown in green) and the No.20 coal bed (shown in light blue) being intersected across the axial zone by boreholes 1983-3, 2004-3v and 2010-17a. The No.13A and No.13B coal beds (shown in dark blue) are interpreted to be displaced by a westward-verging out-of-the-syncline thrust fault situated near the base of the western limb of the Bingay Syncline.

Nine informally-named stratigraphic markers (included in **Table 7-5**, above are present in outcrop or sub-outcrop within the explored part of the Bingay Main coal property. These markers are best recognised at the southern end of the property, in the area of frequent rock outcrops at Bingay Hill, and may be traced northwards, albeit with increasing difficulty, to near the northern boundary of Coal Licence 374190.

From top down, the markers are:

- **Shenfield Rock** - a prominent ledge-forming multi-storey unit of quartz-arenite (mapped by Utah's geologists as 'Channel Deposit 2'), which forms bold cliffs on the western side of Bingay Hill, and which caps the hill itself. The Shenfield Rock also forms a prominent northeast-trending ledge along the south-eastern limb of the Bingay Syncline. The sandstone ranges from 15 to 35 metres thick; part of the thickness variation may be due to lateral pinch-out of some of its constituent channel-fills.

- **Anderson 'marine band'** - a recessive-weathering unit of interbedded mudstone, siltstone, limestone, and ironstone with occasional thin lenses of coal, which has a distinctively elevated geophysical response on gamma-ray logs (typically over 130 API units of log response). This unit is characteristically bioturbated, and on the strength of its gamma-log response, the Anderson 'marine band' is interpreted as a discrete band of marine strata, perhaps deposited during a period of elevated sea level.

- **No.11-12 coal zone** - a recessive-weathering unit of thickly-interbedded coal (Bingay Nos.11, 11R, 12, 12 R and 12T coal beds) and variably-carbonaceous mudstone, with minor thin interbeds of siltstone and tonstein. The 11-12 coal zone subcrops within a deep north-west-trending gully on the southern face of Bingay Hill.

- **Bingay Rock** - a prominent ledge-forming multi-story unit of quartz-arenite (mapped by Utah's geologists as 'Channel Deposit 1'), which forms a persistent ridge of vertically-dipping rocks along the western limb of the Bingay Syncline. The Bingay Rock ranges from 25 to 50 metres thick, locally scouring up to 15 metres into the underlying beds.

No.10 coal bed - a recessive-weathering unit of coal (Bingay Nos.10 and locally the closely-overlying 10R coal beds), with minor thin interbeds of ironstone and tonstein. The No.10 coal bed is exposed in road cuts and trenches along the western limb of the Bingay Syncline, and it is also exposed in numerous old test pits along the western and southern flanks of Bingay Hill.

- **No.4 coal bed** – a recessive-weathering unit of coal (Bingay Nos.4 and locally the closely-overlying 4R coal beds) with minor thin interbeds of mudstone and siltstone. The No.4 coal is not known to outcrop within the Bingay Hill area, being generally covered by a layer of gravel or silty till. However, it may closely approach the ground surface to the east of borehole 2010-38a and to the west of borehole 2010-18a.

- **Moosewood sandstone** – a lenticular unit of very hard, erosive-based, locally cross-bedded quartz-arenite, comprising the basal thick sand of the Mist Mountain Formation. The Moosewood sandstone forms a resistant, slow-drilling zone beneath the No.2A coal bed and above the No.2 coal bed.

- **No.1 coal zone** – a recessive-weathering unit of coal (Bingay Nos.1L, 1 and 1R coal beds) with minor thin interbeds of siltstone and mudstone, and locally thicker interbeds of interlaminated sandstone and siltstone. The No.1 coal zone possibly corresponds to the Balmer coal zone as seen further south in the Crowsnest coalfield.

- **Moose Mountain sandstone** - a prominent ledge-forming unit of very hard and resistant quartz-litharenite, comprising the upper part of the Morrissey Formation. The Moose Mountain sandstone is well-exposed along the south-western face of Bingay Hill, on the eastern side of Elk River Road, just above the fringing gravel flats. The Moose Mountain sandstone also forms a prominent vertically-dipping wall along the northern bank of Bingay Creek, downstream from the road bridge. The sandstone ranges from 12 to 25 metres thick.

The Bingay Rock and the Shenfield Rock are useful in walking-out the structure of the Bingay Hill area, and can be fairly readily recognised on the gamma-ray logs of the various boreholes drilled within the property. Both of these sandstone units are outlined in yellow on **Figure 9-7**. These two sandstones may together correspond with the sandstone-rich Cliff Marker, which has been mapped by Cominco's geologists within the middle of the Kootenay coal-measures along the western slopes of the Greenhills Range (Wolfhard, 1967). The Moose Mountain sandstone, although only sparsely exposed at outcrop, forms a distinctively slow-drilling zone and is therefore useful in subsurface exploration.

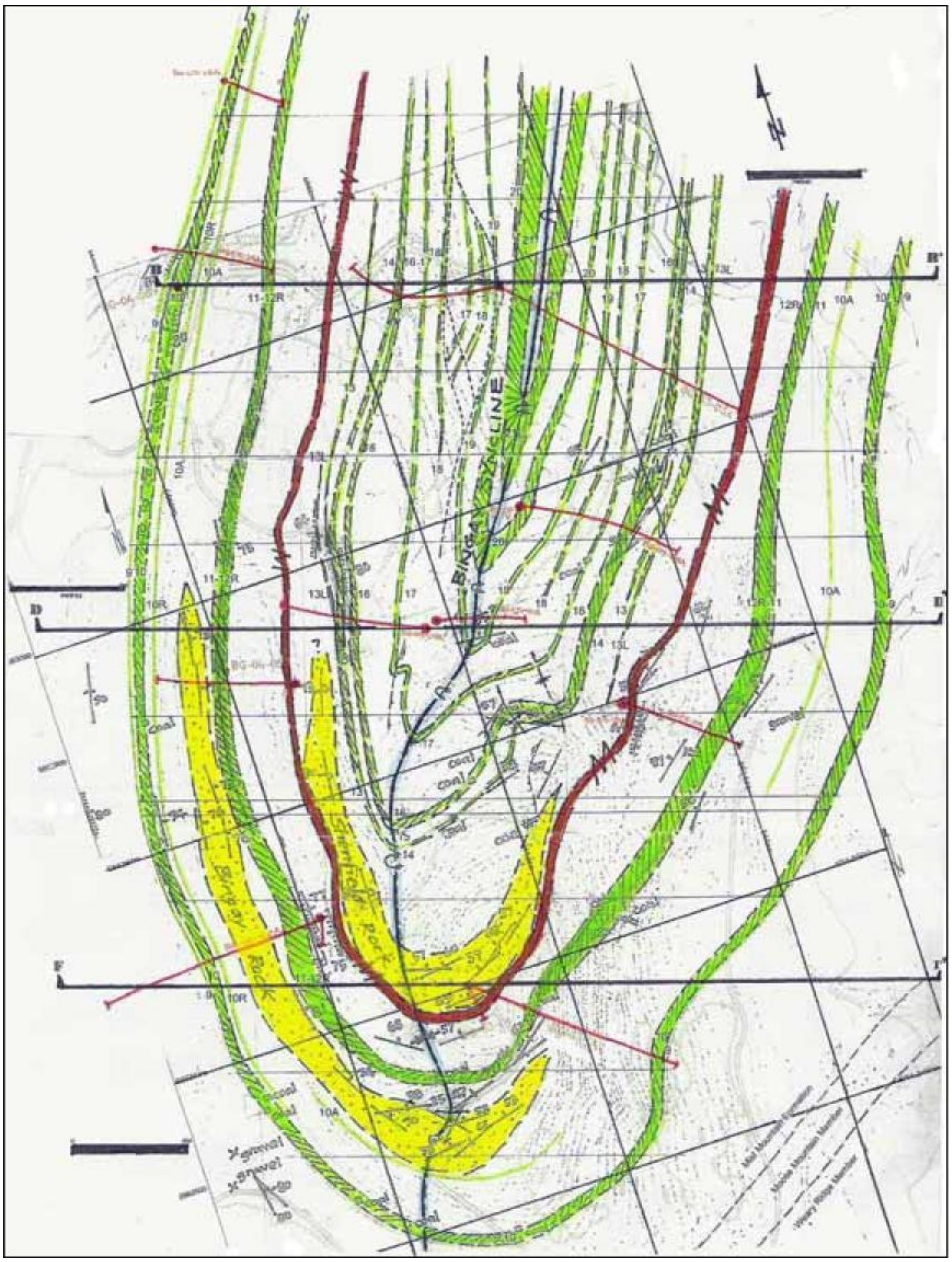


Figure 7-7: Geological map of the Bingay Hill area

The Bingay Main coal property contains at least thirty-two (**Tables 7-6 through Table 7-9**) coal beds, that can be correlated and range in true stratigraphic thickness from 0.3 to 16.2 metres. Cumulative thickness of these coals in a composite section of the coal-measures is 62.6 metres, over a stratigraphic interval of 460 metres (Cathyl-Bickford, 2005). Coal thus forms about 13.6% of the stratigraphic section at Bingay Main. Of these coals, 24 typically have gross thickness of at least 1 metre inclusive of contained bands of rock.

- Eight coal beds (the Nos. 9 and 10 coal beds within the No.9-10 coal zone, the Nos. 11, 1R, 12 and 12R coal beds within the No.11-12 coal zone, and the Nos. 20 and 21 coal beds within the No.21 coal zone) were recognised as being closely-associated, and amenable to resource estimation on the strength of Hillsborough's year-2004 drilling programme (Cathyl-Bickford, 2004).

- A further eight coal beds (the Nos. 13, 17, 18 and 19 coal beds, and the Nos. 14, 15, 15R and 16 coal beds within the No.14-16 coal zone) were sufficiently explored during Hillsborough's year-2005 drilling programme to allow for coal-resource calculations. Thus, a total of 16 major coal beds were incorporated in the year-2005 resource base (Cathyl-Bickford, 2005).

- During the year-2010 drilling programme, emphasis was placed on establishing the thickness and stratigraphic relationships of coals lying beneath the No.9 coal zone. On the basis of this drilling, a further twelve coal beds (the Nos.1L, 1 and 1R coal beds within the No.1 coal zone, and the Nos. 2, 2A, 3L, 3, 4 (including 4R), 5, 6, 7 and 8 coal beds) have now been recognised as sufficiently explored to permit volumetric calculations (Brandão, Barnett and Bui, 2010). As well, the Nos. 12T, 13B, 13A and 13L coals were recognised as being at least locally present.

The Bingay Main coals are normal banded humic coals (as are most coals within the world's coalfields, consisting of alternating bright and dull bands, generally associated with thin and thick partings of rock. Most of the rock partings consist of variably-carbonaceous mudstone, with less-frequent partings of siltstone, ironstone, tonstein and sandstone.

Most of the internal partings within the coals contain plant debris and rootlet traces, indicative of the formation of palaeosols. The floors of the coal beds are often, but not always, rooted as well, suggesting that the coals formed from peats which were derived from in-situ vegetation. However, some of the coal beds' floors, most notably some delicately-laminated, soft, non-silty and very carbonaceous mudstones, lack rootlets altogether. This lack of rootlets suggests that, in such cases, the overlying coals may have originated as floating 'peat islands' above the waters of lakes, ponds or lagoons.

Where seen by the senior author in cores or in trenched sections, the Bingay Main coals have often been observed to be sheared. Shearing ranges from slight to intense. Nevertheless, most of the coals have retained coherent bedding and banding, and the true stratigraphic relationships within and amongst the coals are not difficult to discern. Coals are sometimes intensely weathered at outcrop, reducing them to essentially a smutty, coaly soil; for effective description of such coals, they must be trenched downward until less-weathered material is reached. The requisite depth of trenching at Bingay Main ranges from a few decimetres to a few metres.

Drilled depths to the tops of the Bingay coal beds, their net and gross drilled thicknesses, and their interpreted true stratigraphic thicknesses, were summarised in the 2010 report on **Table 7-6** (for year-1983 boreholes), **Table 7-7** (for year-2004 boreholes), **Table 7-8** (for year-2005 boreholes) and **Table 7-9** (for year-2010 boreholes, presented in five parts owing to the number of holes drilled in 2010).

Those tables also show the depth to the top of the structure and the gross thickness of the Anderson marine band, plus the depths to tops of the Moose Mountain and Weary Ridge sandstones and the Fernie siltstone. Boreholes not listed in these tables were either drilled wholly within older, non-coal-bearing strata, were so shallow as to not reach any coal even though they entered coal-measures, or failed to reach bedrock.

Table 7-6: Drilled and true thickness of coal beds in year-1983 boreholes

hole/	**1983-1a**		**1983-2a**		**1983-3a**	
UTM coordinates	644117	5562601	644117	5562601	644330	5563180
Elevation	1489		1489		1388.2	
Geometry	Azimuth 130	Dip 50	Azimuth 175	Dip 80	Azimuth 135	Dip 45
Drift	3.05		0.61		5.95	
Casing shoe	3.05		3.05		6.1	
notes	no faults		no faults		fold axis @52.5 m 52.5	
coal beds	intersected	dip/true	Intersected	dip/true	intersected	dip/true
No.22						
22-net						
22-gross						
No.21R						
21R-net						
21R-gross						
No.21					19.15	39 degrees
21-net					18.05	14.03
21-gross					20.8	16.16
No.21 repeat					57	30 degrees
21-net					14.15	12.25
21-gross					16	13.86
No.21L					74.1	30 degrees
21L-net					0.68	0.59
21L-gross					0.68	0.59
No.20R					not present?	--
20R-net					0	0
20R-gross					0	0
No.20R repeat					not present	--
20R-net					0	0
20R-gross					0	0
No.20					14.95	40 degrees
20-net					0.78	0.6
20-gross					1.1	0.84
No.20 repeat					97.05	11 degrees
20-net					4.2	4.12
20-gross					4.55	4.47
No.20L					9.5	40 degrees
20L-net					0.5	0.38
20L-gross					0.5	0.38
No.19R					not present	--
19R-net					0	0
19R-gross					0	0
No.19R repeat					not present	--
19R-net					0	0
19R-gross					0	0
No.19					118.55	15 degrees
19-net					4.4	4.25
19-gross					5.5	5.31
No.19 repeat					not present	--
19-net					0	0
19.gross					0	0

Table 7-6: Drilled and true thickness of coal beds in year-1983 boreholes (continued)

No.19L			132.2	15 degrees
19L-net			0.18	0.17
19L-gross			0.18	0.17
No.18R			not present	--
18R-net			0	0
18R-gross			0	0
No.18			137.05	17 degrees
18-net			1.61	1.54
18-gross			2.65	2.53
No.18 repeat			not present	--
18-net			0	0
18-gross			0	0
No.17			157.11	20 degrees
17-net			1.63	1.53
17-gross			1.89	1.77
No.17 repeat			not present	--
17-net			0	0
17-gross			0	0
No.17L			160.45	23 degrees
17L-net			0.25	0.23
17L-gross			0.25	0.23
No.17L repeat			not present	--
17L-net			0	0
17L-gross			0	0
No.16R			not present	--
16R-net			0	0
16R-gross			0	0
No.16R repeat			not present	---
16R-net			0	0
16R-gross			0	0
No.16			187.2	26 degrees
16-net			2	1.8
16-gross			2.7	2.43
No.16 repeat			not present	--
16-net			0	0
16-gross			0	0
No.15R			193.8	26 degrees
15R-net			1.05	0.94
15R-gross			1.2	1.08
No.15			195.85	26 degrees
15-net			1.3	1.17
15-gross			1.55	1.39
No.14			198.35	26 degrees
14-net			1.5	1.35
14-gross			1.6	1.44
No.13			215.56	20 degrees
13-net			2.34	2.2
13-gross			2.74	2.57
No.13L			218.85	20 degrees
13L-net			1.15	1.08
13L-gross			1.15	1.08

Table 7-6: Drilled and true thickness of coal beds in year-1983 boreholes (continued)

No.13L repeat					not present	--
13L-net					0	0
13L-gross					0	0
No.13A					232.05	20 degrees
13A-net					0.9	0.85
13A-gross					1.2	1.13
No.13A repeat					not present	--
13A-net					0	0
13A-gross					0	0
No.13B					not present	--
13B-net					0	0
13B-gross					0	0
No.13B repeat					not present	--
13B-net					0	0
13B-gross					0	0
Anderson	17.75		19.9	41 degrees	237.95	15 degrees
And's'n-gross	9.6		11.45	8.64	8.05	7.78
Anderson repeat	not present	--	not present	--	not present	--
And's'n-gross	0	0	0	0	0	0
No.12T	not present	--	not present	--	not present	--
12T-net	0	0	0	0	0	0
12T-gross	0	0	0	0	0	0
No.12R	55	14 degrees	61.55	41 degrees	293.75	15 degrees
12R-net	4.9	4.75	4.1	3.09	1.7	1.64
12R-gross	4.9	4.75	5.45	4.11	2.8	2.7
No.12R repeat	not present	--	not present	--	not present	--
12R-net	0	0	0	0	0	0
12R-gross	0	0	0	0	0	0
No.12	61	11.5 degrees	68	41.5 degrees	297	16.5 degrees
12-net	3.2	3.14	3.45	2.58	3.6	3.45
12-gross	3.2	3.14	4.4	3.3	5.25	5.03
No.12 repeat	not present	--	not present	--	not present	--
12-net	0	0	0	0	0	0
12-gross	0	0	0	0	0	0
No.11R	64.5	11 degrees	73.95	42 degrees	303.84	15 degrees
11R-net	1.5	1.47	0.5	0.37	0.49	0.47
11R-gross	1.5	1.47	0.8	0.59	0.51	0.49
No.11R repeat	not present	--	not present	--	not present	--
11R-net	0	0	0	0	0	0
11R-gross	0	0	0	0	0	0
No.11	67.9	19 degrees	76.75	42 degrees	305.55	14 degrees
11-net	2.28	2.16	2.4	1.78	1.3	1.26
11-gross	4.52	4.27	3.05	2.27	2.05	1.99
No.11 repeat	not present	--	not present	--	not present	--
11-net	0	0	0	0	0	0
11-gross	0	0	0	0	0	0
No.10A	127.53	10 degrees	140.2	30 degrees	333.5	13 degrees
10A-net	0.07	0.07	1.1	0.95	1.24	1.21
10A-gross	0.07	0.07	1.85	1.6	2.65	2.58
No.10A repeat	not present	--	not present	--	not present	--
10A-net	0	0	0	0	0	0
10A-gross	0	0	0	0	0	0

Table 7-6: Drilled and true thickness of coal beds in year-1983 boreholes (continued)

No.10R	157	10 degrees	170.55	23 degrees	not present	--
10R-net	0.45	0.44	0.65	0.6	0	0
10R-gross	0.45	0.44	0.65	0.6	0	0
No.10	160.15	16.5 degrees	174.75	21 degrees	370.25	13 degrees
10-net	9.6	9.2	9.9	9.24	8.35	8.14
10-gross	10.25	9.83	11.7	11.92	9.35	9.11
No.10 repeat	not present	--	not present	--	not present	--
10-net	0	0	0	0	0	0
10-gross	0	0	0	0	0	0
No.10 repeat 2	not present	--	not present	--	not present	--
10-net	0	0	0	0	0	0
10.gross	0	0	0	0	0	0
No.9	171.7	10.5 degrees	187.7	22 degrees	381.05	14.5 degrees
9-net	2.3	2.26	3.15	2.92	1.87	1.81
9-gross	2.7	2.65	3.8	3.52	2.41	2.33
No.9 repeat	not present	--	not present	--	not present	--
9-net	0	0	0	0	0	0
9-gross	0	0	0	0	0	0
No.9 repeat 2	not present	--	not present	--	not present	--
9-net	0	0	0	0	0	0
9-gross	0	0	0	0	0	0
No.8	194.5	11 degrees	not reached	not reached	not reached	not reached
8-net	0.85	0.83				
8-gross	0.85	0.83				
No.7	201.2	10 degrees				
7-net	1.1	1.08				
7-gross	1.3	1.28				
No.6	207	11 degrees				
6-net	1.2	1.18				
6-gross	1.2	1.18				
No.5	212.85	10 degrees				
5-net	1.05	1.03				
5-gross	1.05	1.03				
No.5 repeat	not present	--				
5-net	0	0				
5-gross	0	0				
No.4R	not present	--				
4R-net	0	0				
4R-gross	0	0				
No.4R repeat	not present	--				
4R-net	0	0				
4R-gross	0	0				
No.4	222.85	11 degrees				
4-net	2.75	2.7				
4-gross	3.05	2.99				
No.4 repeat	not present	--				
4-net	0	0				
4-gross	0	0				
No.3	238.8	11 degrees				
3-net	1.4	1.37				
3-gross	1.4	1.37				
No.3L	240.5	13 degrees				
3L-net	0	0				
3L-gross	0.3	0.29				

No.2A	265.85	15 degrees		
2A-net	0.85	0.82		
2A-gross	1.15	1.11		

Table 7-6: Drilled and true thickness of coal beds in year-1983 boreholes (concluded)

No.2	267.35	16 degrees		
2-net	1.1	1.05		
2-gross	1.1	1.05		
No.1R	279.3	12 degrees		
1R-net	0.37	0.36		
1R-gross	0.37	0.36		
No.1	285.4	12 degrees		
1-net	1	0.98		
1-gross	1.02	1		
No.1L	not present	--		
1L-net	0	0		
1L-gross	0	0		
Moose Mountain	286.42			
No.0	not reached			
0-net				
0-gross				
Weary Ridge				
Fernie				
Total depth / Hole	295.35 1983-1a		199.95 1983-2a	394.41 1983-3a

Table 7-7: Drilled and true thickness of coal beds in year-2004 boreholes

hole	2004-1v relog		2004-2a relog		2004-3v		2004-4a		2004-5a		2004-6v	
UTM coords	644015	5562698	644012	5562698	644333.29	5563183.069	644332	5563183	644058	5562902	644065	5563271
Elevation	1452.3		1452.2		1387.214		1387.2		1440.1		1421.9	
Geometry	vertical	Dip 90	265	Dip 50	Vertical	Dip 90	280	Dip 60	284	Dip 50	vertical	Dip 90
Drift	2.4	2.4	2.3	1.76	0	0	1.8	1.56	0	0	0	0
Casing shoe	2.5	2.5	2.3	1.76	3	3	3	2.6	3	2.3	0	0
notes >注	no faults		no faults		fold axis @ 127.2		thrust @60.8		no faults		all drilled in No.10 coal bed	
coal beds	intersected	dip/true	intersected	dip/true	Intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true
No.22												
22-net												
22-gross												
No.21R												
21R-net												
21R-gross												
No.21					85.4	66 degrees						
21-net					15.8	6.43						
21-gross					15.8	6.43						
No.21 repeat					154.35	37 degrees						
21-net					17.25	13.78						
21-gross					17.8	14.22						
No.21L					not present	--						
21L-net					0	0						
21L-gross					0	0						
No.20R					174.3	38 degrees						
20R-net					1	0.79						
20R-gross					1	0.79						
No.20R repeat					not present	--						
20R-net					0	0						
20R-gross					0	0						
No.20					76.25	66 degrees						
20-net					9.15	3.72						
20-gross					9.15	3.72						
No.20 repeat					177.15	38 degrees						
20-net					1.4	1.1						
20-gross					2.95	2.32						
No.20L					not present	--						
20L-net					0	0						
20L-gross					0	0						
No.19R					10.75	43 degrees						
19R-net					2.25	1.65						
19R-gross					2.25	1.65						
No.19R repeat					52.5	67 degrees						
19R-net					0.2	0.08						
19R-gross					0.2	0.08						
No.19					14.75	53 degrees	8.85	54 degrees				
19-net					6.45	3.88	2.85	1.68				
19-gross					6.45	3.88	2.85	1.68				
No.19 repeat					44.2	67 degrees	not present	--				
19-net					2.9	1.13	0	0				
19.gross					3.3	1.29	0	0				
No.19L					35.35	67 degrees	not present	--				
19L-net					0.85	0.33	0	0				
19L-gross					0.85	0.33	0	0				

Table 7-7: Drilled and true thickness of coal beds in year-2004 boreholes (continued) ）

No.18R			not present	--	96.8	62 degrees		
18R-net			0	0	1.1	0.52		
18R-gross			0	0	1.1	0.52		
No.18			218.5	31 degrees	21.55	58 degrees		
18-net			1.95	1.67	5.5	2.91		
18-gross			2.45	2.1	5.5	2.91		
No.18 repeat			not present	--	98.9	62 degrees		
18-net			0	0	1.7	0.8		
18-gross			0	0	1.7	0.8		
No.17			243.5	28.5 degrees	125.85	58 degrees		
17-net			3.1	2.72	2.6	1.38		
17-gross			3.1	2.72	2.6	1.38		
No.17 repeat			not present	--	not present	--		
17-net			0	0	0	0		
17-gross			0	0	0	0		
No.17L			247.7	28.5 degrees	129.45	58 degrees		
17L-net			0	0	0	0		
17L-gross			1.1	0.97	0.55	0.29		
No.17L repeat			not present	--	not present	--		
17L-net			0	0	0	0		
17L-gross			0	0	0	0		
No.16R			not present	--	not present	--		
16R-net			0	0	0	0		
16R-gross			0	0	0	0		
No.16R repeat			not present	---	not present	---		
16R-net			0	0	0	0		
16R-gross			0	0	0	0		
No.16			286.2	16 degrees	163.15	62 degrees		
16-net			3.65	3.51	2.7	1.27		
16-gross			3.95	3.8	2.7	1.27		
No.16 repeat			not present	--	not present	--		
16-net			0	0	0	0		
16-gross			0	0	0	0		
No.15R			290.65	22 degrees	165.85	62 degrees		
15R-net			2	1.85	1.55	0.73		
15R-gross			2	1.85	1.55	0.73		
No.15			293.15	14.5 degrees	168.1	59 degrees		
15-net			2.45	2.37	1.55	0.8		
15-gross			2.45	2.37	1.55	0.8		
No.14			297.15	11 degrees	171.65	57 degrees		
14-net			2.5	2.45	2.3	1.25		
14-gross			2.5	2.45	2.3	1.25		
No.13			not reached	not reached	232.55	45 degrees		
13-net					0.85	0.6		
13-gross					0.85	0.6		
No.13L					235.8	45 degrees		
13L-net					1.55	1.1		
13L-gross					1.55	1.1		
No.13L repeat					not present	--		
13L-net					0	0		
13L-gross					0	0		
No.13A					not reached	not reached		
13A-net								
13A-gross								

No.13B						
13B-net						
13B-gross						

Table 7-7: Drilled and true thickness of coal beds in year-2004 boreholes (continued)

Anderson MB									3.3	36 degrees		
And's'n-gross									2.25	1.82		
Anderson MB rpt									not present	--		
Anderson gross									0	0		
No.12T	92.8	31 degrees	23.4	30 degrees					10.5	36 degrees		
12T-net	2	1.71	1.3	1.13					0	0		
12T-gross	2	1.71	1.3	1.13					0.55	0.44		
No.12R	95.9	56 degrees	24.7	28.5 degrees					60.35	29		
12R-net	15.3	8.56	5.7	5.01					2.65	2.32		
12R-gross	15.3	8.56	5.7	5.01					2.65	2.32		
No.12R repeat	not present	--	not present	--					not present	--		
12R-net	0	0	0	0					0	0		
12R-gross	0	0	0	0					0	0		
No.12	115.05	54 degrees	32	30.5 degrees					65.25	30 degrees		
12-net	10.5	6.17	6.1	5.26					3.5	3.03		
12-gross	12.25	7.2	6.2	5.34					3.95	3.42		
No.12 repeat	not present	--	not present	--					not present	--		
12-net	0	0	0	0					0	0		
12-gross	0	0	0	0					0	0		
No.11R	131.3	53.5 degrees	39.65	32.5 degrees					70.8	31		
11R-net	2.55	1.52	0.95	0.8					5	4.29		
11R-gross	2.55	1.52	0.95	0.8					5	4.29		
No.11R repeat	not present	--	not present	--					not present	--		
11R-net	0	0	0	0					0	0		
11R-gross	0	0	0	0					0	0		
No.11	142.05	40 degrees	41.95	35 degrees					78.25	32 degrees		
11-net	2.65	2.03	2.45	2.01					2.4	2.04		
11-gross	2.95	2.26	2.85	2.33					2.4	2.04		
No.11 repeat	not present	--	not present	--					not present	--		
11-net	0	0	0	0					0	0		
11-gross	0	0	0	0					0	0		
No.10A	209	19 degrees	109.1	25.5 degrees					not present?	--		
10A-net	0.7	0.66	0.75	0.68					0	0		
10A-gross	0.7	0.66	0.75	0.68					0	0		
No.10A repeat	not present	--	not present	--					not present	--		
10A-net	0	0	0	0					0	0		
10A-gross	0	0	0	0					0	0		
No.10R	233.6	54 degrees	123.5	22.5 degrees					143.55	35 degrees		
10R-net	0.9	0.53	0.95	0.88					0.65	0.53		
10R-gross	0.9	0.53	0.95	0.88					0.65	0.53		
No.10	241.5	37 degrees	129.5	24.5 degrees					155.6	34.5 degrees		
10-net	11.55	9.22	9.85	8.96					9.55	7.87		
10-gross	12.6	10.06	9.85	8.96					9.55	7.87		
No.10 repeat	not present	--	not present	--					not present	--		
10-net	0	0	0	0					0	0		
10-gross	0	0	0	0					0	0		
No.10 repeat 2	not present	--	not present	--					not present	0		
10-net	0	0	0	0					0	0		
10.gross	0	0	0	0					0	0		
No.9	256.35	44 degrees	141.2	17.5 degrees					170.75	34 degrees		
9-net	5.45	3.92	2.55	2.43					0.9	0.74		
9-gross	6.45	4.64	2.65	2.53					0.9	0.74		
No.9 repeat	not present	--	not present	--					not present	--		
9-net	0	0	0	0					0	0		

9-gross	0 0	0 0			0 0	

Table 7-7: Drilled and true thickness of coal beds in year-2004 boreholes (concluded) ）

No.9 repeat 2	not present	--	not present	--					not present	--		
9-net	0	0	0	0					0	0		
9-gross	0	0	0	0					0	0		
No.8	279.95	45 degrees	157.15	27.5 degrees					not reached	not reached		
8-net	1.7	1.2	0.85	0.75								
8-gross	2.55	1.8	0.85	0.75								
No.7	308.8	38.5 degrees	185.75	29 degrees								
7-net	2.65	2.07	1.6	1.4								
7-gross	2.65	2.07	1.6	1.4								
No.6	not reached	not reached	189.75	28 degrees								
6-net			1.55	1.37								
6-gross			1.55	1.37								
No.5			193.5	29 degrees								
5-net			1.75	1.53								
5-gross			1.75	1.53								
No.5 repeat			not present	--								
5-net			0	0								
5-gross			0	0								
No.4R			208.4	22.5 degrees								
4R-net			0.75	0.69								
4R-gross			0.75	0.69								
No.4R repeat			not present	--								
4R-net			0	0								
4R-gross			0	0								
No.4			213.9	26 degrees								
4-net			2.3	2.07								
4-gross			2.5	2.25								
No.4 repeat			not present	--								
4-net			0	0								
4-gross			0	0								
No.3			229.7	25.5 degrees								
3-net			2.55	2.3								
3-gross			2.95	2.66								
No.3L			236.55	25 degrees								
3L-net			0.8	0.73								
3L-gross			0.8	0.73								
No.2A			244	22 degrees								
2A-net			1.15	1.07								
2A-gross			1.35	1.25								
No.2			269.05	22 degrees								
2-net			1.05	0.97								
2-gross			1.05	0.97								
No.1R			not present	--								
1R-net			0	0								
1R-gross			0	0								
No.1			272.5	22 degrees								
1-net			1.05	0.97								
1-gross			1.05	0.97								
No.1L			not present	--								
1L-net			0	0								
1L-gross			0	0								
Moose Mountain			273.55									
No.0			not reached	not reached								
Total depth	316.38		286.5		306.7		245.5		186		32	

Table 7-8: Drilled and true thickness of coal beds in year-2005 boreholes

Hole/	2005-7v		2005-8a		2005-9a		2005-10a		2005-11a relog		2005-12v relog		2005-13a relog		2005-14a relog	
UTM coords	644286	5562991	644299	5562986	644179.438	5562913.758	644187.496	5562916.689	644322	5562796	644321	5562793	644158	5563434	644057	5563313
Elevation	1402.5		1402.1		1416.095		1416.095		1417.5		1417.5		1416.7		1423.7	
Geometry	vertical	Dip 90	127	Dip 50	292	Dip 50	112	Dip 50	127	Dip 50	vertical	Dip 90	132	Dip 50	122	Dip 50
Drift	5.85	5.85	5.7	4.37	6.2	4.75	4.7	3.6	3.8	2.91	2.5	2.5	1	0.77	0.4	0.31
Casing shoe	5.9	5.9	5.9	2.9	9.4	7.2	5.8	4.44	5.8	4.44	2.4	2.4	2.9	2.22	2.25	1.72
Notes >	thrust @102.8		no faults		no faults		fold axis at 33.3		no faults		no faults		thrust @199.25		no faults	
Notes >							fault? @ 91.4									
Coal beds	intersected	dip/true	intersected	dip/true	Intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true
No.22																
22-net																
22-gross 总																
No.21R																
21R-net																
21R-gross																
No.21																
21-net																
21-gross																
No.21L																
21L-net																
21L-gross																
No.20R																
20R-net																
20R-gross																
No.20	7.38	44 degrees														
20-net	10.99	7.91														
20-gross	10.99	7.91														
No.20 repeat	not present	--														
20-net	0	0														
20-gross	0	0														
No.20L	not present	--														
20L-net	0	0														
20L-gross	0	0														
No.19R	not present	--					not present	--								
19R-net	0	0					0	0								
19R-gross	0	0					0	0								
No.19R repeat	not present	--					not present	--								
19R-net	0	0					0	0								
19R-gross	0	0					0	0								
No.19	61.93	50 degrees	22.35	19 degrees			27.15	21 degrees								
19-net	3.74	2.4	4.63	4.38			2.22	2.07								
19-gross	3.74	2.4	4.63	4.38			2.22	2.07								
No.19 repeat	not present	--	not present	--			37.45	32 degrees								
19-net	0	0	0	0			3.05	2.59								
19.gross	0	0	0	0			3.05	2.59								
No.19L	66.38	51 degrees	27.61	17 degrees			not present	--								
19L-net	0.52	0.33	0.37	0.35			0	0								
19L-gross	0.52	0.33	0.37	0.35			0	0								
No.18R	not present	--	not present	--			not present	--								
18R-net	0	0	0	0			0	0								
18R-gross	0	0	0	0			0	0								
No.18	87.98	53 degrees	40.66	14 degrees			not present	--								
18-net	1.71	1.03	1.14	1.11			0	0								
18-gross	2.34	1.41	1.71	1.66			0	0								

No.18 repeat	not present --	not present --		not present --			not reached not reached	
18-net	0 0	0 0		0 0				
18-gross	0 0	0 0		0 0				

Table 7-8: Drilled and true thickness of coal beds in year-2005 boreholes (continued)

No.17	116.67	43 degrees	61.5	18 degrees	38.05	17.5 degrees	72.5	26.5 degrees					330	31 degrees		
17-net	2.43	1.78	2.2	2.09	3.18	3.03	3	2.68					3.75	3.21		
17-gross	2.43	1.78	2.2	2.09	3.18	3.03	3	2.68					3.75	3.21		
No.17 repeat	not present	--	not present	--	not present	--	not present	--					not present	---		
17-net	0	0	0	0	0	0	0	0					0	0		
17-gross	0	0	0	0	0	0	0	0					0	0		
No.17L	120.35	43 degrees	64.28	18 degrees	41.78	17.5 degrees	76.42	34 degrees					327.8	46.5 degrees		
17L-net	0	0	0	0.32	0.8	0.76	0.43	0.36					0	0		
17L-gross	0.2	0.15	0.34	0.32	0.8	0.76	0.43	0.36					0.75	0.52		
No.17L repeat	not present	--	not present	--	not present	--	not present	--					not present	---		
17L-net	0	0	0	0	0	0	0	0					0	0		
17L-gross	0	0	0	0	0	0	0	0					0	0		
No.16R	157.82	52 degrees	not present	--	not present	--	not present	--					not present	--		
16R-net	0.38	0.23	0	0	0	0	0	0					0	0		
16R-gross	0.38	0.23	0	0	0	0	0	0					0	0		
No.16R repeat	not present	---	not present	---	not present	---	not present	---					not present	---		
16R-net	0	0	0	0	0	0	0	0					0	0		
16R-gross	0	0	0	0	0	0	0	0					0	0		
No.16	163.03	54 degrees	101.07	10 degrees	77.62	19.5 degrees	110.2	15 degrees					282.4	47.5 degrees		
16-net	2.79	1.64	2.63	2.59	4.71	4.44	2.85	2.75					3.6	2.43		
16-gross	2.92	1.72	3.2	3.15	4.71	4.44	2.85	2.75					3.6	2.43		
No.16 repeat	not present	--	not present	--	not present	--	not present	--					not present	--		
16-net	0	0	0	0	0	0	0	0					0	0		
16-gross	0	0	0	0	0	0	0	0					0	0		
No.15R	165.95	54 degrees	104.96	10 degrees	82.33	19.5 degrees	113.05	15 degrees					280.6	47.5 degrees		
15R-net	2.19	1.29	1.84	1.81	1.13	1.07	1.57	1.52					1.8	1.22		
15R-gross	2.19	1.29	2.04	2.01	1.13	1.07	1.57	1.52					1.8	1.22		
No.15	168.4	46 degrees	107.77	13.5 degrees	83.91	19.5 degrees	115.45	20 degrees					277.05	44.5 degrees		
15-net	1.85	1.29	1.4	1.36	1.79	1.69	1.45	1.36					2.05	1.46		
15-gross	2.12	1.47	1.4	1.36	1.79	1.69	1.45	1.36					2.05	1.46		
No.14	171.8	40 degrees	110.92	13 degrees	89.85	22 degrees	119.35	27 degrees					272.45	53 degrees		
14-net	0.42	0.32	1.75	1.71	2.27	2.1	1.8	1.6					2.3	1.38		
14-gross	0.42	0.32	1.75	1.71	2.27	2.1	1.8	1.6					2.3	1.38		
No.13	182.95	38.5 degrees	123.72	16 degrees	94.65	40 degrees	127.4	30 degrees					264.65	30 degrees		
13-net	0.2	0.16	1.05	1.01	1.05	0.8	0	0					0.65	0.56		
13-gross	0.2	0.16	2.07	1.99	1.05	0.8	0.45	0.39					0.65	0.56		
No.13L	not reached	not reached	129.67	17 degrees	99.13	40 degrees	not reached	not reached					238.25	55 degrees		
13L-net			1.34	1.28	0.45	0.34							1.2	0.69		
13L-gross			1.34	1.28	0.45	0.34							1.2	0.69		
No.13L repeat			not present	--	not present	--							166.8	44 degrees	not reached	not reached
13L-net			0	0	0	0							0	0		
13L-gross			0	0	0	0							0.5	0.36		
No.13A			not present	--	112.6	36 degrees							130.4	45 degrees	212.55	50.5 degrees
13A-net			0	0	0	0							1.6	1.13	1.85	1.18
13A-gross			0	0	0.33	0.27							1.6	1.13	1.85	1.18
No.13A repeat			not present	--	not present	--							not present	--	not present	---
13A-net			0	0	0	0							0	0	0	0
13A-gross			0	0	0	0							0	0	0	0
No.13B			not present	--	not present	--							116.55	45 degrees	202.1	55 degrees
13B-net			0	0	0	0							2.8	1.98	2.8	1.61
13B-gross			0	0	0	0							2.8	1.98	2.8	1.61
No.13B repeat			not present	--	not present	--							not present	--	not present	---
13B-net			0	0	0	0							0	0	0	0
13B-gross			0	0	0	0							0	0	0	0

Anderson MB		151	9 degrees	157	31 degrees		12.5	18 degrees	19.45	53.5 degrees	110.35	50 degrees	193.8	38.5 degrees
And's'n-gross		7.5	7.41	9	7.71		9	8.56	12	7.14	4.6	2.96	5.55	4.34
Anderson rpt		not present	--	not present	--		not present	--	not present	---	not present	--	not present	--
And's'n-gross		0	0	0	0		0	0	0	0	0	0	0	0

Table 7-8: Drilled and true thickness of coal beds in year-2005 boreholes (continued)

No.12T		203.7	12 degrees	195.37	29 degrees		60.6	13.5 degrees	93.6	47.5 degrees.	87	44 degrees	156.9	35 degrees
12T-net		0	0	2.04	1.78		0	0	2.5	1.69	0	0	0	0
12T-gross		0	0	3.16	2.76		1	0.97	2.5	1.69	0.5	0.36	0.8	0.66
No.12R		208.37	12 degrees	200.85	26 degrees		71	9 degrees	109.3	47.5 degrees?	79.05	45 degrees	151.5	35 degrees
12R-net		1.83	1.79	1.92	1.73		2.05	2.02	4.2	2.84	4.25	3.01	2.6	2.13
12R-gross		2.06	2.01	1.92	1.73		2.05	2.02	4.2	2.84	4.25	3.01	2.6	2.13
No.12R repeat		not present	--	not present	--		not present	---	not present	---	not present	---	not present	---
12R-net		0	0	0	0		0	0	0	0	0	0	0	0
12R-gross		0	0	0	0		0	0	0	0	0	0	0	0
No.12		211.77	10 degrees	206.8	26.5 degrees		73.95	9 degrees	115	47.5 degrees?	75.4	48.5 degrees	148.7	35 degrees
12-net		4.6	4.53	5.37	4.81		6	5.93	8.9	6.01	3.65	2.42	2.8	2.29
12-gross		4.73	4.66	5.82	5.21		6	5.93	8.9	6.01	3.65	2.42	2.8	2.29
No.12 repeat		not present	--	not present	--		not present	---	not present	---	not present	---	not present	---
12-net		0	0	0	0		0	0	0	0	0	0	0	0
12-gross		0	0	0	0		0	0	0	0	0	0	0	0
No.11R		218.2	11 degrees	213.67	28.5 degrees		81.65	15.5 degrees	126.3	47.5 degrees?	71.85	43.5 degrees	146.55	49 degrees
11R-net		0.56	0.55	0.7	0.62		0.65	0.63	2	1.35	1.65	1.2	0.95	0.62
11R-gross		0.68	0.67	0.7	0.62		0.65	0.63	2	1.35	1.65	1.2	0.95	0.62
No.11R repeat		not present	--	not present	--		not present	---	not present	---	not present	---	not present	---
11R-net		0	0	0	0		0	0	0	0	0	0	0	0
11R-gross		0	0	0	0		0	0	0	0	0	0	0	0
No.11		220.33	12 degrees	215.69	28.5 degrees		84.1	10 degrees	130	47.5 degrees?	68.85	42 degrees	141.95	44 degrees
11-net		1.91	1.87	2.46	2.16		2	1.97	not to base	not to base	1.4	1.04	3.3	2.37
11-gross		2.1	2.05	2.46	2.16		2	1.97	not to base	not to base	1.4	1.04	3.3	2.37
No.11 repeat		not present	--	not present	--		not present	--	not reached	not reached	not present	---	not present	---
11-net		0	0	0	0		0	0			0	0	0	0
11-gross		0	0	0	0		0	0			0	0	0	0
No.10A		not reached	not reached	not reached	not reached		126.3	6 degrees			30.7	46 degrees	77.7	50 degrees
10A-net							0.55	0.55			3.6	2.5	1.3	0.84
10A-gross							0.55	0.55			5.35	3.72	3.4	2.19
No.10A repeat							not present	--			not present	--	not present	--
10A-net							0	0			0	0	0	0
10A-gross							0	0			0	0	0	0
No.10R							152	20 degrees			18.65	23 degrees	66.45	51 degrees
10R-net							0	0			1	0.92	0.65	0.41
10R-gross							0	0			1	0.92	0.65	0.41
No.10							163.6	6 degrees			10.75	38 degrees	40.6	49 degrees
10-net							9.84	9.79			7.1	5.59	8.55	5.61
10-gross							10.1	10.04			7.1	5.59	8.8	5.77
No.10 repeat							not present	--			not present	---	not present	---
10-net							0	0			0	0	0	0
10-gross							0	0			0	0	0	0
No.10 repeat 2							not present	--			not present	---	not present	---
10-net							0	0			0	0	0	0
10.gross							0	0			0	0	0	0
No.9							174.6	6 degrees?					28	49 degrees
9-net							2	1.99					1.9	1.25
9-gross							2	1.99					1.9	1.25
No.9 repeat							not present	--						
9-net							0	0						
9-gross							0	0						
No.9 repeat 2							not present	--						
9-net							0	0						
9-gross							0	0						

No.8					187.5 6 degrees?			
8-net					0 0			
8-gross					0 0			

Table 7-8: Drilled and true thickness of coal beds in year-2005 boreholes (concluded)

No.7					211.95 6 degrees?			
7-net					2.05 2.04			
7-gross					2.05 2.04			
No.6					217.1 6 degrees?			
6-net					1.3 1.29			
6-gross					1.3 1.29			
No.5					not reached not reached			
5-net								
5-gross								
No.5 repeat								
5-net								
5-gross								
No.4R								
4R-net								
4R-gross								
No.4R repeat								
4R-net								
4R-gross								
No.4								
4-net								
4-gross								
No.4 repeat								
4-net								
4-gross								
No.3								
3-net								
3-gross								
No.3L								
3L-net								
3L-gross								
No.2A								
2A-net								
2A-gross								
No.2								
2-net								
2-gross								
No.1R								
1R-net								
1R-gross								
No.1								
1-net								
1-gross								
No.1L								
1L-net								
1L-gross								
Moose Mountain								
No.0								
0-net								
0-gross								
Weary Ridge								
Fernie								
Total depth	184.96	230.49	225.18	135	231.65	140.21	354.48	231.65

Table 7-9 (part 1 of 5): Drilled and true thickness of coal beds in year-2010 boreholes

hole/	2010-15a		2010-16a		2010-17a		2010-18A		2010-19a		2010-20a		2010-21a		2010-25a	
UTM coords	644413.132	5563000.113	644418.437	5562992.526	644340	5563173	643984.12	5563158.9	644320.815	5562792.501	644184.986	5562914.74	644335.965	5563185.487	644165.282	5563626.456
elevation	1388.952		1388.636		1387.2		1429.239		1417.365		1415.895		1386.789		1407.43	
geometry	303.04972	Dip 61.8969	130.08889	Dip 47.6792	110	60	282.8808	Dip 56.9033	139.95861	Dip 62.9922	203.244722	Dip 62.5819	287.71722	Dip 69.5189	297.975	Dip 50.1475
Drift	4.57	4.03	6.5	4.81	5.18	4.49	4	3.35	2.4	2.14	3.1	2.75	1.5	1.41	13.7	10.52
Casing shoe	20.12	17.75	9	6.65	10.06	8.71	8.2	6.87	7.4	6.59	8.2	7.28	14.8	13.91	27.95	21.46
notes >	thrust@ 250.75		fault@ 37.80		no faults		no faults		no faults		no faults		thrust @103.7		no faults	
notes >													thrust @310.5			
notes >													(logs to 445)			
coal beds	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true
No.21					67.4	39.5 degrees										
21-net					9	6.94										
21-gross					9.95	7.68										
No.21L					80.95	18.5 degrees										
21L-net					0.45	0.43										
21L-gross					0.45	0.43										
No.20R					93.2	16 degrees										
20R-net					2.4	2.31										
20R-gross					2.4	2.31										
No.20					103.3	32.5 degrees										
20-net					4.6	3.88										
20-gross					4.6	3.88										
No.20L					113.7	40.5 degrees										
20L-net					0	0										
20L-gross					0.3	0.23										
No.19R					not present	--										
19R-net					0	0										
19R-gross					0	0										
No.19					127.8	6 degrees							21.5	55 degrees		
19-net					3.6	3.58							1.8	1.03		
19-gross					3.6	3.58							1.8	1.03		
No.19L					132.7	6 degrees							not present	---		
19L-net					0.6	0.6							0	0		
19L-gross					0.6	0.6							0	0		
No.18R					not present	---							123.7	45 degrees		
18R-net					0	0							0.7	0.49		
18R-gross					0	0							0.7	0.49		
No.18					149.6	6 degrees							35.85	49 degrees		
18-net					0.9	0.9							7.75	5.08		
18-gross					0.9	0.9							7.75	5.08		
No.18 repeat					not present	---							125.05	45 degrees		
18-net					0	0							2.04	1.44		
18-gross					0	0							2.15	1.52		
No.17					172.4	6 degrees					20.4	2 degrees	83.4	45 degrees		
17-net					2.35	2.34					2	2	10.2	7.21		
17-gross					2.35	2.34					2	2	10.7	7.57		
No.17 repeat					not present	---					not present	---	155.1	47.5 degrees		
17-net					0	0					0	0	3.4	2.3		
17-gross					0	0					0	0	3.4	2.3		
No.17L					not present	---					not present	---	95	45 degrees		
17L-net					0	0					0	0	0.95	0.67		
17L-gross					0	0					0	0	1.1	0.78		
No.17L repeat					not present	---					not present	---	159.95	45 degrees		

17L-net			0 0			0 0	0.8 0.57	
17L-gross			0 0			0 0	0.8 0.57	

Table 7-9 (part 1 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (continued)

No.16R	10.6	42 degrees			not present	---					65.45	5 degrees	not present	---		
16R-net	6.85	5.09			0	0					2.1	2.09	0	0		
16R-gross	6.85	5.09			0	0					2.1	2.09	0	0		
No.16R repeat	201	0 degrees			not present	---					not present	---	not present	---		
16R-net	0	0			0	0					0	0	0	0		
16R-gross	0.4	0.4			0	0					0	0	0	0		
No.16	243.95	42 degrees	17.4	17 degrees	203.8	6 degrees					73.85	4 degrees	209.75	50 degrees		
16-net	6.2	4.61	3.05	2.92	2.4	2.39					3.25	3.24	3.85	2.47		
16-gross	6.2	4.61	3.55	3.39	3.5	3.48					3.25	3.24	3.85	2.47		
No.16 repeat	251.05	45 degrees	not present	--	not present	"--"					not present	--	not present	--		
16-net	5.5	3.89	0	0	0	0					0	0	0	0		
16-gross	5.5	3.89	0	0	0	0					0	0	0	0		
No.15R	257	53 degrees	28.25	15 degrees	212	6 degrees					77.1	8 degrees	213.6	50 degrees		
15R-net	4.75	2.86	3.15	3.04	0.75	0.75					1.55	1.53	2.5	1.61		
15R-gross	4.75	2.86	3.15	3.04	0.75	0.75					1.55	1.53	2.5	1.61		
No.15	264.6	37 degrees	32.75	18 degrees	213.35	6 degrees					79.5	8 degrees	217.7	50 degrees		
15-net	4.35	3.47	1.85	1.76	1.7	1.69					0.9	0.89	2.35	1.51		
15-gross	4.35	3.47	1.85	1.76	1.7	1.69					0.9	0.89	2.35	1.51		
No.14	272.8	20 degrees	46.45	13.5 degrees	216.75	6 degrees					82.45	7.5 degrees	222.45	46 degrees		
14-net	6.2	5.83	3.35	3.26	1.9	1.89					1.5	1.49	2.75	1.91		
14-gross	6.65	6.25	4.5	4.38	1.9	1.89					1.5	1.49	2.75	1.91		
No.13	not reached?	not reached?	faulted	missing	236.9	6 degrees					91.3	17 degrees	232.55	60 degrees		
13-net			faulted	missing	2.05	2.04					0	0	0	0		
13-gross			faulted	missing	2.95	2.93					1.15	1.1	0.45	0.23		
No.13L			faulted	missing	241.45	6 degrees					96.4	13 degrees	267.55	55 degrees		
13L-net			faulted	missing	4.8	4.77					0	0	1.2	0.69		
13L-gross			faulted	missing	4.8	4.77					0.3	0.29	1.6	0.92		
No.13A			faulted	missing	250.9	6 degrees					113.6	20 degrees	298.6	50 degrees		
13A-net			faulted	missing	1.6	1.59					0.85	0.8	0.8	0.51		
13A-gross			faulted	missing	1.6	1.59					0.85	0.8	0.8	0.51		
No.13A repeat			faulted	missing	not present	--					not present	---	339.65	45 degrees		
13A-net			faulted	missing	0	0					0	0	1.35	0.95		
13A-gross			faulted	missing	0	0					0	0	1.35	0.95		
No.13B			faulted	missing	not present	--					not present	---	304.7	45 degrees		
13B-net			faulted	missing	0	0					0	0	1.6	1.13		
13B-gross			faulted	missing	0	0					0	0	1.7	1.2		
No.13B repeat			faulted	missing	not present	--					not present	---	355.55	53.5 degrees		
13B-net			faulted	missing	0	0					0	0	3.25	1.93		
13B-gross			faulted	missing	0	0					0	0	3.25	1.93		
Anderson MB			75.8	20 degrees	264.5	6 degrees			13.5	56 degrees	153.05	17 degrees	307.25	45 degrees		
And’s’n-gross			6.8	6.39	4.8	4.77			5.3	2.96	7.05	6.74	2.25	1.59		
Anderson rpt			not present	---	not present	--			not present	---	not present	--	360.2	45 degrees		
And’s’n-gross			0	0	0	0			0	0	0	0	3.5	2.47		
No.12T			not present	---	not present	--			66.55	12.5 degrees	211.6	5.5 degrees	396.05	45 degrees.		
12T-net			0	0	0	0			0.95	0.93	2.35	2.34	0	0		
12T-gross			0	0	0	0			0.95	0.93	3.1	3.09	0.4	0.28		
No.12R			122	4.5 degrees	315.25	6 degrees			73.75	12.5 degrees	215.65	5.5 degrees	397.35	50 degrees		
12R-net			2.55	2.54	1.35	1.34			2.15	2.1	2.75	2.74	3.85	2.47		
12R-gross			2.55	2.54	1.35	1.34			2.55	2.49	2.75	2.74	3.85	2.47		
No.12			125.3	5 degrees	320.4	6 degrees			77.5	16 degrees	220.8	11 degrees	401.55	62.5 degrees		
12-net			4.4	4.38	4.1	4.08			4.9	4.71	>6.4	>6.28	3.7	1.71		
12-gross			4.8	4.78	4.9	4.87			4.9	4.71	>6.4	>6.28	3.7	1.71		
No.11R			131.45	12 degrees	326.9	6 degrees			83.9	16 degrees	not reached	not reached	407.2	60 degrees		
11R-net			0.9	0.88	0.8	0.8			0.9	0.87			0.95	0.48		

11R-gross		0.9	0.88	0.8	0.8		0.9	0.87		0.95	0.48	
No.11		133.8	24 degrees	329.05	6 degrees		86.3	13.5 degrees		409.9	47.5 degrees	
11-net		2	1.83	1.65	1.64		2	1.94		4.15	2.8	
11-gross		2	1.83	2.4	2.39		2	1.94		4.15	2.8	

Table 7-9 (part 1 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (concluded)

No.10A			145.4	3 degrees	not reached	not reached			128.45	16 degrees			455.85	51.5 degrees		
10A-net			0	0					0	0			0.4	0.25		
10A-gross			0.6	0.6					0.65	0.62			0.4	0.25		
No.10R			167.3	15 degrees					149.6	13 degrees			480.22	45 degrees		
10R-net			0	0					0	0			0.97	0.69		
10R-gross			0.5	0.48					0	0			0.97	0.69		
No.10			204.2	1.5 degrees					162.85	3 degrees			505.25	54 degrees		
10-net			9.8	9.8					>6.35	>6.34			12.43	7.31		
10-gross			9.8	9.8					>6.35	>6.34			12.7	7.46		
No.9			215.9	0 degrees					not reached	not reached			530.05	53 degrees		
9-net			2	2									2.87	1.73		
9-gross			2	2									2.93	1.76		
No.8			250.6	0.5 degrees			19.8	38.5 degrees					565.27	53 degrees		
8-net			2.35	2.35			0.95	0.74					0	0		
8-gross			2.7	2.7			0.95	0.74					0	0		
No.7			254.2	2 degrees			58.2	44.5 degrees					568.61	53 degrees		
7-net			1.3	1.3			1.6	1.14					0	0		
7-gross			1.3	1.3			1.8	1.28					0	0		
No.6			258.4	0 degrees			62.55	37 degrees					not present	--		
6-net			0.95	0.95			1.5	1.2					0	0		
6-gross			0.95	0.95			1.5	1.2					0	0		
No.5			265.5	1 degrees			69.7	36 degrees					577.29	63 degrees		
5-net			1.05	1.05			0.65	0.53					0	0		
5-gross			1.05	1.05			0.65	0.53					0	0		
No.4R			272.45	0 degrees			not present	--					622.39	70 degrees	16.4	42 degrees
4R-net			1.15	1.15			0	0					0	0	2.6	1.93
4R-gross			1.15	1.15			0	0					0	0	2.6	1.93
No.4			278.95	0.75 degrees			86.5	41.5 degrees					623.41	51 degrees	19.95	42 degrees
4-net			2.6	2.6			2.9	2.17					4.54	2.86	2.6	1.93
4-gross			3.45	3.45			2.9	2.17					4.54	2.86	4.25	3.16
No.3			303.6	0 degrees			98.65	40 degrees					636.65	60 degrees	35.3	53 degrees
3-net			1.4	1.4			1.8	1.38					7.11	3.56	0	0
3-gross			1.7	1.7			2.1	1.38					7.31	3.66	0	0
No.3L			310.65	0 degrees			105	36 degrees					645.8	65 degrees	39	53 degrees
3L-net			0.7	0.7			2.75	2.22					3.98	1.68	0	0
3L-gross			0.7	0.7			2.75	2.22					5.77	2.44	0	0
No.2A			not reached	not reached			120.65	41.5 degrees					656.8	57.5 degrees	43	53 degrees
2A-net							0.95	0.71					1.8	0.97	1.8	1.08
2A-gross							0.95	0.71					1.89	1.02	2.15	1.29
No.2							153.75	55 degrees					694.37	64 degrees	69	58 degrees
2-net							1.15	0.66					0	0	0	0
2-gross							1.3	0.75					0.05	0.02	0	0
No.1R							158.1	42.5 degrees					716	50 degrees	not present	--
1R-net							0.65	0.48					1.71	1.1	0	0
1R-gross							0.65	0.48					1.71	1.1	0	0
No.1							160.5	38 degrees					717.74	50 degrees	74.5	56 degrees
1-net							1.3	1.02					1.77	1.14	1.7	0.95
1-gross							1.3	1.02					1.77	1.14	1.7	0.95
No.1L							not present	--					not reached	not reached	92	53 degrees
1L-net							0	0							0	0
1L-gross							0	0							0	0
Moose Mountain							164.8								92.7	
No.0							not present	--							not present	--
0-net							0	0							0	0

0-gross				0 0				0 0
Weary Ridge				185.4				109.5
Fernie				not reached not reached				127.2
Total depth	284.99	323.09	365.76	214.58	188.98	230.73	722.68	322.17

Table 7-9 (part 2 of 5): Drilled and true thickness of coal beds in year-2010 boreholes

hole	2010-26a		2010-27v		2010-35a		2010-38a		2010-39a		2010-40v		2010-42v		2010-44a	
UTM coords	644177.76	5563617.387	644062.865	5564273.545	644147.753	5563435.666	643839.894	5563010.012	644185.1	5562914.862	644376.837	5563714.01	644182.293	5562913.528	644303.158	5562978.704
Elevation	1407.012		1411.583		1416.575		1420.157		1416.025		1392.259		1415.567		1401.874	
Geometry	121.295	Dip 48.3311	vertical	Dip 90	298.00719	Dip 50	100	Dip 50	280	Dip 65	vertical	Dip 90	vertical	Dip 90	293.18989	Dip 50
Drift	13.1	10.04	>141.73	>141.73	1.3	1	1.4	1.07	7.5	6.8	73.76	73.76	7.62	7.62	9.2	7.05
Casing shoe	15.5	11.87	141.73	141.73	3.2	2.45	13.11	10.04	8.5	7.7	77.42	77.42	8.6	8.6	12.19	9.34
notes >	thrust @97.8		not to rock		extensional fault @109.9		no faults		thrust @373.65		no faults		no faults		no faults	
notes >									thrust @389.75							
notes >									thrust @272.15							
coal beds	intersected	dip/true	intersected	dip/true	Intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true	intersected	dip/true
No.21L																
21L-net																
21L-gross													.			
No.20R															47.6	21.5 degrees
20R-net															0	0
20R-gross															0.5	0.47
No.20															58.2	31 degrees
20-net															2.4	2.06
20-gross															3.3	2.83
No.20L															62.3	40 degrees
20L-net															0.65	0.5
20L-gross															0.65	0.5
No.19R															82.1	25.5 degrees
19R-net															0.35	0.32
19R-gross															0.35	0.32
No.19															82.8	29.5 degrees
19-net															1.85	1.61
19-gross															1.85	1.61
No.19L															not present	--
19L-net															0	0
19L-gross															0	0
No.18R															not present	--
18R-net															0	0
18R-gross															0	0
No.18															not present	--
18-net															0	0
18-gross															0	0
No.17									28.4	45 degrees			21.6	30 degrees	104.4	4.5 degrees
17-net									3.2	2.26			2.55	2.21	2.35	2.34
17-gross									3.2	2.26			2.55	2.21	2.35	2.34
No.17L									32.45	45 degrees			not present	---	107.2	28 degrees
17L-net									0.8	0.59			0	0	0.25	0.22
17L-gross									0.8	0.59			0	0	0.25	0.22
No.16R									59.6	35 degrees			80.75	43 degrees	not present	--
16R-net									0	0			0	0	0	0
16R-gross									1.45	1.19			0.75	0.75	0	0
No.16									69.4	35 degrees			96	40 degrees	150.2	36 degrees
16-net									8.15	6.68			2.9	2.22	1.7	1.38
16-gross									8.15	6.68			2.9	2.22	1.7	1.38
No.16 repeat									not present	--			not present	--	not present	--
16-net									0	0			0	0	0	0
16-gross									0	0			0	0	0	0
No.15R									77.55	35 degrees			98.6	45 degrees	151.9	36 degrees
15R-net									4.9	4.01			3.2	2.26	1.9	1.54

15R-gross					4.9	4.01			3.2	2.26	1.9	1.54
No.15					83.85	37 degrees			104.45	40 degrees	154.7	36 degrees
15-net					3.25	2.6			2.51	1.92	1.5	1.21
15-gross					3.25	2.6			2.55	1.95	1.5	1.21

Table 7-9 (part 2 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (continued)

No.14									92.5	25 degrees			110	45 degrees	not reached	not reached
14-net									1.9	1.72			2.16	1.53		
14-gross									1.9	1.72			2.2	1.56		
No.13									97.35	25 degrees			116.26	45 degrees		
13-net									0.75	1.68			0.68	0.48		
13-gross									0.75	1.68			0.94	0.66		
No.13L									111	38 degrees			not present	--		
13L-net									1	0.79			0	0		
13L-gross									1	0.79			0	0		
No.13A									154.4	40 degrees			162.3	47 degrees		
13A-net									1.25	0.96			1.33	0.91		
13A-gross									1.25	0.96			1.35	0.92		
No.13B									not present	--			not present	---		
13B-net									0	0			0	0		
13B-gross									0	0			0	0		
Anderson MB									192.25	26 degrees			205.35	38 degrees		
And's'n-gross									9.1	8.18			8.35	6.58		
No.12T	126	32 degrees							245	20 degrees			253.7	23.5 degrees		
12T-net	>0.40	>0.34							2.2	2.07			4.27	3.92		
12T-gross	>0.40	>0.34							3	2.82			4.6	4.22		
No.12R	88.9	25 degrees							251.35	20 degrees			265.4	19.5 degrees		
12R-net	4.7	4.26							2.25	2.11			2.95	2.78		
12R-gross	4.7	4.26							2.25	2.11			2.95	2.78		
No.12R repeat	115.5	32 degrees							not present	---			not present	---		
12R-net	3.8	3.22							0	0			0	0		
12R-gross	3.8	3.22							0	0			0	0		
No.12	84.2	25 degrees							257.7	20 degrees			273.05	26.25 degrees		
12-net	4.7	4.26							6.3	5.92			5.66	5.08		
12-gross	4.7	4.26							6.3	5.92			5.95	5.34		
No.12 repeat	109.6	28 degrees							not present	---			not present	---		
12-net	4.5	3.97							0	0			0	0		
12-gross	5.9	5.21							0	0			0	0		
No.11R	77.4	47.5 degrees							266	20 degrees			280.85	39 degrees		
11R-net	5.6	3.78							0.7	0.66			0.9	0.7		
11R-gross	5.6	3.78							0.7	0.66			0.9	0.7		
No.11R repeat	100.25	50.5 degrees							not present	---			not present	---		
11R-net	5.45	3.47							0	0			0	0		
11R-gross	5.45	3.47							0	0			0	0		
No.11	72.2	26 degrees							268.15	20 degrees			283.2	43 degrees		
11-net	2.7	2.43							2.85	2.68			3.03	2.22		
11-gross	4.05	3.64							3.35	3.15			3.05	2.23		
No.11 repeat	97.8	27 degrees							272.15	20 degrees			not present	---		
11-net	0.70 partial	0.62 partial							5.3	4.98			0	0		
11-gross	0.70 partial	0.62 partial							5.3	4.98			0	0		
No.10A	47	32 degrees							332.45	45 degrees			342.6	40 degrees		
10A-net	0	0							0.8	0.57			0.8	0.61		
10A-gross	0.6	0.51							0.8	0.57			0.8	0.61		
No.10R	41.2	38 degrees							349.4	45 degrees			363.65	25 degrees		
10R-net	0.7	0.55							0.4	0.28			0.7	0.63		
10R-gross	0.7	0.55							0.4	0.28			0.7	0.63		
No.10	29.2	44 degrees							364.05	30 degrees			374.05	34 degrees		
10-net	7.35	5.29							9.09	7.87			9.72	8.06		
10-gross	7.35	5.29							9.6	8.31			11.05	9.16		
No.10 repeat	not present	---							373.65	30 degrees			not present	---		

10-net	0 0				11.14 9.52		0 0	
10-gross	0 0				12.4 10.6		0 0	

Table 7-9 (part 2 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (concluded) ）

No.10 repeat 2	not present	---							389.75	48 degrees			not present	---		
10-net	0	0							3.45	2.31			0	0		
10.gross	0	0							3.45	2.31			0	0		
No.9	not reached	not reached					not reached	not reached	398.05	45 degrees	not reached	not reached	388.6	41 degrees		
9-net									3.22	2.28			2.25	1.7		
9-gross									3.35	2.37			2.25	1.7		
No.8					4.95	50 degrees	152.05	70 degrees	not reached	not reached	279.4	42 degrees	408.6	45 degrees		
8-net					2.25	1.45	0.9	0.31			3.1	2.3	0	0		
8-gross					2.25	1.45	0.9	0.31			3.5	2.6	0	0		
No.7					45.5	35 degrees	127.95	72.5 degrees			268.35	42 degrees	436.6	40 degrees		
7-net					1.1	0.91	7.52	2.26			7.9	5.87	2.65	2.03		
7-gross					1.6	1.31	8.35	2.51			9.45	7.02	2.65	2.03		
No.6					57.6	41 degrees	115.45	67.5 degrees			259.05	53.5 degrees	443.05	32 degrees		
6-net					0	0	2.65	1.01			5.4	3.21	1.75	1.48		
6-gross					0	0	2.65	1.01			6.15	3.66	1.75	1.48		
No.5					68.7	20 degrees	96.5	80 degrees			234.7	56 degrees	450.3	36 degrees		
5-net					6.2	5.83	2.15	0.37			2.7	1.51	0.45	0.36		
5-gross					6.8	6.39	2.15	0.37			3.9	2.18	0.45	0.36		
No.4R					85.05	23.5 degrees	61.65	46.5 degrees			224	52.5 degrees	456.45	40 degrees		
4R-net					0.75	0.69	0.9	0.62			1.45	0.88	0.9	0.69		
4R-gross					0.75	0.69	0.9	0.62			1.45	0.88	0.9	0.69		
No.4					85.8	44 degrees	54.6	41.5 degrees			220.2	44.5 degrees	480.25	40 degrees		
4-net					7.45	5.36	5.85	4.38			3.25	2.32	3.25	2.49		
4-gross					7.45	5.36	5.85	4.38			3.25	2.32	3.85	2.95		
No.3					103.4	23.5 degrees	29.9	70 degrees			214	55 degrees	500.6	45 degrees		
3-net					3.2	2.93	2	0.68			0	0	2.88	2.04		
3-gross					3.2	2.93	2	0.68			0.5	0.29	3.45	2.44		
No.3L					faulted out?	faulted out?	5.35	21.5 degrees			209.8	54.5 degrees	507.9	53 degrees		
3L-net					faulted out?	Faultedout?	5.85	5.44			0	0	0.8	0.48		
3L-gross					faulted out?	faulted out?	6.35	5.91			0.5	0.29	0.8	0.48		
No.2A					faulted out?	faulted out?					200	54 degrees	533	45 degrees		
2A-net					faulted out?	faulted out?					0	0	0	0		
2A-gross					faulted out?	faulted out?					0.8	0.47	0.55	0.39		
No.2					faulted out?	faulted out?					168.95	46.5 degrees	536.6	25 degrees		
2-net					faulted out?	faulted out?					1.7	1.17	1.05	0.95		
2-gross					faulted out?	faulted out?					2.2	1.51	1.3	1.18		
No.1R					not present?	--					143	44 degrees	539.95	35 degrees		
1R-net					0	0					2.6	1.87	2.85	2.33		
1R-gross					0	0					2.6	1.87	2.85	2.33		
No.1					116.95	43.5 degrees					137.8	38.5 degrees	543	40 degrees		
1-net					3.1	2.25					0.6	0.47	3.7	2.83		
1-gross					3.1	2.25					0.6	0.47	3.7	2.83		
No.1L					not present?	--					136.65	49 degrees	548.05	42.5 degrees		
1L-net					0	0					0.55	0.36	1.05	0.77		

1L-gross					0	0					0.55	0.36	1.05	0.77		
Moose Mountain					122.8						133.3	overturned	549.3	40 degrees		
No.0					not present?	--					116	46.5 degrees	not present	--		
0-net					0	0					2.15	1.48	0	0		
0-gross					0	0					2.4	1.65	0	0		
Weary Ridge					137.5						99.6	overturned	579.25			
Fernie			not reached	not reached	153.4						81.6	overturned	not reached	not reached		
Total depth	128.02		142.65		201.17		184.1		415.75		347.47		610.51		157.89	

Table 7-9 (part 3 of 5): Drilled and true thickness of coal beds in year-2010 boreholes

hole/	2010-45v		2010-46a		2010-47a		2010-48a		2010-49a		2010-51a		2010-52a		2010-53a	
UTM coords	644342.891	5563370.624	644344.02	5563365.163	644187.97	5562909.141	644350.174	5563360.897	644308.698	5562982.465	644303.204	5562976.725	643785.8253	5562852.592	644169.2428	5563623.668
Elevation	1385.402		1388.103		1416.991		1391.545		1401.586		1401.814		1420.9977		1406.9339	
Geometry	vertical	Dip 90	320.111	Dip 50	111.775	Dip 65	129.6387	Dip 50	333.71204	Dip 50	251.47219	Dip 50	100.02916	Dip 50	345.60225	Dip 48
Drift	18.4	18.4	18.5	14.17	8.84	8.01	33.53	25.69	9.14	7	9.14	7	19.51	14.95	12.8	9.51
Casing shoe	23.1	23.1	21.7	16.62	9.75	8.84	36	27.58	10.67	8.17	9.14	7	17.37	13.31	15.85	11.78
notes >	no faults		fault @142.00		no faults		fault @273.96		no faults		fault @35.00		thrust @266.00		extensional @120.75	
notes >							log to 195.1				thrust @116.0		thrust @303.80			
coal beds	Intersected	dip/true	intersected	dip/true	intersected	Dip/true	intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true
No.22							58.3	61 degrees								
22-net							1	0.48								
22-gross							1	0.48								
No.22 repeat							69.85	52.5 degrees								
22-net							0.95	0.58								
22-gross							0.95	0.58								
No.21R							49.9	61 degrees								
21R-net							1.5	0.73								
21R-gross							1.5	0.73								
No.21R repeat							80.55	54 degrees								
21R-net							0	0								
21R-gross							0.7	0.41								
No.21							42.2	60 degrees								
21-net							8.65	4.33								
21-gross							9.2	4.6								
No.21 repeat							83.45	54 degrees								
21-net							13.35	7.85								
21-gross							14.2	8.35								
No.21L							not present	--								
21L-net							0	0								
21L-gross							0	0								
No.20R							162.25	15 degrees	21.6	42 degrees						
20R-net							1.65	1.59	0	0						
20R-gross							1.65	1.59	0.75	0.56						
No.20R repeat							not present	--	78.8	44.5 degrees						
20R-net							0	0	0	0						
20R-gross							0	0	0.5	0.36						
No.20							164.7	22 degrees	100.75	51 degrees	48.8	28 degrees				
20-net							7.05	6.54	0.95	0.6	12.75	11.26				
20-gross							8	7.42	0.95	0.6	13.6	12.01				
No.20L							not present	--	102.5	38 degrees	65	20.5 degrees				
20L-net							0	0	1.45	1.14	1.8	1.69				
20L-gross							0	0	1.45	1.14	1.8	1.69				
No.19R							not present	--	147.6	48 degrees	98	14.5 degrees				
19R-net							0	0	0.55	0.37	0.8	0.77				
19R-gross							0	0	0.55	0.37	0.8	0.77				
No.19					19.95	28 degrees	192.87	25 degrees	149	37 degrees	99.55	12 degrees				
19-net					2.85	2.52	3.38	3.06	8.2	6.55	1.65	1.61				
19-gross					2.85	2.52	3.38	3.06	8.2	6.55	1.65	1.61				
No.19 repeat					44.65	40 degrees	not present	--	not present	--	not present	--				
19-net					1.72	1.32	0	0	0	0	0	0				
19.gross					2.3	1.76	0	0	0	0	0	0				

No.19L			not present	--	201.79	34 degrees	157.7	26 degrees	not present	--		
19L-net			0	0	5.6	4.64	0.55	0.49	0	0		
19L-gross			0	0	5.6	4.64	0.55	0.49	0	0		
No.18R			not present	--	not present	--	not present	--	not present	--		
18R-net			0	0	0	0	0	0	0	0		
18R-gross			0	0	0	0	0	0	0	0		

Table 7-9 (part 3 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (continued)

No.18					not present	--	217.2	40 degrees	not present	--	not present	--				
18-net					0	0	5.93	4.54	0	0	0	0				
18-gross					0	0	6.13	4.7	0	0	0	0				
No.17	115.9	57.5 degrees	32	17.5 degrees	58.75	41 degrees	300.29	28 degrees	193.45	23.5 degrees	130.6	3.5 degrees				
17-net	13.6	7.31	2.95	2.81	4.7	3.55	3.27	2.89	3.35	3.07	2.55	2.55				
17-gross	13.6	7.31	2.95	2.81	4.7	3.55	3.39	2.89	3.35	3.07	2.55	2.55				
No.17L	134.5	55 degrees	36.35	12 degrees	63.61	40 degrees	306.88	31 degrees	198.2	45.5 degrees	133.75	5 degrees				
17L-net	2.6	1.49	0.7	0.68	1.29	0.99	3.21	2.75	0.55	0.39	0.55	0.55				
17L-gross	2.6	1.49	0.7	0.68	1.29	0.99	3.28	2.81	0.55	0.39	0.55	0.55				
No.16R	not reached	not reached	not present	--	not present	--	not present	--	not reached	not reached	not present	--				
16R-net			0	0	0	0	0	0			0	0				
16R-gross			0	0	0	0	0	0			0	0				
No.16			76.5	14.5 degrees	98.65	48 degrees	331.48	45 degrees			158.95	2.5 degrees				
16-net			2.55	2.47	2.55	1.71	2.98	2.11			3.35	3.35				
16-gross			2.55	2.47	2.55	1.71	2.98	2.11			3.35	3.35				
No.15R			79.05	14.5 degrees	101.2	37 degrees	334.68	42.5 degrees			162.3	2 degrees				
15R-net			2.4	2.32	3.05	2.44	1.22	0.9			2.5	2.5				
15R-gross			2.4	2.32	3.05	2.44	1.22	0.9			2.5	2.5				
No.15			82.3	7 degrees	105.1	36 degrees	337.11	40 degrees			165.6	8.5 degrees				
15-net			1.7	1.69	2	1.62	0	0.8			1.3	1.29				
15-gross			1.7	1.69	2	1.62	1.04	0.8			1.3	1.29				
No.14			85.55	10 degrees	109.45	36 degrees	343.69	37.5 degrees			169.4	10.5 degrees				
14-net			2.3	2.27	2.25	1.82	0.41	0.33			1.9	1.87				
14-gross			2.3	2.27	2.25	1.82	0.41	0.33			1.9	1.87				
No.13			93.05	24 degrees	118.35	42.5 degrees	355.4	25 degrees			174.2	19 degrees				
13-net			0.75	0.69	0.45	0.33	0	0			0.75	0.71				
13-gross			0.75	0.69	0.45	0.33	0	0			0.75	0.71				
No.13L			111.1	34 degrees	not present	--	402.12	15 degrees			not reached	not reached				
13L-net			0.75	0.62	0	0	>0.8	>0.77								
13L-gross			0.75	0.62	0	0	>0.8	>0.77								
No.13L repeat			142	19.5 degrees	not present	--	not reached	not reached								
13L-net			0.65	0.61	0	0										
13L-gross			0.65	0.61	0	0										
No.13A			138.1	13 degrees	140	38 degrees										
13A-net			0.6	0.58	1.05	0.83										
13A-gross			0.6	0.58	1.05	0.83										
No.13A repeat			159	20 degrees	not present	--										
13A-net			0.8	0.75	0	0										
13A-gross			0.8	0.75	0	0										
No.13B			168.8	12 degrees	not present	--										
13B-net			1.6	1.57	0	0										
13B-gross			1.6	1.57	0	0										
No.13B repeat			199.8	16.75 degrees	not present	--										
13B-net			4.65	4.45	0	0										
13B-gross			5.4	5.17	0	0										
Anderson MB			170.4	19 degrees	166.45	31 degrees										
And’s’n-gross			3.9	3.69	9.6	8.23										
Anderson rpt			207.7	21.5 degrees	not present	--										
And’s’n-gross			2.7	2.51	0	0										
No.12T			242.5	23.5 degrees	219	30 degrees										
12T-net			0.8	0.73	0	0										

12T-gross		0.8 0.73	2.45 2.12					
No.12R		251.7 52 degrees.?	229.75 25.5 degrees					
12R-net		>0.9 >0.55?	1.6 1.44					
12R-gross		>0.9 >0.55?	1.6 1.44					
No.12		not reached not reached	232.1 30 degrees					
12-net			6.7 5.8					
12-gross			6.9 5.98					

Table 7-9 (part 3 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (continued)

No.11R					240.55	30 degrees										
11R-net					0.75	0.65										
11R-gross					0.75	0.65										
No.11					242.65	41 degrees										
11-net					2	1.51										
11-gross					2	1.51										
No.10A					282.3	22 degrees							304.2	49 degrees		
10A-net					0.55	0.51							0.9	0.59		
10A-gross					0.55	0.51							0.9	0.59		
No.10R					310.3	--							329	40 degrees		
10R-net					0	0							0.9	0.69		
10R-gross					0	0							0.9	0.69		
No.10					320.95	35.5 degrees							266	67.5 degrees		
10-net					9.7	7.9							10.5	4.02		
10-gross					10.35	8.43							11.9	4.55		
No.10 repeat					not present	--							363.68	70 degrees		
10-net					0	0							38.6	13.2		
10-gross					0	0							40.12	13.72		
No.9					331.8	35 degrees							248.9	67.5 degrees		
9-net					2.9	2.38							5.8	2.22		
9-gross					3.35	2.74							7.75	2.97		
No.9 repeat					not present	--							283.35	58 degrees		
9-net					0	0							4.7	2.49		
9-gross					0	0							4.9	2.6		
No.9 repeat 2					not present	--							414.05	65 degrees		
9-net					0	0							3.55	1.5		
9-gross					0	0							3.55	1.5		
No.8					347.3	27 degrees							213	57.5 degrees		
8-net					0	0							1.2	0.64		
8-gross					0	0							1.2	0.64		
No.7					376.45	31 degrees							169.05	60 degrees	17	36 degrees
7-net					2.15	1.84							2.7	1.35	0	0
7-gross					2.15	1.84							2.7	1.35	0.55	0.44
No.6					381.55	29 degrees							162.95	55 degrees	33.3	41 degrees
6-net					1.4	1.22							1.45	0.83	1.8	1.36
6-gross					1.4	1.22							1.45	0.83	1.8	1.36
No.5					387.9	25 degrees							138.2	70 degrees	39.6	33.5 degrees
5-net					1.4	1.27							1.1	0.38	1.6	1.33
5-gross					1.4	1.27							1.1	0.38	1.6	1.33
No.4R					395.1	30 degrees							109.2	60 degrees	49.3	56 degrees
4R-net					1.65	1.43							0.55	0.28	0.3	0.17
4R-gross					2.2	1.91							0.55	0.28	0.3	0.17
No.4					407.4	35 degrees							106.95	60 degrees	51.6	33 degrees
4-net					3.2	2.62							1.65	0.83	2	1.68
4-gross					3.85	3.15							1.65	0.83	2	1.68
No.3					433	35 degrees							80.4	62.5 degrees	67.65	30 degrees
3-net					1.95	1.6							2.4	1.11	1.35	1.17
3-gross					2.5	2.05							2.4	1.11	1.35	1.17
No.3L					439.1	31 degrees							65.25	65 degrees	71.2	13 degrees
3L-net					0.5	0.43							1.45	0.61	0.65	0.63
3L-gross					0.5	0.43							2.05	0.87	0.65	0.63
No.2A					458.7	25 degrees							48.45	60 degrees	73.4	22 degrees
2A-net					0.32	0.29							2.35	1.18	0.6	0.56
2A-gross					0.46	0.42							2.35	1.18	0.6	0.56

No.2			459.9	35 degrees					not present	--
2-net			1.45	1.19					0	0
2-gross			1.9	1.56					0	0

Table 7-9 (part 3 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (concluded)

No.1R					464.25	36.5 degrees									not present	--
1R-net					2.3	1.85									0	0
1R-gross					2.3	1.85									0	0
No.1					466.75	36.5 degrees									89.6	30.5 degrees
1-net					3.07	2.47									0.55	0.47
1-gross					3.1	2.49									0.55	0.47
No.1L					470.92	35 degrees									97.8	31.5 degrees
1L-net					0.98	0.8									0	0
1L-gross					0.98	0.8									0	0
Moose Mountain					471.9	35 degrees									98.65	32.5 degrees
No.0					not present	--									109.2	32.5 degrees
0-net					0	0									0	0
0-gross					0	0									0	0
Weary Ridge					503										120.75	
Fernie					not reached	not reached									not reached	not reached
Total depth	243.84		262.13		531.27		376.73		213.36		201.17		453.24		140.21	

Table 7-9 (part 4 of 5): Drilled and true thickness of coal beds in year-2010 boreholes）

hole/	2010-54a		2010-55a		2010-56a		2010-57a		2010-58a		2010-59a		2010-60a		2010-61a	
UTM coords	644173.978	5563624.18	644164.201	5563616.99	643970.543	5563151.14	643978.207	5563164.79	644144.92	5563436.50	644133.322	5563431.78	643931.501	5562576.81	644098.717	5562455.12
Elevation	1406.8777		1407.1641		1428.7837		1429.1906		1416.3361		1416.7003		1441.9328		1462.588	
Geometry	359.20772	Dip 48	270.9302	Dip 48	233.63238	Dip 48	307.8509	Dip 48	313.2060	Dip 49	243.4207	Dip 48	270	Dip 50	220.3848	Dip 48
Drift	13.41	9.97	12.5	9.29	1.52	1.13	2.13	1.58	1.52	1.15	8.84	6.57	4.57	3.5	18.58	14.23
Casing shoe	15.85	11.78	15.85	11.78	5.79	4.3	9.75	7.25	5.79	4.37	9.75	7.25	6.1	4.67	21.95	16.81
notes >	no faults		no faults		fault at 192.0		no faults		extensional fault @100.60		extensional fault @129.8		extensional fault @92.8 92.8 处延伸断层		no faults 无断层	
coal beds	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected 夹层	dip/true	Intersected 夹层	dip/true
No.10A																
10A-net																
10A-gross																
No.10R													10.2	17 degrees	39.6	6 degrees
10R-net													0.55	0.53	0.7	0.7
10R-gross													0.55	0.53	0.7	0.7
No.10													16.8	50 degrees	43.45	24 degrees
10-net													13.75	8.84	13.8	12.61
10-gross													13.75	8.84	14.3	13.06
No.9													35	50 degrees	59.15	21 degrees
9-net													0.85	0.55	5.25	4.9
9-gross													0.85	0.55	5.25	4.9
No.8					13.8	36.5 degrees	9.7	25 degrees	10.55	50 degrees			75.25	50 degrees	78.3	42 degrees
8-net					2	1.61	0.9	0.82	0.5	0.32			1.35	0.87	2.7	2.01
8-gross					2.3	1.85	0.9	0.82	0.5	0.32			1.35	0.87	3.25	2.42
No.7	30.8	41 degrees	19.75	15 degrees	64.6	35.5 degrees	49.95	29.5 degrees	47.2	12 degrees			faulted out	faulted out	95	4 degrees
7-net	0	0	4.95	4.78	2.1	1.71	1.65	1.44	0	0			faulted out	faulted out	0.3	0.3
7-gross	0.5	0.38	4.95	4.78	2.1	1.71	1.65	1.44	0.3	0.29			faulted out	faulted out	0.3	0.3
No.6	41.8	40 degrees	35.3	48 degrees	69.75	33.5 degrees	53.8	23 degrees	53	49 degrees			faulted out	faulted out	104.1	2 degrees
6-net	0	0	0.7	0.47	1.8	1.5	1.05	0.97	0	0			faulted out	faulted out	1.55	1.55
6-gross	0.5	0.38	0.7	0.47	1.8	1.5	1.05	0.97	0	0			faulted out	faulted out	1.55	1.55
No.5	59.4	43.5 degrees	51.6	32 degrees	77.9	40.5 degrees	61	29 degrees	64.5	61 degrees	34.9	44 degrees	93	32 degrees	110.8	0.5 degrees
5-net	7.6	5.51	10	8.48	0.85	0.65	0.5	0.44	4.55	2.21	8.8	6.33	1.45	1.23	1.25	1.25
5-gross	7.6	5.51	10.2	8.65	0.85	0.65	0.5	0.44	5.05	2.45	9.6	6.91	1.45	1.23	1.25	1.25

No.4R	99	66.5 degrees	73.4	11.5 degrees	98.6	35.5 degrees	76.25	16.5 degrees	77.25	54 degrees	52.9	43 degrees	98	35 degrees	119.75	3 degrees
4R-net	3	1.2	2.45	2.4	0.6	0.49	0.35	0.34	1.55	0.91	4	2.93	0.95	0.78	0.9	0.9
4R-gross	3	1.2	2.45	2.4	0.6	0.49	0.35	0.34	1.55	0.91	5.1	3.73	0.95	0.78	0.9	0.9
No.4	104.8	46 degrees	76.45	45 degrees	99.2	30.5 degrees	76.6	25.5 degrees	79.35	40 degrees	58.85	33 degrees	99.8	35 degrees	121.65	2 degrees
4-net	4.55	3.16	5.15	3.64	2.4	2.07	2.25	2.03	3.85	2.95	7.8	6.54	4.8	3.93	3.1	3.1
4-gross	5.15	3.58	5.15	3.64	2.4	2.07	2.25	2.03	3.85	2.95	8.25	6.92	4.8	3.93	3.4	3.4

Table 7-9 (part 4 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (concluded)

No.3	115	47 degrees	85.95	30.5 degrees	113	26.5 degrees	86.95	26.5 degrees	93.2	35 degrees	124.7	53 degrees	124.4	40 degrees	141.2	7 degrees
3-net	0	0	0.75	0.65	3	2.68	3.35	3	2.55	2.09	3.95	2.38	2.8	2.14	1.8	1.79
3-gross	0.25	0.17	0.75	0.65	3	2.68	3.35	3	2.55	2.09	4.1	2.47	3.7	2.83	1.8	1.79
No.3L	122.75	43.5 degrees	89.85	53.5 degrees	121.1	39.5 degrees	94.25	15 degrees	99.4	31 degrees	faulted out	faulted out	133.3	45 degrees	149.4	1 degrees
3L-net	0	0	0	0	1.5	1.16	1.65	1.59	1.2	1.03	faulted out	faulted out	1.15	0.81	0	0
3L-gross	0.25	0.18	0	0	2	1.54	1.65	1.59	1.2	1.03	faulted out	faulted out	1.15	0.81	0.6	0.6
No.2A	134.8	42 degrees	93.95	25.5 degrees	136.25	33 degrees	111.35	5 degrees	faulted out	faulted out	faulted out	faulted out	144.6	42.5 degrees	174.25	4 degrees
2A-net	1.6	1.19	1.05	0.95	1.5	1.26	0.65	0.65	faulted out	faulted out	faulted out	faulted out	1.5	1.11	3.55	3.54
2A-gross	1.6	1.19	1.05	0.95	1.5	1.26	0.65	0.65	faulted out	faulted out	faulted out	faulted out	1.5	1.11	3.55	3.54
No.2	not reached	not reached	not present	--	168.85	51.5 degrees	137	7 degrees	faulted out	faulted out	faulted out	faulted out	171.25	45 degrees	179.85	0.5 degrees
2-net			0	0	0	0	0	0	faulted out	faulted out	faulted out	faulted out	0	0	1.3	1.3
2-gross			0	0	0.4	0.25	0.6	0.6	faulted out	faulted out	faulted out	faulted out	0.15	0.11	1.3	1.3
No.1R			112.7	25.5 degrees	170.5	45 degrees	138.75	5.5 degrees	112.25	21 degrees	138.45	46 degrees	175.8	45 degrees	185.75	1.5 degrees
1R-net			1.4	1.26	1.2	0.85	0.85	0.85	1.05	0.98	0.75	0.52	1.75	1.24	0.9	0.9
1R-gross			1.4	1.26	1.2	0.85	0.85	0.85	1.05	0.98	0.75	0.52	1.75	1.24	0.9	0.9
No.1			114.7	25.5 degrees	175.3	30 degrees	141.75	13 degrees	113.55	21 degrees	141.6	36 degrees	180.4	45 degrees	192.2	7.5 degrees
1-net			0.95	0.86	1.1	0.95	0.85	0.83	0.75	0.7	0.75	0.61	1.95	1.38	1	0.99
1-gross			0.95	0.86	1.1	0.95	0.85	0.83	0.75	0.7	0.75	0.61	1.95	1.38	1	0.99
No.1L			122.75	25.5 degrees	177.6	14 degrees	143.8	39 degrees	not present	--	not present	--	not present	--	not present	--
1L-net			0	0	0.7	0.68	0.85	0.66	0	0	0	0	0	0	0	0
1L-gross			0	0	0.7	0.68	0.85	0.66	0	0	0	0	0	0	0	0
Moose Mountain			125.2	25.5 degrees	179.6	52 degrees	146.05	11 degrees	114.3	21 degrees	148.9	31.5 degrees	182.35	45 degrees	193.2	12 degrees
No.0			139.6	25.5 degrees	191	30 degrees	152.25	17 degrees	not present	--	158.6	24.5 degrees	not present	--	not present	--
0-net			0.7	0.63	faulted?	faulted?	0	0	0	0	0	0	0	0	0	0
0-gross			0.7	0.63	faulted?	faulted?	0.45	0.43	0	0	0.2	0.18	0	0	0	0
Weary Ridge			147.8		not reached	not reached	165.7		132.3		167.5		195.85	42.5 degrees	202.75	
Fernie			174.3				Not reached	not reached	152.8		not reached	not reached	217.8	45 degrees	not reached	not reached
Total depth	170.69		268.22		193.55		170.69		188.98		170.69		302.36		211.23	

Table 7-9 (part 5 of 5): Drilled and true thickness of coal beds in year-2010 boreholes

hole/	2010-62v		2010-63v		2010-64a		2010-65a		2010-66a		2010-67a		2010-68a		2010-69a		2010-70a	
UTM coords	643784.65	5562852.7	643936.99	5562571.3	643794.32	5562851.0	644120.62	5562601.7	643941.44	5562575.6	644316.46	5562794.5	644102.68	5562448.8	643936.84	5562575.8	644107.61	5562448.1
Elevation	1420.9071		1441.6413		1420.6983		1489.0119		1442.0804		1417.3722		1462.4481		1442.191		1462.2742	
Geometry	vertical	Dip 90	vertical	Dip 90	95	Dip 85	82.7210	Dip 47	56.9298	Dip 50	136.1076	Dip 48	176.3162	Dip 49	200.1042	Dip 50	143.5422	Dip 50
Drift	18.2	18.2	1.9	1.9	15.85	15.79	0.9	0.69	6.5	4.98	5.5	4.09	39.45	30.22	3	2.3	39.6	30.34
Casing shoe	17.9	17.9	6.2	6.2	15.24	15.18	4.57	3.5	6.5	4.98	5.9	4.38	39.3	30.1	5	3.83	46.05	35.28
notes >	no faults		fault?@362.74		no faults		thrust? @206		fold axis @133.0		no faults		no faults		fold axis @141.5		no faults	
notes >							(may be major one)								thrust @168.8			
coal beds	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true	Intersected	dip/true
No.13B																		
13B-net																		
13B-gross																		
Anderson MB							22.3	2 degrees			15.6	5 degrees						
And's'n-gross							9.3	9.29			4.4	4.38						
No.12T							69.6	2 degrees			66.4	5 degrees						
12T-net							2.4	2.4			1.5	1.49						
12T-gross							2.4	2.4			1.5	1.49						
No.12R							72	6.5 degrees			73.05	10 degrees						
12R-net							2.65	2.63			2.47	2.43						
12R-gross							2.65	2.63			2.65	2.61						
No.12							75.95	0.5 degrees			76.85	10 degrees						
12-net							5.1	5.1			4.84	4.76						
12-gross							5.1	5.1			4.95	4.87						
No.11R							82.65	7 degrees			83.2	10 degrees						
11R-net							0.75	0.74			0.64	0.63						
11R-gross							0.75	0.74			0.69	0.68						

Table 7-9 (part 5 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (continued)

No.11							84.95	6.5 degrees			85.6	10 degrees						
11-net							1.25	1.24			2.15	2.12						
11-gross							1.25	1.24			2.15	2.12						
No.10A							153.25	6 degrees	16.1	45 degrees	127.7	8 degrees						
10A-net							0.6	0.6	0	0	0	0						
10A-gross							0.6	0.6	0.65	0.57	0.3	0.3						
No.10A repeat							not present	--	276.2	50 degrees	not present	--						
10A-net							0	0	1.05	0.67	0	0						
10A-gross							0	0	1.05	0.67	0	0						
No.10R			43.85	75 degrees			181	4 degrees	315.3	50 degrees	151.2	9 degrees			23.3	19.5 degrees		
10R-net			0	0			0	0	1.15	0.74	0	0			1.05	0.95		
10R-gross			0	0			0.85	0.85	1.15	0.74	0	0			1.05	0.95		
No.10			51.75	60 degrees			183.4	1 degrees	not reached		164.55	8 degrees	39.45	12 degrees	32.25	24 degrees	39.6	35 degrees
10-net			10.45	5.23			8.85	8.85			8.16	8.08	1.3	1.27	8.95	8.18	0.8	0.66
10-gross			10.65	5.23			8.85	8.85			8.55	8.47	1.3	1.27	8.95	8.18	0.8	0.66
No.9			64.55	45 degrees			193	3 degrees			174	6 degrees	41.8	4 degrees	42	11.5 degrees	41.3	41.5 degrees
9-net			1.1	0.78			3.2	3.2			1.97	1.97	4.6	4.59	4.2	4.12	3.15	2.36
9-gross			1.1	0.78			3.2	3.2			1.97	1.97	4.95	4.94	4.2	4.12	3.15	2.36
No.8			86.2	60 degrees			216.85	6 degrees			199.3	14.5 degrees	60.45	13.5 degrees	60.45	28 degrees	57.95	3.5 degrees
8-net			1.7	0.85			2.8	2.78			0	0	2.3	2.24	1.05	0.93	2.1	2.1
8-gross			2.6	1.3			2.8	2.78			0	0	2.3	2.24	1.05	0.93	2.1	2.1
No.7			200.6	65 degrees			222.9	3 degrees			211	6.5 degrees	72.8	13 degrees	89.8	38 degrees	65.25	5.5 degrees
7-net			2.8	1.18			1.1	1.1			1.6	1.59	0	0	1.8	1.42	0	0
7-gross			2.8	1.18			1.45	1.45			1.6	1.59	0.6	0.58	1.8	1.42	0.25	0.25
No.6			213.85	66 degrees			229	2 degrees			216	8.25 degrees	79.35	6 degrees	99	62 degrees	74.9	6 degrees
6-net			2.75	1.12			1.4	1.4			1.35	1.34	1.65	1.64	1.2	0.74	1.55	1.54
6-gross			2.75	1.12			1.4	1.4			1.4	1.39	1.65	1.64	1.2	0.74	1.55	1.54
No.5			229.1	45 degrees			235.8	3.5 degrees			224.35	5 degrees	86.4	4 degrees	115.25	36.5 degrees	82.65	5 degrees
5-net			1.3	0.92			0.8	0.8			1.2	1.19	1.25	1.25	1.6	1.29	1.25	1.25
5-gross			1.3	0.92			0.8	0.8			1.2	1.19	1.25	1.25	1.6	1.29	1.25	1.25
No.5 repeat			not present	--			not present	--			not present	--	not present	--	167.2	30.5 degrees	not present	--
5-net			0	0			0	0			0	0	0	0	1.8	1.55	0	0
5-gross			0	0			0	0			0	0	0	0	1.8	1.55	0	0
No.4R			257.8	55 degrees			243.6	6 degrees			230.9	8 degrees	94.65	7.5 degrees	125.25	27.5 degrees	90.55	8.5 degrees
4R-net			0.7	0.4			0.55	0.55			0.75	0.74	1.55	1.54	1	0.89	1.45	1.43
4R-gross			0.7	0.4			0.55	0.55			0.75	0.74	1.55	1.54	1	0.89	1.45	1.43
No.4R repeat			not present	--			not present	--			not present	--	not present	--	160.65	18.5 degrees	not present	--
4R-net			0	0			0	0			0	0	0	0	0.35	0.33	0	0
4R-gross			0	0			0	0			0	0	0	0	0.35	0.33	0	0
No.4			258.5	55 degrees			244.45	7 degrees			237.6	10 degrees	99.2	3.5 degrees	127	31 degrees	94.1	9.5 degrees
4-net			4.55	2.29			1.95	1.94			3.1	3.05	3.15	3.14	2.2	1.89	3.2	3.16
4-gross			4.55	2.29			1.95	1.94			3.65	3.59	3.15	3.14	2.2	1.89	3.95	4.94
No.4 repeat			not present	--			not present	--			not present	--	not present	--	154.85	32 degrees	not present	--
4-net			0	0			0	0			0	0	0	0	1.95	1.65	0	0
4-gross			0	0			0	0			0	0	0	0	1.95	1.65	0	0
No.3			281.4	53.5 degrees			264.4	3 degrees			266.6	15 degrees	118.35	4.5 degrees	200.95	37.5 degrees	114.65	3 degrees

3-net			4	2.38			1.35	1.35			1.48	1.43	1.05	1.05	4.1	3.25	1.25	1.25
3-gross			4	2.38			1.75	1.75			2.05	1.98	1.05	1.05	4.4	3.49	1.25	1.25
No.3L			289.35	45 degrees			268.25	5 degrees			271.6	15 degrees	122.2	6 degrees	212.8	29 degrees	121.3	4.5 degrees
3L-net			0	0			0	0			0.7	0.68	0	0	0.35	0.31	0	0
3L-gross			0.5	0.35			0.35	0.35			0.7	0.68	0.3	0.3	0.35	0.31	0.3	0.3
No.2A			323.35	49 degrees			290.95	2 degrees			282.4	12 degrees	148.5	4.5 degrees	234	43 degrees	144	31 degrees
2A-net			3.25	2.13			2.45	2.45			0.17	0.17	1.55	1.55	2.55	1.86	1.8	1.54
2A-gross			3.25	2.13			2.45	2.45			0.17	0.17	1.55	1.55	2.55	1.86	1.8	1.54
No.2	30.7	45 degrees	329.7	49 degrees	49.95	75 degrees	297.1	2 degrees			284.1	16 degrees	153.65	8.5 degrees	252.6	8.5 degrees	149.55	5.5 degrees
2-net	0.2	0.14	0.6	0.39	0	0	0	0			1.36	1.31	1.1	1.09	0	0	0.55	0.55
2-gross	0.2	0.14	0.6	0.39	0	0	0	0			2	1.92	1.1	1.09	0.6	0.59	0.55	0.55

Table 7-9 (part 5 of 5): Drilled and true thickness of coal beds in year-2010 boreholes (concluded)

No.1R	33.6	45 degrees	342.8	41 degrees	57.35	70 degrees	301.75	2 degrees			289.45	0 degrees	161.8	1 degrees	258	4.5 degrees	157.95	18 degrees
1R-net	2.36	1.67	0.95	0.72	2.9	0.99	0.7	0.7			3	3	0.85	0.85	1.15	1.15	0.65	0.65
1R-gross	2.45	1.73	0.95	0.72	2.9	0.99	0.7	0.7			3	3	0.85	0.85	1.15	1.15	0.65	0.65
No.1	38.65	45 degrees	352.95	47 degrees	65.75	73 degrees	306.75	2 degrees			292.65	6 degrees	169	no data	266.15	7 degrees	165.95	20.5 degrees
1-net	1.71	1.21	1.75	1.19	5.45	1.59	0.9	0.9			1.95	1.94	no data	no data	1.1	1.09	0.75	0.7
1-gross	1.71	1.21	1.75	1.19	5.45	1.59	0.9	0.9			1.95	1.94	no data	no data	1.1	1.09	0.75	0.7
No.1L	not present	--	not reached		not present	--	not present	--			295.4	5 degrees			not present	--	not present	--
1L-net	0	0			0	0	0	0			0.95	0.95			0	0	0	0
1L-gross	0	0			0	0	0	0			0.95	0.95			0	0	0	0
Moose Mountain	40.36	45 degrees			71.2	74 degrees	307.65				296.35	5 degrees			267.8	18 degrees	166.7	22 degrees
No.0	55.2	60 degrees			not present	--	not present	--			not present	--			279.4	19.5 degrees	not present	--
0-net	0	0			0	0	0	0			0	0			0	0	0	0
0-gross	0	0			0	0	0	0			0	0			0.2	0.19	0	0
Weary Ridge	60.45	58 degrees			105.9		327.8				310				not reached		178	21.5 degrees
Fernie	not reached 未打到				151.9		not reached				356.7						not reached	
Total depth	118.87		282.85		250.85		339.24		324.92		440.74		173.74		288.65		187.45	

8.0 Exploration

8.1 Rock Sampling

A limited amount of rock or coal sampling was done on surface since the coal, mudstones and shales were heavily weathered. Several hard sandstone outcrops were sampled and sent to Vancouver Petrographics Ltd. And reported on in 2010 by this author (Munroe) for analysis. That report details the nature of some of the confining structures found in the drilling program. The petrographic analysis will allow researchers to establish a basis for future nomenclature applications.

In July 2012, Spring MacAskill submitted additional samples from her trench work for petrographic analysis. The following is the summary of that work. A full copy of the report is located in Appendix under the July 2012 folder.

Sample 120251 Sierra is of well sorted metamorphosed siltstone consisting of equant grains 0.05-0.1 mm in size dominated by quartz with less abundant micritic calcite (stained orange brown by limonite), much less abundant sparry calcite (with thin limonite rims), accessory hematite, carbonaceous opaque lenses and chert, and minor plagioclase, quartzite, and zircon. Bedding, parallel to a weak foliation, is defined by elongate lenses of carbonaceous opaque and hematite/limonite and by one layer with abundant zircon. Two calcite-quartz veinlets cut across the foliation at a high angle. One of these is offset up to 1 mm along a fracture zone parallel to foliation in an area containing abundant lenses of carbonaceous opaque and hematite and remnants of a calcite veinlet.

Sample 120252 Shenfield is of well sorted cherty arenite that consists mainly of angular to subangular grains of a variety of types of chert, rocks intermediate between chert and mudstone, lesser fragments of mudstone, in part strongly hematitic, and of single quartz grains, and minor fragments of chalcedony, quartzite, and carbonaceous opaque in a sparse matrix of sericite. Three layers are dominated by quartz fragments and contain minor calcite cement.

Sample BR269454 Moosewood is of cherty arenite that contains angular fragments of a variety of cryptocrystalline to extremely fine grained chert, mudstone (variable from sericite-rich to hematite-rich), quartz grains, and minor ones of siltstone, quartzite, and carbonaceous opaque. Fragments are closely packed, with a very sparse matrix dominated by sericite.

Sample 8R269455 Moose Mountain is of well sorted slightly foliated siltstone containing angular fragments of quartz and much less abundant ones of mudstone and chert, moderately abundant ones of carbonaceous opaque, and minor ones of muscovite, tourmaline, and chalcedony in a moderately abundant cryptocrystalline matrix of uncertain composition, probably dominated by plagioclase, quartz, and sericite. Rare fragments are of zircon and tourmaline.

Sample 8R269457 Bingay is of well sorted arenite containing angular fragments of quartz, chert, cherty mudstone, and mudstone (ranging from sericite-rich to hematite-rich) with minor fragments of latite/quartzite, quartzite, siliceous siltstone, carbonaceous opaque, chalcedony, and hematite in a very sparse groundmass of quartz-sericite with trace calcite.

MacAskill and other consultants involved in the sample and analysis program submitted their samples to the company for lab analysis but the actual lab assay certificates were either not returned to the company by the labs or were not generated. The assay results for samples sent to China for testing were returned in a manner that is quite different from North American standards. Each consultant's report noted in this report is included in the Appendix in date order. There are specific notations made in each section of the Appendix detailing whether or not sample site locations or assay certificates are available.

As an example Ryan took a single sample (March 2011) to examine the ash percentage and residual moisture of what he felt was a typical coal showing on the property. [redacted] The company is reporting the result in the interests of complete disclosure wherein other sample programs are much more comprehensive and contain location and assay certificate data.

This single sample was followed up by the April 2011 submission for a more comprehensive sample suite taken from coal sections along the drill core. This work is reported in the April 2011 spread sheet which shows the additional 24 samples [redacted]. Additional sample programs were planned for after the 2012 exploration work when new coal sections were available.

Further specific work on the #17 seam was started in 2010 and reported on after the lab work was done in April 2011 (see Appendix 1- April 2011). That analysis (Oxide Coal Quality) keyed on two parts (top and bottom) of the #17 seam as a potential target seam for future production. [redacted] These are also very wide swings and again highlight the need for additional drilling and seam exposures by trenching to define a better expected production average.

Additional samples were submitted to Pal Sharma for carbonization evaluation in July 2011 and to SGS Labs for coal quality analysis on seams 4, 10, 12, 12R, 20 and a blended suite. Each of these sample/analysis suites are for unique definition of a particular area of the property and coal exposures. Taken in isolation they give a wide range of values but as an initial sample suite they provide a good baseline for the company to better understand the nature of the property.

The entire Bingay deposit appears to be a complex but good source for production coal. Much more work is required to better define all needed parameters but this is the direction of the company. As more definition drilling and trench work is done more rock sample suite will become available to define the many coal seams and their economic potential. Many more samples are required to achieve this goal.

The June 2012 report on the drill hole 2R ash characteristics (included in the July 2012 part of Appendix 1) was another example of further defining the general nature of the ash content of the property as a whole. The coal's ash content in these portions of intersected seams 4, 5, 6, 7 was highly elevated from the seam 1 testing done in April 2011. [redacted]

When coal intersections from single hole are submitted, there is no baseline to know what may be coming out of each hole from a particular area of the property. In the earlier work (2010 report) submitted earlier by this writer, it was apparent that the complex rating of this deposit is correct. Distinct variability of coal quality has been noted throughout it exploration history. Only additional drilling and trenching will allow an end user to truly understand the nature of the deposit.

In July 2012, the material encountered from hole 1Ra was used as a test to see what coal quality existed in that part of the property. Four seams were encountered and tested (see the July 2012 report in Appendix 1) [redacted]

From this range and the ranges found in trench work and other drill holes reported upon in this (and other reports) it is clear that a blended extraction program is needed to ensure any economic viability of the property in future. Certainly, very high grade sections exist across the property suite but to understand and quantify it as a whole additional exploration is required. The additional exploration is to define both the quality and quantity of the coal reserves in Bingay Main and possibly in other distal parts of the property suite (Bingay A, B or C)

The company even undertook a program (reported in the Walgren Soil Testing report of January 2012) to better understand the rock quality of the sediments found between the coal seams. This testing is needed to know if suitable rock quality exists on site for building concrete retaining walls and other support structures. As the property is opened up by exploration, the thoughts of the company must also look to the future for general rock durability for gravel roads and other infrastructure building.

The Walgren report indicated that the sandstone seam considered at that point was not suitable for coarse concrete work. However, there are many different types of border rock encountered in the property. (See the PAYNE Petrographic report- July 2011) as an example. The company was examining many aspects of the property as a whole in the 2011-2012 programs to better define the entire materials suite. This work must be an on going process and be reflected in future exploration efforts.

8.2 Grid Layout

Bingay Main's grid layout is not cut out on the forested surface but is based on a Geometrics flyover referencing ground known point survey markers which was used to create a digital terrain model at 0.5 metre contour intervals. Those markers were placed by Kodiak Surveyors.

The drill holes and trenches were survey controlled using the terrain model. The grid maps clearly assisted in defining the topographic elements of the Bingay Hill Property suite. The sharp geological boundaries are well defined in places by the differential erosion of the sand and mud stone belts. The complex nature of the boundary movements also required a very sophisticated suite of instrumental techniques to maximize the value of each drill hole. Geophysical and geotechnical down hole and physical test methods were used on all the holes to ensure any and all data sets were possible to obtain.

The wide varieties of data sets from each analysis are noted in the assorted appendices of this report. They also serve to provide a solid foundation of bed lithological nature. Understanding this nature is important for future drilling and exploration efforts on the property as a good foundation of knowledge across a broad spectrum of parameters is now available. This data base will continue to be enhanced in future exploration efforts.

The geophysical testing included dip meter and gamma recording. Calipers and down hole nuclear tools were used to obtain density and resistivity logs as well. In short, if there was a standard testing process available for the hole, it was generally done. With respect to the drill core analysis, RQD and Q Index values were obtained and all drill core was digitally photographed to allow for direct visual “calibration” to the assorted core/down hole reporting methods. This method of analysis and reporting was followed through with the 2011 and 2012 drilling. Full reports on the drill core analysis can be found in Appendix 1.

Similar intensity was directed to the various surface trench examinations. Detailed logging and measurements by the writer (Munroe) in 2010 and later by MacAskill in 2012 were coupled with fine element sample collection (plus coal seam analysis submissions, where encountered) and prolific photography of all stages of the analysis. More trenching is recommended.

8.3 Data Verification

Data used in the preparation of this report were confirmed and sealed with Engineer's Stamps by Ted Nunn Edward, P.Eng. All Lab analysis was done by certified firms and each assay result was certified by them. Each lab used (SGS, ACME, etc.) are controlled by strict reporting guidelines.

The new drilling and analysis efforts were not used to increase the amount of coal values on the property, but for refining the work already reported upon in the 2010 submission. Bickford's report and resource estimations continue to remain valid but much more modeling work is required to augment any of the values she report on.

More drilling was undertaken 2016 to assist in the understanding of the deposit and any possible upgrades in tonnage values. The reporting on that work and any from 2012 to 2016 will be reported by others in due course. This current report makes no efforts to discuss the past or current resource valuation numbers. Report data verification is thought to be sufficient as checks and balances have been put in place to ensure quality reporting. Caveats are in place to control the unwarranted discussion of any possible resources or reserves apart from what is already in the public domain. This writer certainly makes no reference or statements pertaining to coal quality or volumes in any manner. This type of reporting will have to be done by others.

In addition, much of the core is still locked in storage should anyone want to referee the results at any time. Coal samples degrade over time so the ability to obtain valid quality information becomes more limited with each passing day.

In her 2011 report, Bickford advised that; "exploratory data were cross-checked between years: for example, the year-2010 geophysical records were compared with those obtained in 1983, 2004 and 2005, to ensure that coals were consistently correlated within each year's collection of geophysical data as well as between year-sets. The year-to-year comparison was important inasmuch as several geophysical contractors have worked at Bingay Main over the years."

This year to year comparison approach continues today and is essentially the only standard of measure that can be taken. These yearly "snapshots" are only possible when new permitting is allowed and the company can action on the permits. All data verification is essentially a yearly process based on multiple labs looking at the same sample sites. The wide range in values is testament to the variety that exists across the property.

9.0 Conclusions and Recommendations

9.1 Interpretation & conclusions

Verification of regional geology, local presence of potentially-mineable coal, and lateral continuity of the major coal beds at Bingay Main, has been accomplished to the senior author's satisfaction, by means of geological mapping, review of historic drilling, execution of current drilling and downhole geophysical programmes, and interpretation of borehole geophysical logs.

The Bingay Main coals had shown a variable, but generally-acceptable, propensity to provide a clean coal product [redacted] Only a small number of samples were examined when compared to the Bickford work. This writer cannot comment on how the current testing affects the previous average.

The Bingay Main coal deposit comprises at least 32 coal beds, whose individual true stratigraphic thickness ranges from 0.3 to 16.2 metres. Of these coals, 24 typically are at least 1 metre thick, inclusive of contained bands of rock. Cumulative stratigraphic thickness of these coals is interpreted to be 62.6 metres, within an overall coal-bearing rock thickness of 460 metres. Coal sections measured to date reflect about 13.6% of the coal-bearing rocks at Bingay Main.

A volumetric model of the Bingay Main coal deposit was constructed, and from that model an estimate of the coal resources at measured level-of-assurance was derived by the company, not this auther. This model is unconstrained as to minimum coal thickness, and in subsequent modelling work, a minimum workable coal thickness cut-off will be required to be applied, so that coal resources may be properly supported by reasonable prospects of economic extraction. A minimum thickness of 60 centimetres is here suggested for use in subsequent modelling work.

Average ash contents based on coal samples of various thicknesses and levels of core recovery, and an ash/specific gravity correlation formula derived from analytical results, have been used to determine the resource tonnages of coal interpreted to be present at Bingay Hill. [redacted] No addition work was done in the 2011-2012 program to even discuss the past resource valuations. Depth of oxidation is assumed to be 10 metres below the top of bedrock. The maximum depth to which the -resource estimate has been taken is 600 metres below the ground surface.

Oxidised coal is principally conceived to be of value as feedstock for the production of activated carbon, perhaps suitable for used in pulverised coal injection (PCI) into blast-furnaces, or as thermal coals.

Further analytical work and further drilling, along with other supporting studies, were recommended in 2010 for the Bingay Main coal property, which Bickford regarded as being a property of merit. Several of these recommendations were followed up and are reported in this 2011-2012 reporting document.

9.2 Recommendations

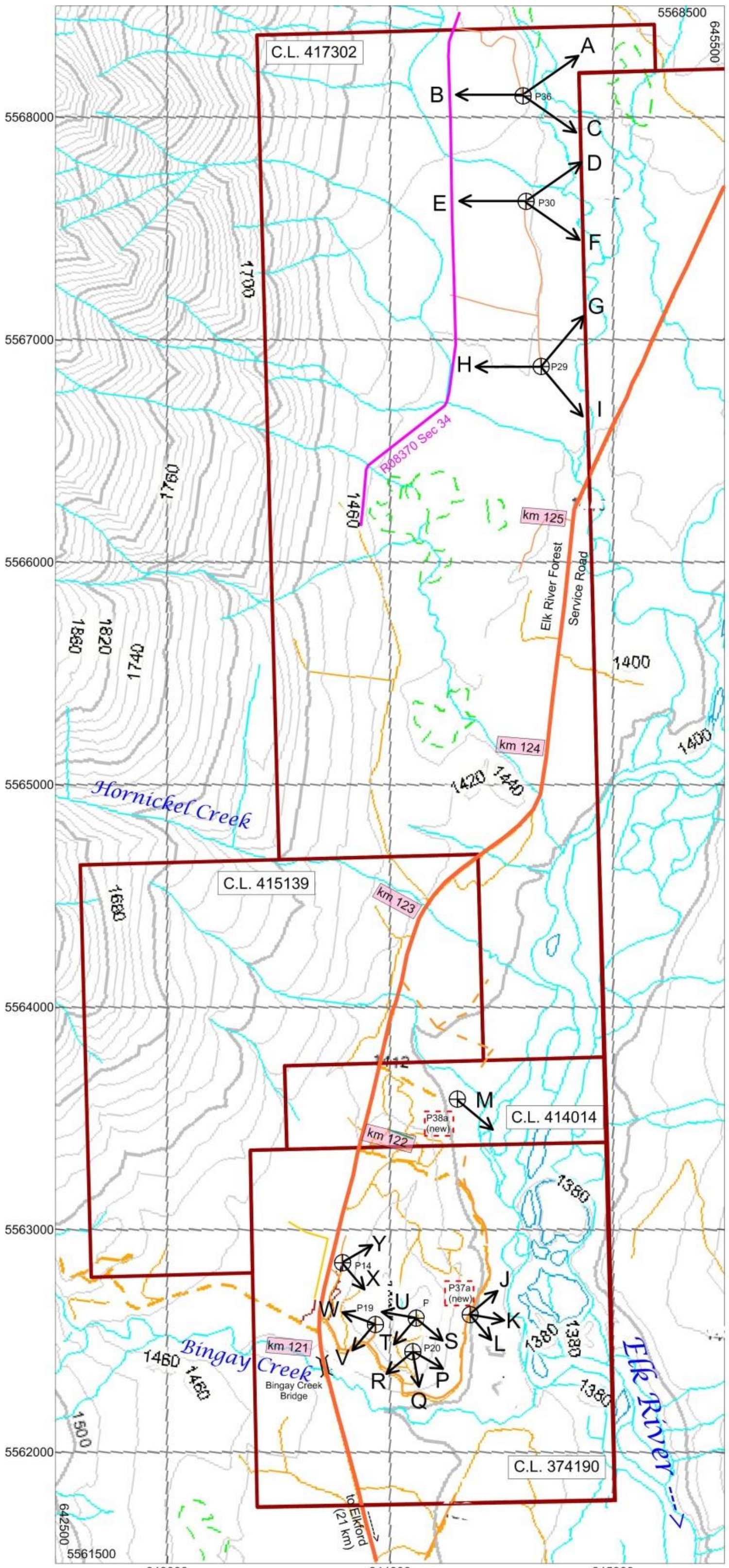
In the 2010 report it was recommended that all parties working at Bingay Main focus on two points:

Firstly, detailed exploration should be aimed at improving understanding of the geometry and quality of coal resources within the eastern, southern and western flanks of Bingay Hill, in support of mine-planning for this area.

- Core drilling should be done, as it affords the only means other than adit driveage, by which solid samples of the coals can be obtained from depths beneath the zone of near-surface oxidation. This was partially done in the 2011-12 programs and should be expanded upon in all parts of the property suite. The following map (Figure 22-1) shows some of the recommended general drilling.
- Trenching should be done along the subcrops of the major coal beds, to collect additional information as to the thickness and internal structure of the coal beds, and further to collect samples of oxidised coal from known, surveyed locations in support of activated-carbon testwork. As direct seam-tracing by means of continuous trenches was unlikely to be approved under the present regulatory regime, consideration was given to excavating a series of closely-spaced cross-trenches along the subcrop traces. This work was completed in October 2012. (McCaskill report)
- Detailed geotechnical mapping within the southern Bingay Hill area should also be done, with the objective of collecting information concerning the orientation, irregularities and frequencies of joints and fractures within potential highwall and endwall strata. This was not done yet and an outstanding matter.
- Borehole and trench positions should be surveyed on an as-needed and ongoing basis.
- Sampling and coal-quality analysis should be done as close to concurrently with retrieval of borehole cores and collection of trench samples as possible. Some of this was done for the oxidation work on the targeted seams and composite samples. More work is always required.

Second, exploratory drilling should be continued within the northernmost part of the Bingay Main and Bingay A and B properties. This drilling would support rapid assessment of whether coal-measures are present at accessible depths within areas which were not successfully addressed by historical work up to the year-2010 drilling programme.

- Drilling of additional holes across the property for both coal quality and pit design. With the poor country rock strength results noted in the Walgren report, opening sections of the pit may be problematic. All holes would be from existing permitted locations. Core drilling is recommended, for the structural information thus made available.



North Area
(in order of priority):
9 holes, 5400 metres

Hole	Pad	Azi.	Dip	Length
A	P36	055	−60	600 m
B	P36	270	−60	600 m
C	P36	125	−60	600 m
D	P30	055	−60	600 m
E	P30	270	−60	600 m
F	P30	125	−60	600 m
G	P29	040	−60	600 m
H	P29	270	−60	600 m
I	P29	140	−60	600 m

South Area
(in order of priority):
14 holes, 4400 metres

Hole	Pad	Azi.	Dip	Length
J	P37a	050	−60	300 m
K	P37a	100	−60	300 m
L	P37a	140	−60	300 m
M	P38a	130	−60	500 m
P	P20	120	−60	300 m
Q	P20	170	−60	300 m
R	P20	230	−60	300 m
S	P18	130	−60	300 m
T	P18	220	−60	300 m
U	P18	280	−60	300 m
V	P19	220	−60	300 m
W	P19	290	−60	300 m
X	P14	140	−60	300 m
Y	P14	060	−60	300 m

Total Drilling:
23 holes, 9800 metres

UTM Grid North
(NAD83 Zone 11)

Legend

Drill pad with multiple boreholes, each one individually lettered

Note: Pads 37a and 38a are new, and will require permit amendment

Drill Pads

Pad	Easting	Northing
P14	643785	5562870
P18	644110	5562600
P19	643930	5562580
P20	644120	5562455
P29	644670	5566870
P30	644610	5567590
P36	644600	5568080
P37a	644360	5562625
P38a	644300	5563590

metres
0 500 1000 1500 2000

Revised: 2 February 2011
(changes to P37a and P38a)

Drawn: C.G. Cathyl-Bickford P.Geo.(BC) Lic.Geol.(WA)
Date: 13 June 2010 Scale: as shown Contours in metres
Base map from http://webmaps.gov.bc.ca/imfx/
UTM NAD 83 Zone 11 Drawing: bingay-recommended-boreholes-2.srf

Centermount Coal Ltd.
Bingay Main Property

Figure 22-1: Recommended drilling

10.0 Statement of Costs

2011 Cost Statement					
Exploration Work type	**Comment**	**Days**			**Totals**
Mimi Chien/Professional			$0.00	$60,000.00	
Bryan /Professional			$0.00	$36,000.00	
Munroe Geological/Professional			$0.00	$7,117.18	
Ron A Swaren/Professional			$0.00	$17,778.12	
Access/Professional			$0.00	$22,677.27	
WSA/Professioanl				$18,743.94	
Moose Mountain/Professional				$11,564.27	
Dunsmuir Geoscience /Professional				$29,375.42	
Barry Ryan/Professional				$1,344.00	
Other (specify)					
				$204,600.20	**$204,600.20**
Office Studies	**List Personnel (note - Office only, do not include field days**				
Reprocessing of data	geological modelling		$0.00	$16,000.00	
BC hydro				$977.16	
Supply				$22,581.21	
				$39,558.37	**$39,558.37**
Airborne Exploration Surveys	**Line Kilometres / Enter total invoiced amount**				
Aeromagnetics			$0.00	$0.00	
				$0.00	**$0.00**
Remote Sensing	**Area in Hectares / Enter total invoiced amount or list personnel**				
Aerial photography			$0.00	$420.00	
				$420.00	**$420.00**
Ground Exploration Surveys	**Area in Hectares/List Personnel**				
Geological mapping				$1,400.00	
				$1,400.00	**$1,400.00**
Geochemical Surveying	**Number of Samples**	**No.**	**Rate**	**Subtotal**	
Sample Preparation	146 samples for all items coal quality analysis			$17,371.23	
Water	Preliminary Hydrogeological Investigation by Watterson Geoscience Inc.		$0.00	$45,746.23	

Core Box				$2,615.04	
Holes	8 holes, 270.50m			$1,865.00	
				$67,597.50	**$67,597.50**
Drilling	**No. of Holes, Size of Core and Metres**	**No.**	**Rate**	**Subtotal**	
Diamond Core	17 holes, 1505.11m.		$0.00	$268,413.88	
Dozer/Cat road maintenance				$14,750.00	
Reverse circulation (RC)	6 holes, 589.18m. for Preliminary Hydrogeological Investigation.		$0.00	$174,189.23	
Bryan'Expense				$29,964.68	
Mimi Chien'Expense				$3,108.41	
Water truck				$25,409.61	
Tools				$1,081.20	
Labor				$17,295.00	
Pump Test for hydrological				$32,892.50	
Mine Electrical Power Design				$28,300.00	
Other (specify)			$0.00	$0.00	
				$595,404.51	**$595,404.51**
Other Operations	**Clarify**	**No.**	**Rate**	**Subtotal**	
Trenching			$0.00	$18,000.00	
Coal quality analysis	146 samples,			$291,909.43	
Sample Tags				$844.00	
excavator				$7,278.65	
Other (specify)			$0.00	$0.00	
				$318,032.08	**$318,032.08**
Reclamation	**Clarify**	**No.**	**Rate**	**Subtotal**	
After drilling	Seeding/Gravel			$18,000.00	
Other (specify)			$0.00	$0.00	
				$18,000.00	**$18,000.00**
Transportation		**No.**	**Rate**	**Subtotal**	
Freight				$10,031.14	
Helicopter (hours)			$0.00	$18,185.40	
Fuel (litres/hour)			$0.00	$34,463.40	
Other					
				$62,679.94	**$62,679.94**
Accommodation & Food	**Rates per day**				

Camp			$0.00	$28,149.25	
Camp Communication				$1,153.70	
Camp Cook				$5,676.00	
Storage Rent				$10,173.60	
Van Rental				$2,121.82	
				$47,274.37	**$47,274.37**
Miscellaneous					
Telephone			$0.00	$1,769.75	
Other (Specify)			$0.00	$0.00	
				$1,769.75	**$1,769.75**
TOTAL Expenditures					**$1,356,736.72**

2012 Cost Statement					
Exploration Work type	**Comment**	**Days**			**Totals**
Mimi Chien/Professional			$0.00	$60,000.00	
Bryan /Professional			$0.00	$36,000.00	
Munroe Geological/Professional			$0.00	$6,420.00	
Ron A Swaren/Professional			$0.00	$28,131.66	
Rescan/Professional			$0.00	$10,429.18	
Spring/Professional			$0.00	$33,878.43	
Norwest/Professioanl			$0.00	$23,900.00	
Other (specify)					
				$198,759.27	**$198,759.27**
Office Studies	**List Personnel (note - Office only, do not include field days**				
Report preparation			$0.00	$1,400.00	
Supply				$1,165.87	
Other (specify)					
				$2,565.87	**$2,565.87**
Ground Exploration Surveys	**Area in Hectares/List Personnel**				
Seismic Surveys	Seismic Reflection Investigation, by Ralf Hansen.		$0.00	$11,417.60	
Other (specify)			$0.00	$0.00	
				$11,417.60	**$11,417.60**

Ground geophysics	**Line Kilometres / Enter total amount invoiced list personnel**				
Logging Services	5 holes, 887.97m.			$31,090.05	
Other (specify)				$0.00	
				$31,090.05	**$31,090.05**
Geochemical Surveying	**Number of Samples**	**No.**	**Rate**	**Subtotal**	
Drill (cuttings, core, etc.)			$0.00	$0.00	
Measurement	Access-Geochemcial Characterization Report			$16,956.25	
Petrology	Rock Photographics Report, **John G. Payne, Ph.D., P.Geol.**		$0.00	$825.00	
Other (specify)			$0.00	$0.00	
				$77,775.46	**$77,775.46**
Drilling	**No. of Holes, Size of Core and Metres**	**No.**	**Rate**	**Subtotal**	
Diamond	8 holes, 1861.49m.		$0.00	$137,197.89	
Rotary air blast (RAB)	5 holes, 896.09m		$0.00	$225,555.20	
Labor				$15,639.00	
Other (specify)			$0.00	$0.00	
				$378,392.09	**$378,392.09**
Other Operations	**Clarify**	**No.**	**Rate**	**Subtotal**	
Trenching	Long: 483m, wide: 1.5m.		$0.00	$19,000.00	
Coal quality analysis	84 samples.			$110,144.27	
Sample Tags				$1,053.00	
excavator Rental				$70,877.00	
Coal Sample analysis	60 samples.			$39,636.39	
Smowplowing				$990.00	
Other (specify)			$0.00	$0.00	
				$241,700.66	**$241,700.66**
Reclamation	**Clarify**	**No.**	**Rate**	**Subtotal**	
After drilling	Seeding/Gravel			$17,000.00	
Other (specify)			$0.00	$0.00	
				$17,000.00	$17,000.00
Transportation		No.	Rate	Subtotal	
truck Rentals			$0.00	$57,972.00	
Helicopter (hours)			$0.00	$5,508.88	
Fuel (litres/hour)			$0.00	$70,966.18	

Tank				$1,906.58	
Other					
				$136,353.64	$136,353.64
Accommodation & Food	Rates per day				
Camp			$0.00	$41,200.00	
Camp Cook				$2,600.00	
Storage Rent				$8,478.00	
Meals	day rate or actual costs-specify		$0.00	$0.00	
				$52,278.00	$52,278.00
Miscellaneous					
Telephone			$0.00	$2,864.89	
Other (Specify)			$0.00	$0.00	
				$2,864.89	$2,864.89
TOTAL Expenditures					**$1,150,197.53**

11.0 References

The principal reference sources for this document were the year-2005 geological report on the Bingay Main (formerly known as 'Bingay Creek') property (Cathyl-Bickford, 2005) and the regional geological reports by Gibson (1985) and Grieve (1992); both of the latter works are available in major university libraries across Canada. Other technical and scientific reports, as listed below, were found to contain relevant information.

AEC Oil & Gas Ltd.

2000: Geological report on AECOG Mosquito d-16-D/82-J-7; *British Columbia Ministry of Energy and Mines*, Petroleum Resources Branch, file WA 13085.

Airey, E.M.

1968: Gas emission from broken coal, an experimental and theoretical investigation; *International Journal of Rock Mechanics and Mineral Science*, volume 5, pages 475 to 494

Anderson, R.B.

1984: 1983 report of exploration activities (drilling report) on the Bingay Creek property, Coal Licence Nos. 7299, 7471, 7688 and 7689; unpublished report dated June 1984 for Utah Mines Ltd.; *British Columbia Ministry of Energy and Mines*, coal assessment report No. 256.

Bannister, W.E.

1957: Geological report describing the stratigraphy and structure of that portion of southeastern British Columbia contained within petroleum and natural gas permit areas 686, 687 and 690; unpublished geological report dated April 23, 1957 for California Standard Company; *British Columbia Ministry of Energy and Mines*, Petroleum Resources Branch, assessment report GR-617.

Brandão, G., Barnett, M. and Bui, T.

2010: Geological modeling of Bingay Creek coal deposit; *Gemcom Software International Inc*., unpublished report dated 9 December 2010 for Centerpoint Resources Inc.

Braumandl, T.F. and Curran, M.P.

1992: A field guide for site identification and interpretation for the Nelson Forest Region; *British Columbia Ministry of Forests*, Research Branch, resource handbook.

Brezovski, R.

2000: Coring & testing program proposal; letter on behalf of AEC Oil & Gas Ltd.; *British Columbia Ministry of Energy and Mines*, Petroleum Resources Branch, file WA 13085.

Bustin, R.M., Brezovski, R. and Nassichuk, B.

2000a: Analysis of coalbed methane, MC5 a-85-L/82-J-2, Elkford, British Columbia, AEC Oil and Gas; *British Columbia Ministry of Energy and Mines*, Petroleum Resources Branch, file WA 13082.

2000b: Analysis of coalbed methane, MC3 d-96-L/82-J-2, Elkford, British Columbia, AEC Oil and Gas; *British Columbia Ministry of Energy and Mines*, Petroleum Resources Branch, file WA 13083.

Bustin, R.M., Cameron, A.R., Grieve, D.A. and Kalkreuth, W.D.

1985: Coal petrology - its principles, methods and applications; *Geological Association of Canada*, Short Course Notes, volume 3, 230 pages.

Cathyl-Bickford, C.G.

2004: Geological report on the Bingay Creek coal property (Kootenay Land District, British Columbia); *Westwater Mining Ltd.*, report 207-6 dated 18 December 2004 for Hillsborough Resources Limited.

2005: Geological report on the Bingay Creek coal property (Kootenay Land District, British Columbia), incorporating the results of drilling done in March, 2005; *Westwater Mining Ltd.*, report 207-12 dated 9 May 2005 for Hillsborough Resources Limited.

Chien, M.

2010: Conversion of coal volumes to tonnages; *Centermount Coal Ltd*., unpublished memorandum dated 29 December 2010.

2011: Approximate resource memo addendum; *Centermount Coal Ltd*., unpublished memorandum dated 31 January 2011.

China National Coal Quality Supervision and Testing Centre

2010: Analysis reports for coal and coke, project WT101336; unpublished analytical reports dated 18 November and 29 November 2010, for Centermount Coal Ltd.

CIM Standing Committee on Reserve Definitions

2005: CIM definition standards for mineral resources and mineral reserves; *Canadian Institute of Mining, Metallurgy and Petroleum*; document dated November 22, 2005, website at *http://www.cim.org/committees/CIMDefStds_Dec11_05.pdf,* viewed 26 January 2010.

Davis, A.

1978: The reflectance of coal; *in* Karr, J. (editor): *Analytical methods for coal and coal products*; Academic Press, New York (New York).

Davis, J.D.

1984: Bingay Creek coal project - update; unpublished report dated February 6, 1994 for Utah Mines Ltd.

Dawson, F.M. and Clow J.T.

1992: Coalbed methane research, Elk Valley Coalfield*; The Canadian Coal and Coalbed Methane Forum Proceedings*, Parksville (British Columbia), pages 57 to 71.

Department of Trade and Industry [United Kingdom]

2003: Glossary of terms; website at *http://www.dti.gov.uk/energy/coal/mine_reviews/ glossary.pdf*, viewed on March 14, 2003.

de Zwart, Ico

2010: Summary of Bingay Environmental Studies – 2010*; Masse Environmental Consultants Ltd*., unpublished letter report for Centermount Coal Ltd., dated 23 November 2010.

Diamond, W.P. and Levine, J.R.

1981: Direct method determination of the gas content of coal, procedures and results; *United States Bureau of Mines*, Report of Investigations 8515, pages 1 to 36.

Donald, R.L.

1984: Sedimentology of the Mist Mountain Formation in the Fording River area, southeastern Canadian Rocky Mountains; *University of British Columbia*, Vancouver (British Columbia), unpublished M.Sc. thesis, 180 pages.

Dunlop, R.L. and Bustin, R.M.

1987: Depositional environments of the coal-bearing Mist Mountain Formation, Eagle Mountain, southeastern Canadian Rocky Mountains; *Bulletin of Canadian Petroleum Geology*, volume 35, number 4, pages 389 to 415.

Elliott, R.E., Jones, A.R.L. and Rippon, J.H.

1984: Procedures in coal-mining geology; *National Coal Board*, Mining Department, London (England), 241 pages.

EnCana Corporation

2004: Elk Valley experimental scheme update; *British Columbia Ministry of Energy and Mines*, Petroleum Resources Branch, open file report regarding Experimental Scheme Approval #00-15-001, dated June 30, 2004.

Evolution Markets LLC

2005: Glossary of terms; website at *http://www.evomarkets.com/otc_glossary.htm*, viewed on September 25, 2005.

Ferguson, H.

2010: Bingay Creek model; *Gemcom Software International Inc*., e-mailed letter report dated 3 December 2010 to Centerpoint Resources Inc.

Fraser, N.
1908: The Elk Valley Coal and Coke Company Limited: report of Norman Fraser, Esquire, Govt. inspector of mines for the Province of Alberta and prospector; unpublished report to Alfred Laurie, Esquire, dated September 24, 1908; *Glenbow-Alberta Institute Archives*, CPR Papers (M2269), Box 199, File 1962.

Gardner, S.L.
1982: A geologic overview of the Bingay Creek coal property, Elk River Valley; unpublished report dated June 6, 1982 for Mr. W. Shenfield; *British Columbia Ministry of Energy and Mines*, coal assessment report No. 254.

2004a: Mineral & coal notice of work and reclamation for Bingay Creek Property; *Hillsborough Resources Limited*, application submitted to British Columbia Ministry of Energy and Mines, dated 7 June 2004.

2004b: 2004 Exploration Program, Bingay Creek Coal Project, Elk Valley, East Kootenay coalfield; *Hillsborough Resources Limited*, unpublished report.

2005: Bingay Creek coal property coal assessment report for coal licences 374190, 414014, 415139 and 417302, NTS map 82J/2W, Kootenay Land District; *British Columbia Ministry of Energy and Mines*, coal assessment report No. 895.

Gibson, D.W.
1977: Sedimentary facies in the Jura-Cretaceous Kootenay Formation, Crowsnest Pass area, southwestern Alberta and southeastern British Columbia; *Bulletin of Canadian Petroleum Geology*, volume 25, pages 767 to 791.

1979: The Morrissey and Mist Mountain formations -- newly defined lithostratigraphic units of the Jura-Cretaceous Kootenay Group, Alberta and British Columbia; *Bulletin of Canadian Petroleum Geology*, volume 27, pages 183 to 208.

1985: Stratigraphy, sedimentology and depositional environments of the coal-bearing Jurassic-Cretaceous Kootenay Group, Alberta and British Columbia; *Geological Survey of Canada*, Bulletin 357.

Glass, D.
1990: Lexicon of Canadian stratigraphy, volume 4: western Canada, including eastern British Columbia, Alberta, Saskatchewan and southern Manitoba; *Canadian Society of Petroleum Geologists*.

Graham, B.C.
1998: Determining coalbed gas content; *Gas Research Institute*, GRI 98/0365.2

Graham, P.S., Gunther, P.R. and Gibson, D.W.

1977: Geological investigations of the coal-bearing Kootenay Formation in the subsurface of the Upper Elk River Valley, British Columbia; in Report of Activities, Part B, *Geological Survey of Canada*, Paper 77-1B, pages 203 to 210.

Grieve, D.A.

1992: Geology and rank distribution of the Elk Valley coalfield, southeastern British Columbia; *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Bulletin 82, 187 pages.

Grieve, D.

1993: Geology of the Elk Valley Coalfield*; British Columbia Ministry of Energy, Mines and Petroleum Resources*, Bulletin 82.

Grieve, D.A. and Pearson, D.E.

1983: Geology of the Greenhills Range, Elk Valley coalfield; *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Preliminary Map No.51, three map-sheets at 1:10,000 scale.

Grieve, D.A. and Price, R.A.

1987: Geological setting of the south half of the Elk Valley coalfield; *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Preliminary Map No.63, one map-sheet at 1:50,000 scale.

Hannigan, P., Lee, P.J., Osadetz, K.G. and Olsen-Heise, K.

1993: Oil and gas resource potential of the Kootenay area of British Columbia; *British Columbia Ministry of Energy and Mines*, Geofile 2001-07.

Henderson, G.G.L.

1956: Preliminary geological report describing the stratigraphy and structure of that portion of south-eastern British Columbia contained within petroleum and natural gas permit areas 686, 687 and 690 and 691; unpublished geological report dated December 7, 1956 for California Standard Company; *British Columbia Ministry of Energy and Mines*, Petroleum Resources Branch, assessment report GR-588.

Hoffman, G.L., Jordan, G.R. and Wallis, G.R.

1982: Geophysical borehole logging handbook for coal exploration; *Coal Mining Research Centre*, Devon (Alberta), 270 pages.

Hughes, J.D., Klatzel-Mudry, L. and Nikols, D.J.

1989: A standardised coal resource/reserve reporting system for Canada; *Geological Survey of Canada*, Paper 88-21, 17 pages.

Jenks, J.

1979: Preliminary geological report, Coal Licence No.5176 (Lot No.9478), Fort Steele Mining Division, N.T.S. 82J/SE; unpublished report dated August 25, 1979, for Specific Natural Resources Ltd.; *British Columbia Ministry of Energy and Mines*, coal assessment report No. 253.

Johnson, D.G.S. and Smith, L.A.

1991: Coalbed methane in southeast British Columbia; *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Petroleum Geology Branch Special Paper 1991-1.

Jordan, G.R. and Engler, R.F.

2007: Technical report, Jiangcang mining area, Muli coal field, Qinghai Province, China; *Norwest Corporation*, unpublished technical report 06-2930 dated 24 April 2007, for East Energy Corp.

Kearey, P., Brooks, M. and Hill, I.

2002: An introduction to geophysical exploration; *Blackwell Science*, Oxford (England), 262 pages.

Kissell, F.N. McCulloch, C.M and Elder, C.H.

1973: The direct method of determining methane content of coalbeds for ventilation design: *United States Bureau of Mines,* Report of Investigations 7767.

Labrecque, J.E.

1959: Geological & geophysical report, British Columbia P&NG permits 841, 842, 843; unpublished report dated October 7, 1959 for Imperial Oil Limited; *British Columbia Ministry of Energy and Mines*, Petroleum Resources Branch, assessment report GR-816.

Lacelle, J.E.H.

1990: Biophysical resources of the East Kootenay area; *British Columbia Ministry of Environment*, British Columbia Soil Survey Report No.20.

Lawrence, G. and Pawson, M.

2004: Location map: Bingay Creek coal property, Elk Valley, southeastern British Columbia, showing regional geology and infrastructure; unpublished geological map dated November 15, 2004, on behalf of *Lawrence Consulting and Resources Ltd.*, for Hillsborough Resources Ltd.

Leonard, J.W., Humphreys, K.K., Lawrence, W.F., McMillan, B.G., and Muter, R.B. (editors)

1979: Coal preparation; *American Institute of Mining, Metallurgical and Petroleum Engineers*, New York (New York), fourth edition.

Marshall, J.R.

1920: Upper Elk and Upper Highwood rivers, British Columbia and Alberta; *Geological Survey of Canada*, Publication No.1980; one coloured map-sheet at 1:250,000 scale.

1921: Upper Elk River Valley, British Columbia; *Geological Survey of Canada*, Summary Report 1920, Part B, pages 7 to 10.

McCulloch, C.M., Levine, J.R., Kissell, F.N. and Duel, M.

1975: Measuring the methane content of bituminous coalbeds; *United States Bureau of Mines*, Report of Investigations 8043; NTIS: PB-242139, 1975; pages 1 to 22.

McKenny, C., Mills, D., Leslie, D., Griffiths, R. and Komenac, K.

2003: Review of the Fording River Operations; *Elk Valley Coal Corporation*, unpublished technical report dated April 29, 2003.

Monahan, P.A.

2000: The geology and oil and gas potential of the Fernie-Elk Valley area, southeast British Columbia; report dated December 2000 for *British Columbia Ministry of Energy and Mines*.

Morin, K.A. and Hutt, N.M.

2004: Bingay Creek Project - first-phase ML/ARD results and recommendations; *Minesite Drainage Assessment Group*, unpublished report dated 2 November 2004 for Hillsborough Resources Limited.

Munroe, R.G.R.

2010a: Geological examination of trench works on the Bingay Creek property, Elk River Valley north of Elkford, British Columbia; *Munroe Geological Services Ltd*., unpublished report dated 12 October 2010 for Centermount Coal Ltd.

2010b: Bingay coal property structural analysis; *Munroe Geological Services Ltd*., unpublished report dated 10 November 2010 for Centermount Coal Ltd.

2010c: Regional structural analysis; *Munroe Geological Services Ltd*., unpublished report [date not stated] for Centermount Coal Ltd.

Norwest Corporation

2005: Bingay Creek Property: small mine permit application dated January 2005, submitted to British Columbia Ministry of Energy and Mines on behalf of Hillsborough Resources Limited.

Pearson, D.E.

1980: The quality of Western Canadian coking coal*; Canadian Mining and Metallurgical Bulletin*, January 1980.

Pearson, D.E. and Duff, P.McL.D.

1976: Studies in the East Kootenay coalfields; *British Ministry of Energy, Mines and Petroleum Resources*, Geological Fieldwork in 1975, Paper 1976-1, pages 93 to 99.

Price, R.A., Grieve, D.A. and Patenaude, C.

1992: Geology and structure cross-section, Fording River (west half), British Columbia - Alberta; *Geological Survey of Canada*, Map 1824A, scale 1:50,000.

Ruby, C.M., Horne, J.C. and Reinhart, P.J.

1981: Cretaceous rocks of western North America - a guide to terrigenous clastic rock identification; *Research Planning Institute, Inc.*, 100 pages.

Ryan, B.D.

2010: Preliminary gas desorption results, Bingay Creek coal property; unpublished letter report dated November 17, 2010 for Centermount Coal Ltd.

Ryan, B.D. and Grieve, D.A.

1996: Source and distribution of phosphorus in British Columbia coal seams; *British Columbia Geological Survey Branch*, Geological Fieldwork 1995, Paper 1996-1, pages 277 to 294.

Ryan, B.D. and Khan, M.

1998: Maceral affinity of phosphorus in coals from the Elk Valley coalfield, British Columbia; *British Columbia Geological Survey Branch*, Geological Fieldwork 1997, Paper 1998-1, pages 28-1 to 28-19.

Schori, A.

2005: Bingay Creek Coal Project: soil inventory and soil reclamation suitability assessment; *A. Schori Consultants Inc.*, unpublished report dated January 2005 for Norwest Corporation.

Sharma, P.

2005: Petrographic report on 9 drill hole composites; *Elk Valley Environmental Services*, unpublished report for Hillsborough Resources Limited.

Shenfield, W. and Gardner, S.

1996: 1996 exploration summary, Bingay Creek coal property, Elk Valley, British Columbia; unpublished report dated December 1996 for Iron Creek Exploration Ltd.; *British Columbia Ministry of Energy and Mines*, coal assessment report No. 849.

Taplin, A.C.

1974: Geological report: 1974 Elk Valley exploration program, NTS 82J 2/W and J 7/W; unpublished technical report dated December 23, 1974, for Cominco Ltd.; *British Columbia Ministry of Energy and Mines*, coal assessment report No. 261.

Turnbull, J.M.

1904a: Preliminary description of south coal field, being a portion of the C.P.R. Co's Elk River coal lands north of Michel B.C.; unpublished manuscript dated December 23, 1904; *Glenbow-Alberta Institute Archives*, CPR Papers (M2269), Box 199, File 1962.

1904b: South coal field compared with north field; unpublished report dated December 23, 1904; *Glenbow-Alberta Institute Archives*, CPR Papers (M2269), Box 199, File 1962.

Ward, C.R.

1984: Chemical analysis and classification of coal; Chapter 1, *in* Ward, C.R. (editor*), Coal Geology and Coal Technology*, Blackwell Scientific Publications, Carlton, Victoria (Australia).

Wilson. A.W.G.

1904: Report on the Elk River coal fields: section re development; unpublished report dated December 2, 1904, for Mining and Metallurgical Department of Canadian Pacific Railway Co.; *Glenbow-Alberta Institute Archives*, CPR Papers (M2269), Box 199, File 1962.

Wolfhard, N.R.

1967: Elk River coal, NTS 82 J/2W and 82 J/7W; unpublished report dated September 11, 1967, for Cominco Ltd.; *British Columbia Ministry of Energy and Mines*, coal assessment report No. 261.

(from Geological Report by C.G. (Gwyneth) Cathyl-Bickford P.Geo. Lic. Geo, in 2011 Item 23)

12.0 Certificate of Qualification

I, Edward J. Nirrin, residing at 4226 Granger Road, Nelson, British Columbia, declare:

I. That I have been associated with the mining industry for 49 years primarily working in project engineering and management for mine operating companies. Twenty nine of these years were experienced in the coal and industrial mineral industries for: Kaiser Resources Ltd., An Tai Bao Surface Coal Mine, Greymouth Coal, Crystal Graphite Corporation and Centermount Coal Ltd. My metal mining experience included Cominco Ltd. (four operations), Lomex Mining Corporation, Echo Bay Mines, Reeves MacDonald Mines, and Granduc Operating Company.

2. My experience includes exploration including assessment reports, geological engineering, civil/structural engineering, mine engineering, contract management, safety programs, financial analyzes, governmental affairs and project/operations supervision and management in both surface and underground mining environments.

3. I obtain a degree in Mining Engineering from Queens's University and Mineral Resource Geology from Northern Alberta Institute of Technology.

4. I am registered as a Professional Engineer in the Province of British Columbia.

5. I have been employed as Vice President — Technical of Centermount Coal Ltd since 2009.

6. Since the beginning of Centermount's Bingay project, I have managed all exploration related programs, and have been the Qualified Person for Geological Resource Modelling.

Edwarcp. Nunn, P. Eng.

4 March 2016

I, Richard G.R. Munroe, residing at 1408 Madrona Place, Coquitlam, British Columbia, declare that:

1. I am a geologist and have been employed in mineral exploration, industrial mineral development and earth science studies with industry and government since 1977. I was involved as either a consultant or employee of Lafarge Canada and its associated names from 1977 to 2002. I held the position of President of Sutherland Minerals Ltd., which is a private mining development corporation in Manitoba. I am a past director of Teslin Resources Ltd., which is a publicly traded corporation in British Columbia. In addition, I am the President of Munroe Geological Services Ltd., a private company registered in BC. I am also the Chief Executive Officer of Augustus Mining Corp. and Tiberius Gold Corp, which are private companies registered in BC. There is no current linkage between the affairs of Centermount Coal Ltd., Sutherland Minerals Ltd., Teslin Resources Ltd., Augustus Mining Corp. or Tiberius Gold Corp. that has anything to do with the basis of this reporting.
2. I obtained a Bachelors degree in Earth Science from the University of Manitoba in 1977. I was installed as a Fellow of the Geological Association of Canada in 1984.
3. I am actively registered as a Professional Geoscientist with the Association of Professional Engineers and Geosciences of British Columbia, Alberta and Manitoba.
4. I visited the Bingay Creek area between July 9, 2010 and November 26, 2010 and on many occasions since that time.
5. I am not an employee or insider of the issuer.
6. I have read the definition of "qualified person" set out in National Instrument 43-101 for the role filled in this report and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of this assessment report. As a Qualified Person, I have read the Instrument and the Assessment Report has been prepared in line with that instrument's format. I have had no involvement in any manner with any resource valuations or calculations contained in any of the past or current reports.
7. I am responsible for the preparation of the technical report titled "Bingay Coal Property Structural Analysis" of November 10, 2010". I did not have prior involvement (pre-July 2010) with the properties that are the subject matter of that Technical Report.
8. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in this Assessment Report, the omission to disclose which makes the Assessment Report misleading.
9. I am independent of the issuer applying all of the tests in section 1.5 of National Instrument 43-101
10. I consented to the filing of the "Bingay Coal Property Structural Analysis of November 10 2010" , with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication and the public company files on their websites accessible by the public, of that Technical Report. That consent stands.

Dated: March 4, 2016

Richard Munroe, B.Sc., F.G.A.C., P.Geo. (APEGBC, AGEGM, APEGA)

2011 Bingay Coal Exploration Project Detail

Hole Number	Coordinates (UTM, NAD83)				Drill Hole		All Hole Location map	Pad Hole map	Pad map	Well Core Log	Wireline log	Samples	Assay Samples		Assay	Cross Section	
	Easting	Northing	Elevation	Depth (m)	Azimuth	Dip						Coal	Coal		FSI		
													Canada	China			
2011-1a(ka)	644365	5562645	1395.8	185.01	31.6	64	X	P16		X				2	G-factor	3,5	Geo-Drillhole, Rod Swaren
2011-2a(ja)	644407	5562712	1395	364.85	80.4	64	X	P16		X							Geo-Drillhole, Rod Swaren
2011-3a(38a)	644301	5563567	1404	95.57	160	60	X	P8								16	Geo-Drillhole, Rod Swaren
2011-CQ01	644071.80	5563282.48	1422.05	41.0		90	X	P9	2004-6V			31	#10		3.5		coal quality for Bulk Samples
2011-CQ02	644315.17	5563016.46	1400.98	52.5		90	X	P17	2004-7V			17	#20		6.5		coal quality for Bulk Samples
2011-CQ03	644389.05	5563044.11	1386.71	27.0		90	X	P17	2010-16A			12	#19		9.0		coal quality for Bulk Samples
2011-CQ04	643854.17	5563001.79	1420.98	4.0		90	X	2010-38A				3	#3L		9.0		coal quality for Bulk Samples
2011-CQ05	643987.47	5562702.89	1452.03	42.0		90	X	2004-2A				25	#12				coal quality for Bulk Samples
2011-CQ06	643992.50	5562702.90	1452.35	32.0		90	X	2004-2A	EAST 7m to CQ05			18	#12R		2.0		coal quality for Bulk Samples
2011-CQ07	644086.09	5563305.95	1422.37	61.0		90	X	P9	2004-6V			27	#10		7.0		coal quality for Bulk Samples
2011-CQ08	643925.36	5563203.52	1423.95	11.0		90	X	P12	2010-18A			11	#4		7.0		coal quality for Bulk Samples
MW-11-1D	644050.0	5562270.0	1419.50	102.11		90	X	P20		X	X						Watterson Report for PACK TEST
MW-11-2D	644325.0	5562318.0	1399.50	109.73		90	X	On the road		X	X						Watterson Report for PACK TEST
MW-11-3D	644429.3	5562524.1	1390.50	117.35		90	X	CAMP		X	X						Watterson Report for PACK TEST
MW-11-4D	644344.6	5563366.4	1388.50	151.18		90	X	P10		X	X						Watterson Report for PACK TEST
MW-11-5D	644348.0	5562562.2	1397.50	102.41		90	X	P16		X	X						Watterson Report for PACK TEST
MW-11-5S	644460.0	5562760.0	1392.00	6.40		90	X			X							Watterson Report for PACK TEST

1. BULK SAMPLE TESTING Report (2011-CQ01 TO CQ08)
2. Preliminary Hydrogeological Investigation, Watterson Geoscience Ltd.
3. Preliminary Geotechnical Study-Sandstone Durability Report, Walgren Soils Testing Ltd.
4. SGS Coal Quality Analysis Results
5. Bingay Drillhole Core Selenium Analysis Result
6. Model: Gemcom and China Coal

October 2012- Bingay Drill Hole Detail May- Oct 2012

2012 Bingay Coal Exploration Project Detail

Hole Number	Coordinates (UTM, NAD83)				Drill Hole		All Hole Location map	Pad Hole map	Pad map	Well Core Log	Wireline log	Assay Sample	
	Easting	Northing	Elevation	Depth (m)	Azimuth	Dip						Coal	
												Canada	
2012-01Ra	643849.0	5563464.0	1429.0	350.52	129	45	X	P12	X	X	X	8	JR Drilling
2012-02Ra	644164.0	5563943.0	1399.0	426.72	135	50	X	P5	X	X	X	76	JR Drilling
2012-03Ra	644336.0	5563812.0	1394.0	159.88	125	51	X	P7	X	X	X		JR Drilling
2012-04Da	643430.0	5562575.0	1443.0	118.17	200	51	X	P19	X	X	X	10	Spring MacAskill
2012-05Da	644110.0	5562595.0	1486.0	218.85	200	51	X	P18	X	X	X	18	Spring MacAskill
2012-06Da	644120.0	5562460.0	1462.0	280.75	135	51	X	P20	X	X	X	5	Spring MacAskill
2012-07Da	644005.0	5563115.0	1430.0	218.82	135	51	X	P12	X	X	X		Spring MacAskill
2012-08Da	644312.0	5562570.0	1405.0	87.78	290	47	X	CAMP	X	X	X	27	Spring MacAskill
BH12-1a	644050.0	5562270.0	1419.5	279.08	180	70	X	ROAD/P20-P21		X	X		JR Drilling
BH12-2a	644456.0	5562789.0	1390.0	102.18		69	X	P16	X	X	X		JR Drilling
BH12-3a	644470.0	5562776.0	1395.0	305.00		60	X	P16	X	X	X		JR Drilling
MW12-1D	644405.0	5562369.0	1403.0	107.67			X	P9	X	X	X		JR Drilling
MW12-2D	644456.0	5562790.0	1395.0	102.18			X	P16	X	X	X		JR Drilling

1. Drilling: 8-geoholes; 5-coal quality holes
2. Rock Photographics Report, July 2012
3. Access-Geochemcial Characterization Report, Apr. 2012
4. Seismic Reflection Investigation, by Ralf Hansen, Oct. 2012
5. Model: Norwest, Feb. 2012
6. Waste Rock Selenium Kinetic Testing, 27 May,2013

2011 Appendices:

Appendix I

2011 Samples, Analysis Results & Certificates

Appendix II

2011 BINGAY MAIN BULK SAMPLE (Oxidized Coal) TESTING

Pic 1: BINGAY MAIN DRILLING SITE FOR BULK SAMPLE, SEPT 2011

Pic 2: BINGAY MAIN DRILLING SITE FOR BULK SAMPLE, SEPT 2011

Pic 3: BINGAY MAIN DRILLING SITE FOR BULK SAMPLE, SEPT 2011

Pic 4: BINGAY MAIN DRILLING SITE FOR BULK SAMPLE, SEPT 2011

Pic 5: BINGAY MAIN DRILLING SITE FOR BULK SAMPLE, SEPT 2011

Appendix III

2011 Bingay Main Coal Borehole CoreLog lithology Description & Core Box Photos

2011-Ka
2011-01a
Diamond Drill
Rod Swaren

Core	Box		Top (ft)	Recovery	Depth (m)	Lithology	Core Description	Apparent Dip of Bedding	Core cut (m)		RQD (cm)														Note
	From	To							Recovery	Run	core sticks ≥10cm														
1					0.00		Casing to 21 feet.		1.78	1.83															
			21	1.4	6.40	Gravel	till - small pieces of sandstone core from larger rocks in the gravel.																		
				0.38	7.80	Siltstone	dark gray, grading to fine grained light grey sandstone at base. Thin coaly bards throughout top at in sandstone. Some polishing and slickensides showing slippage along coal. No fizz with HCL.	40																	
2			27	0.26	8.23	Siltstone	Sandstone (50/50) - thinly interbedded with very thin carbonaceous to coaly beds. Bedding is wavy and variable: SST is light grey and siltstone medium grey.	50	3.04	3.04	29	19	35	18	34	14	10	15	20	13					
				0.31	8.49	Mudstone	silty, medium to dark grey, carbonaceous coaly in basal 0.04m.																		
				2.01	8.80	Siltstone	Sandstone (50/50) - medium to thinly bedded and interbedded. More sandy in centre and silty at top and base sandstone light grey, quartzitic with cross-bedding and coasening to fine and medium grained in centre. Very thin carbonaceous bands grained into silty mudstone at base. hard minor vertical fractions. Minor fizz in med grained SST.	40																	
	1	2		0.72	10.81	Mudstone	silty medium hard, dark grey, more carbonaceous in bottom half and less silty down. minor thin coaly bands near base with slippage shown by polishing and slickensides.																		
							minor thin coaly bands near base with slippage shown by polishing and slickensides.	45																	
3			37	0.17	11.28	Sandstone	fine grained, light grey, hard, quartzitic with thin interbeds of mudstone and carbonaceous mudstone. Some cross-bedding. Minor fizz.	35	3.04	3.04	12	11	15	12	33	19	23	32	20	20	13	24			
				1.24	11.45	Siltstone	muddy near base thin sandy bands in upper 2/3. very thin carbonaceous bands scattered more slippage on these with polishing. Medium hard, medium grey to dark coaly near base. No fizz.	40																	
				0.77	12.69	Sandstone	silty at base light grey salt and pepper texture, quartzitic, fine to almost medium grained near top one vertical fracture in middle with some calcite. Some minor very thin coaly to carbonaceous laminations near top. Sandstone is well sorted, well indurated. Minor fizz.	40																	
				0.86	13.46	Siltstone	slightly muddy, medium grey, very thin very fine grained sandstone bands scattered, minor fracture across-bedding with calcite mineralization. No fizz.	40																	
4	2	3	47	0.36	14.33	Siltstone	same as above continued slightly muddy. Minor fizz.	45	3.04	3.04	29	15	24	24	32	32	16	10	29	26	21	10	15		
				0.04	14.69	Siltstone	sandier with bands and sand throught slightly ferrous. Fizz slight to med greenish.	45																	
				0.31	14.73	Siltstone	Sandstone - finely interbedded. Light grey and medium grey very fine carbonaceous laminations in bottom half with polishing on slippage on bedding. Turbioaceousing top half slightly ferric. Slight fizz.	45																	
				1.97	15.04	Siltstone	sadier in top half, muddier and more carbonaceous and dark grey in bottom half. Very minor thin coaly bands and inclusions in bedding with minor slippage. No fizz.	40																	
5	3	4	57	1.45	17.37	Siltstone	medium in top 1/2 with sandstone at base. Minor fizz in SST at base.	40	3.04	3.04	13	38	43	30	21	10	15	24	38	20	10	10			

				1.59	18.82	Siltstone	Muddy Siltstone/Sandstone - thickly to medium interbeds. Sandstone is very fine grained, light grey with slight brownish ferric beds. A few very minor coaly laminations. No fizz.Slippages, polishign and slickensides on some bedding surfaces. more coaly inclusions and core is slightly broken up near base. No fizz.	40																	
							more coaly inclusions and core is slightly broken up near base. No fizz.																		
6			67	0.3	20.42	Siltstone	sandy hard, medium grey, some fractures and movement with polishing and slickensides. Fairly sharp bedding contact with underlying ironstone. No fizz.		3.04	3.04	17	16	38	30	11	69	20	42							
				0.17	20.72	Ironstone	very fine grained, slightly brownish medium grey. Some calcite filled cracks and fractures. Slight fizz turns greenish.	45																	
				1.28	20.89	Siltstone	muddy in top half more sandy in bottom half with thin sandstone beds and bands. Sharp basal contact with underlying sandstone, sandy basal section is slightly carboncaeous. Medium grey, upper part darker grey and carbonaceous. Minor calcite filled gractures at top. Slight fizz no SST.	40																	
	4	5		0.65	22.17	Sandstone	thinly laminated and within upper 1/2 with some silt in bottom 1/2. thin carbonaceous mudstone bands and slightly coaly. Bands in top 1/2. SST fine to very fine. Good fizz top 1/2 med to bottom 1/2.	40																	
				0.64	22.82	Sandstone	as above but silty interbeds in top 1/3. sandstone fine to finely medium grained cross-bedding with minor thin coaly bands. hard, light grey salt + pepper texture. Good fizz.																		
7			77	3.04	23.47	Sandstone	Siltstone (60/40) - sandstone is thinly banded and interbedded with silstone thinly at top and bottom with thick beds of sandstone and some silstone in middle. Minor cross-bedding and very thin carbonaceous and coaly laminations throughout. Sandstone is fine grained in most and almost medium grained in center. Minor fizz SST in middle.	35	3.04	3.04	40	13	14	22	24	45	24	42	12	33					
8			87	0.25	26.52	Siltstone	Sandstone - thinly interbedded with fine calcite fracture and white calcite flecks throughout randomly scattered. Thin coaly and carbonaceous laminations. No fizz.	40																	
	5	6		0.8	26.77	Siltstone	sandy at top with sandstone laminations and muddy at bottom. Medium grey, hard. Sandstone light grey and fine grained.No fizz.	40																	
				0.19	27.57	Mudstone	slightly silty, black, carbonaceous, medium, hard thin calcite on bedding. Some polishing on thin coaly laminations with slippages occurered.No fizz.	40																	
				0.16	27.76	Siltstone	slightly muddy medium grey, meidum hard, with sharp basal bedding contact with sandstone.No fizz.																		
				1.64	27.92	Sandstone	fine to almost medium grained, quartzitic with thin wavy irregular muddy carbonaceous laminations throught. Some coaly laminations, minor cross-bedding and unit is competent, hard, well indurated somewhat silty near top some calcite filled cracks across-bedding in top 1/3.Minor fizz top, med fizz bottom.	35-40																	
9			97	1.6	29.57	Siltstone	sandstone (50/50) - thin to medium interbeds siltstone med greym sandstone light grey. Medium hard to hard, minor thin carbonaceous laminations.No fizz.	40	3.08	3.04	13	13	22	20	14	47	61	53	13						
	6	7		1.48	31.17	Siltstone	Silty mudstone/sandstone (40/30/30) - mainly silky mudstone at top and very bottom - siltstone sandstone are thin to thinly medium bedded in remainder. Some very minor cross-bedding. Moderately hard and competent medium grey with lighter grey sandstone.Minor fizz.	40																	

10			107	1.24	32.61	Mudstone	slightly silty, carbonaceous with minor ironstone bands that are medium brown has light grey thin sandstone beds scattered throughout. Cabonaceous and most is dark grey color. Moderatly hard to hard. Competent and well indurated.No fizz.	40	3.04	3.04	120	20	41	26	53	10	12								
				0.7	33.85	Siltstone	sandstone (50/50) - hard sandstone light grey and moderately cross-bedded with black carbonaceous laminations. Silstone medium grey with thin SST beds. Sandstone fine to finely medium grained. More silty at base.No fizz.	40																	
				0.7	34.55	Sandstone	light grey, fine to almost medium grained with thin carboanceous muddy laminations at top, salt and pepper texture two calcite filled fractures across-bedding. Sharp basal contact with mudstone.No fizz.	30																	
				0.08	35.25	Mudstone	black, carboanceous slightly silty.																		
	7	8		0.32	35.33	Mudstone	dark, grey, silty, moderately hard.																		
11			117		35.66	Sandstone	silty mudstone/siltstone (40/20/40) - thin to medium interbeds with dark grey moderately hard silty mudstone, medium grey harder siltstone and hard quartzitic light grey sandstone.No fizz to minor on SST.	35	3.04	3.04	11	11	21	16	26	19	14	67	17	36	15	13			
					37.66	Sandstone	is fine to very fine grained and shows turbioty in upper 1/3 of unit minor cross-bedding and thin carbonaceous laminations. Minor thin calcite filled fractures across-bedding in upper 1/2. silty mudstone at base.																		
12			127	0.9	38.71	Mudstone	silty dark, grey, moderately hard carboncaeous more silty in top 1/2. minor thin very fine grained sandstone beds.No fizz.	35	3.04	3.04	13	52	19	12	23	42	29	12	43	14					
	8	9		0.95	39.61	Mudstone	continues getting siltier downwards.No fizz.	40																	
				1.19	40.56	Siltstone	muddier in top 1/2 sandier in bottom half with sandsotne interbeds near base sandstone and carbonaceous beds at base are thinly interlaminated with dire vertical fracture.No fizz.	30																	
13			137	1.12	41.76	Sandstone	siltstone (80/20) - sandstone with thin to thinly medium siltstone interbeded mainly in bottom 1/3. sandstone fine to almost medium grained, well sorted, quartzitic, light grey, hard. Some muddy carboanceous slippage on coaly bands near base with polishing SST has salt + pepper texture.No fizz.	45	3.04	3.04	10	14	30	16	23	13	15	28	10	10	10	15	14	15	
	9	10		0.88	42.88	Sandstone	silstone (40/60) - more siltstone with thin fine grained sandstone and carbonaceous bands interbeds.No fizz.	40																	
				1.04	43.76	Sandstone	siltstone (60/40) - more sandstone, some almost medium grained. Salt + pepper texture carbonaceous + coally bands very thin and scattered some bross-bedding.No fizz.	35																	
14			157	1.55	47.85	Sandstone	siltstone (50/50) - more sandy at top thinly to medium interbeds. More the same as preceding but centre portion is broken + fractured with calcite on fracture planed.No fizz.	45	3.04	3.04	15	12	11	13	20	39	10	10							
				1.15	49.40	Sandstone	with thin carbonaceous and silty bands. Almost medium grained slight cross-bedding. Some thin bands are coaly with slippage along these soft beds.No fizz.																		
	10	11		0.2	50.55	Sandstone	as above continued. [Shenfield Sandstone - bottom]	35																	
				0.14	50.75	Mudstone	slightly silty. Moderately hard, dark grey.																		
				0.41	50.89	Mudstone	silty at top, muddy and more carbonaceous and coaly down to basal contact with coal.	35	1.81	3.04	32														
				0.4	51.30	Coal	powdered fine, dull with some bright flecks. [coal] [seam 12 - top]																		
				1.23	51.70	missing	missing coal most likely.[coal] [seam 12]																		
				0.7	52.93	Coal	dull broken ground.[coal] [seam 12]																		
				0.3	53.63	Coal	hard blocky, but broken with bright bands.[coal] [seam 12]																		
15			167	2.64	50.90	missing	missing [coal? Most likely.][coal] [seam 12]																		
				0.4	53.54	Coal	dull broken some bright bands.[coal] [seam 12]																		

16			177	2.74	53.95	missing	missing [coal most likely.][coal] [seam 12]		0.3	3.04															
				0.3	56.69	Coal	dull hard borken minor bright flecks.[coal] [seam 12 - floor]																		
17			187	0.05	57.00		small ground lumes probably left from previous run coal.[coal]		1.13	3.04															
				0.8	57.05	Mudstone	coaly fragments throughtou - fractured, polished and slickensided. Some calcite in minor thin fractures.[parting]																		
	11	12		0.1	57.85	Mudstone	continued.[parting]																		
				0.18	57.95	Coal	broken ground dull, hard. Lumps.[coal] [seam 11 - roof]																		
				1.91	58.13	missing	missing [coal probably.][coal] [seam 11]																		
18			197	1	60.05	missing	missing [coal most likely.][coal] [seam 11 - floor]		1.3	3.04															
				0.2	61.05		hard coaly lumps rounded, dull, may be left from last run?[coal]																		
				0.13	61.25	Coaly Mudstone	hard, brown streak, coaly bands, broken, don't know exact stratigraphic location. [no-E-log][parting]																		
				0.48	61.38	Coal	hard blocky, dull broken, bright bands, slightly dirty at top.[coal]																		
				0.12	61.86	Mudstone	medium grey dull.[parting]	35																	
				0.1	61.98	Coal	hard dull with bright bands.[coal]																		
				0.08	62.08	Mudstone	slightly coaly.[parting]																		
				0.16	62.16	Coal	dull, minor birght bards some cleating. [coal]																		
				0.73	62.32	missing	[coal brobably.][coal]																		
19			207	0.14	63.09	missing	[coal?][coal]		2.9	3.04	51	31	20	54	10	13	13	10	14	10					
				0.07	63.23	Coal	ground lumps rounded and washed. Dull with minor bright bands.[coal]																		
				0.26	63.30	Mudstone	carbonaceous, coaly lenses and roots: rooting!!																		
				2.15	63.56	Sandstone	siltstone/silty mudstone (25/45/30) - interbedded thin to medium thick sandier in top 1/2 muddier in bottom. Silty throughtou. Coaly lenses and debris slattered throughout. No fizz.Minor calcite filled fractures across-bedding. [Bingay Sandstone - top]	35																	
	12	13		0.42	65.71	Mudstone	silty, coaly lenses and debris, minor very thin very fine grained SST. Beds high angle polished fracture at bottom.No fizz.	40																	
20			217	3.1	66.14	Sandstone	Siltstone (50/50) - thin and medium beds interbedded sandstone very fine to fine grained. Light grey, quartzitic thin calcite filled vertical fractures and high angle fractures across-bedding. [Bingay Sandstone]	40	3.1	3.04	11	24	19	37	45	21	14	34	17						
21			227	0.53	69.19	Sandstone	Muddy siltstone (50/50) - muddy siltstone in top 1/2, coaly pieces + plart material. Some rooting + thin coaly beds and lenses. [Bingay Sandstone]	40	3.04	3.04	13	15	36	16	25	20	26	43	25						
	13	14		0.3	69.72	Coal	bright medium hard flacky in part and blocky.[coal]																		
				2.21	70.02	Sandstone	fine to very fine grained with thin siltstone + muddy carbonaceous interbeds, minor cross-bedding. Hard, light grey, quartzitic.No fizz. [Bingay Sandstone - bottom]	40																	
22			237	1.58	72.24	Sandstone	minor siltstone thinly interbedded as well as carbonaceous thin lenses SST. Very fine grained, bross-bedding near base. Minor thin calcite filled fractures across-bedding. Lots of coaly plant ...in thin coaly layers. No fizz.	40	3.16	3.04	17	16	27	25	47										
	14	15		0.27	73.82	Siltstone	fine SST beds at top calcareous in bottom 1/3.Good fizz.																		
				0.1	74.09	Linestone	carbonacoues - linestone? (marine band) partly dolomitic?? High fizz. [marine]																		
				1.21	74.19	Sandstone	siltstone (70/30) - one fracture with oil traces. Other fine calcite filled fractured across-bedding. Light grey, quartzitic very fine to fine grained with thin siltstone interbeds.No fizz. [oil]	45																	
23			247	2.52	75.29	Sandstone	silstone - sandstone light grey, very fine to fine grained, thin calcite fractures across-bedding. Conpetent well indurated. Thinly to medium interbedded. Minor thin coaly bands.No fizz.		3.04	3.04	39	23	12	10	53	79	52								
	15	16		0.52	77.81	Sandstone	siltstone - contniued from above.No fizz.	40																	

24				3.07	78.33	Sandstone	silstone/silty mudstone (45/45/10) - mainly sandstone in bottom half siltstone in top 1/2 and silty mudstone scattered throught upper 1/2 in thin beds. Thin calcite filled fractures across-bedding.Minor fizz SST.	35	3.07	3.04	36	18	20	23	44	50	17	14	24	13	10	20			
25			267	0.41	81.38	Sandstone	siltstone (50/50) - with thin mudstone and muddy carbonaceous stringers/laminations coaly lenses scattered.No fizz.	40	3.04	3.04	10	17	19	40	13	13	23	12	15	20	37				
	16	17		2.63	81.79	Sandstone	siltstone - continued some turbioty in central part. Bottom 1/3 has vertical irregualr fractures some slippage on bedding with polishing, slikensides and calcite.No fizz.	35																	
26			277	1.48	84.43	Sandstone	silstone (50/50) - continued somewhat muddier near base. Thin calcite veins throughout and vertical fractures at very top. More carbonaceous at bottom plant material scattered throughtou.No fizz.		2.94	3.04	10	19	17	17	30	27	18	35	51	28	12				
	17	18		1.47	85.91	Sandstone	siltstone (50/50) - more argrlacous at top. Thin to medium interbeds SST very fine to fine grained. Thin calcite fracture with oil seeping from one or two larger ones. Also pyrite visible on fracture surfaces. Minor fizz SST. [pyrite][oil]	40																	
27	18	19	287	2.68	87.48	Sandstone	siltsotne - thicker SST beds in middle. Thin to medium interbeds. SST very fine to fine grained, quartzitic. Muddy coaly, 0.10 zone at top of bottom 1/3. thin calcite filled fractures across-bedding.No fizz.	40	3.14	3.04	65	20	11	11	10	10	26	29	32	23	21	17			
				0.46	90.16	Sandstone	siltstone - continued.																		
28			294	2.94	89.61	Siltstone	minor ironstone near top. Muddier in top 1/3 and slightly carbonaceous. Coaly lenses and debris scattered. Thin calcite veins across-bedding.No fizz.	40	3.09	3.04	18	59	12	28	17	17	47	22	31	10	15				
				0.15	92.55	Sandstone	fine grained white quartizitic, fine grained.Good fizz.																		
29			307	0.62	93.57	Sandstone	siltstone (90/10) - fine to very fine grained light/grey calcareous cement thin calcareous bands.Good fizz.	40	3.07	3.04	62	11	43	20	13										
	19	20		2.45	94.19	Sandstone	as above highly fractured + broken with irregular vertical fractures. Pyrite + calcite visible on fractures. Top 3/4 calcareous cement. Slippage surfaces have polishing and slikensides.Good fizz top 3/4.	35-40																	
30			317	1.45	96.62	Sandstone	siltstone (85/15) - SST mainly fine grained, almost medium at bottom. Turbiocarous but also lots of movements with fractures + calcite deposite throught.No fizz.	35	3	3.04	13	43	33	22	18	39	12	41	17	16	10				
				1.55	98.07	Siltstone	sandstone (80/20) - sitstone, slightly muddy with thin SST. Beds of light grey fine grained quartzitic sand. Minor fracture across-bedding filled with calcite and movements on bedding with polishing and slickensides.No fizz.	40																	
31			327	0.44	99.67	Siltstone	continued.		2.52	3.04	19	22	25	12	19	13	18								
				2.02	100.11	Mudstone	slightly silty calcite in fractures also fracture planes with slickensides and polishing. Coaly bands and fragments throughtout medium hard and medium grey.	45-50																	
	21	22		0.05	102.13	Mudstone	Coaly mudstone broken ground may be some missing.																		
				0.52	102.18	missing	missing [coal most likely.][coal] [seam 10 - roof]																		
32			337	1.08	102.72	Coal	small rounded lumps at top from missing core and then good solid coal core. Hard dull with bright bands.[coal] [seam 10]		2.72	3.04	10	10													
				0.12	103.80	Coal	muddy coal - hard brownish with brown streak, minor brgiht coaly banding. [parting] [seam 10]																		
				1.01	103.92	Coal	hard dull - ground and brighter at bottom. Broken into fragments probaby some missing here.[coal] [seam 10]																		
				0.32	104.93	missing	missing [coal from base probably.][coal] [seam 10]																		
				0.51	105.25	Mudstone	coaly mudstone - coal bands.[parting]	45																	
33			347	0.1	105.77	Coal	broken, hard dull blocky.[coal] [seam 10 - floor]		3.09	3.09	12	10	16												
				0.92	105.87	Mudstone	carbonaceous, coaly bands and fragments throughout. No fizz. [parting]	40																	

	22	23		0.28	106.79	Mudstone	coaly mudstone - broken, fractures, many polished and slickensided slip faces. Carbonaceous, dark grey to black.																		
				0.29	107.07	Coal	ground broken - may be some missing? Good contact with underlying midstone dull platy with bright bands.[coal] [seam 9 - roof]	45																	
				0.38	107.36	Mudstone	many coal bands and fragments throughtou. Some fairly bright moderately hard, medium grey slippage planes polished and slickensided. [parting]																		
				0.19	107.74	Coal	pulverized exact thickens unknown without E-logs. Dull + bright power.[coal] [seam 9]																		
				0.73	107.93	Mudstone	coaly mudstone - carbonaceous with bands + fragments throughout medium to dark grey. [parting]																		
				0.2	108.66	Coal	dull blockly broken. Dull bright gragments.[coal] [seam 9]																		
34			357	1.4	108.81	Coal	unknown true thickens without E-logs broken up, dull bright bands. Some in good solid core pieces. Dull fairly hard.[coal] [seam 9]		3.04	3.04	13	10	30	10	10										
	23	24		0.1	110.21	Coal	bright + dull broken fragments good basal contact with mildstone.[coal] [seam 9 - floor]																		
				0.1	110.31	Mudstone	medium grey, coaly bands + fragments, carbonaceous. [parting]	40																	
				0.23	110.41	Coal	dirty in top half and ground + powered in bottom half with bright flecks.[coal]																		
				1.21	110.64	Mudstone	scattered thin sandstone band and fine grained sandstone concentrated at base. Medium to dark grey, slightly silty down with coal band and fragments throughout. Carbonaceous rooting throughout.	45																	
35			367	1.55	111.86	Sandstone	muddy siltstone - mainly coal lenses, fragments wavy uneven bedding contacts sandstone fine to very fine and slightly brownish rooting and some biothurbation. Slippage bands are polished and slickensided and often occur on coal bands.No fizz.		3.04	3.04	25	18	13	16	24	16	24								
				0.16	113.41	Coal	hard dull and some mudstone bands. Muddy in upper 0.08.[coal]																		
				0.19	113.57	Mudstone	coaly mudstone - dark grey to black with coaly bands and lenses throughotu.	35																	
				0.24	113.76	Coal	hard dull - good core with minor brightbands.[coal]																		
	24	25		0.65	114.00	Mudstone	coaly mudstone - dark grey and black medium hard to soft, coal lenses + carbonaceous.																		
				0.25	114.65	Siltstone	muddy siltstone - medium grey, medium hard.																		
36			477	3.04	145.39	Sandstone	siltstone (60/40) - thinly to medium interbeds, some minor cross-bedding sandstone - fine to very fine grained, light grey, hard. One large fracture near base is full of visible pyrite. Other minor thin fractures filled with calcite. Muddy carbonaceous laminations and thin coaly laminations and fragments throughotu. No fizz. [pyrtie] polishing and slickensides on slip faces.	40	3.04	3.04	47	43	61	20	18	13	19	13	19	16	10				
37			387	0.24	117.96	Coal	hard, one single coal pieces - upper contact was polished slip face. [coal]		2.26	3.04	12	11	18	20											
				0.78	118.20	missing	(coal?) [coal?]																		
				0.52	118.98	Coal	hard, dull blocky. Minor bright banding throughout.																		
				0.75	119.50	Mudstone	coally mudstone - coaly lenses and bands throughout. Some rooting. Medium to dark grey and carbonaceous. No fizz. [parting]	45																	
				0.18	120.25	Coal	broken up, brgiht, cleated coal band. [coal]																		
				0.57	120.43	Mudstone	coaly mudstone - dark grey to black carbonaceous, coaly bands, fragmetns, rooting.																		
38			397	2.12	121.01	Mudstone	silty mudstone/siltstone - silstone is muddy varies in thin to medium beds throuhgout. Medium grey, medium hard, coaly and carboanceous bands and fragments, some very fine grained SST bands throughout. Polishing and sclikensides on slip faces. No fizz.	40	3.04	3.04	10	23	14	19	34	15	25	10	14	46	11				

	26	27		0.92	123.13	Siltstone	slightly muddy near top, near sandy quartzitic bands near bottom. No fizz.	40																	
39			407	1.22	124.05	Siltstone	slightly muddy at top grading to muddier and mudstone at bottom. Medium grey, medium hard.	45	2.34	3.04	18	26	17	14	17	18	12	12							
				0.98	125.27	Mudstone	coaly silty mudstone - broken, fractured, polished and slickensided. Dark grey to black, carboanceous, coaly material throughout. More competent and less broken at bottom. Sharp contact with underying coal. No fizz.																		
				0.14	126.25	Coal	broken, flacked, bright, greasy. [coal]																		
				0.7	126.39	missing	(most likely coal) fell out of bottom of barreal. [coal?]																		
40				0.64	127.09	missing	(most likely coal) [coal?]		2.4	3.04	17	10	18	10	34	26	22	27	40	10					
				0.1	127.73	Coal	ground, rounded coal fragmetns. All that remains of above coal scam. [coal]																		
				0.3	127.83	Mudstone	carbonaceous mudstone - balck, coaly debric and lenses throughtout silty at bottom. [coal] No fizz.	40																	
				0.27	128.13	Siltstone	hard, slightly muddy, medium grey.																		
	27	28		1.83	128.40	Sandstone	silstone (70/30) - top and bottom mainly sandstone light grey, quartizitic fine to very fine grained. Muddy carbonaceous and coaly bards, fragments, lenses throughout. No fizz.	35																	
41				1.35	130.23	Sandstone	silstone (90/10) - sandstone light grey and fine to almost medium grained with a salt + pepper texture. Muddy carbonaceous bands, at top and bottom. Coaly material scattered. No fizz.	40	3.04	3.04	13	55	25	17	17	12	13								
				0.72	131.58	Mudstone	slight silty, some thin light grey quartizitc sandstone bands. Slippage with polishing, slikencided and caclcite on surfaces. Minor thin calcite filled fractures. No fizz.																		
	28	29		0.97	132.30	Mudstone	silty lightly sandy bands at bottom. Calcite on fractures. Core is more broken up. No fizz.	40																	
42			437	0.31	133.20	Sandstone	silstone (60/40) - thinly interbedded, hard, light to medium grey. Muddy carbonaceous bands.	45-50																	
				0.39	133.51	Mudstone	carbonacoues mudstone - dark grey to black, moderately hard, coaly gragments throughout with polishing on slip faces.																		
				0.65	133.90	Coal	dull hard in top and brighter more flacky and broken at base. (may be missing some here but put all the missing at the bottom of this run where it would fall out + be washed away?) don't know without E-logs. [coal)																		
				0.92	134.55	Mudstone	coaly mudstone - carbonaceous, soft, black, coal throughout, badly broken.																		
				0.77	135.47	missing	Not Coal																		
43			447	2.61	136.25	missing	Not Coal		0.43	3.04	14	13													
				0.1	138.86	Coal	small rounded washed fragments. [coal?]																		
				0.33	138.96	Sandstone	silty mudstone at top coal contact. Coal lenses throughout. Movement, polishing and slickensided on coal. No fizz.	40																	
44			457	0.1	139.29	Mudstone	silty mudstone.		3.04	3.04	23	12	12	16	10	14	14	11							
	29	30		0.66	139.39	Sandstone	fine grained, light grey well indurated, quarzitic, fractures and polished across-bedding. No fizz.	45																	
				0.47	140.05	Mudstone	silty mudstone, moderately hard, dark grey, polished slip faces, minor coaly material. No fizz.																		
				0.7	140.52	Sandstone	light grey, fine grained, hard, coaly lenses, thin and scattered. No fizz.	40																	
				1.11	141.22	Mudstone	coaly mudstone - very carboanceous soft to moderately hard, broken, coal lenses fragements bands throughout. Slip faces black polished.																		
45				0.32	142.33	Mudstone	coaly mudsotne continued.		3.04	3.04	13	10	16	12	13	19	11	10	19	14					

				0.87	142.65	Siltstone	slightly muddy coaly bands and carbonaceous material throuhgout moderately hard, medium grey.																		
	30	31		1.85	143.52	Sandstone	siltstone (50/50) - siltstone in top 1/2 and sandstone in bottom half. Minor SST ands in slitstone high angle fractures with polishing. SST has moderate fizz.																		
46			477	0.72	145.39	Siltstone	sandstone - interbedded, hard broken contact with mudstone. Fractures with polishing across and with bedding. No fizz.	50	3.04	3.04	10	11	16	15	22	13	60	13	16	15					
				0.68	146.11	Mudstone	carbonaceous mudstone - coaly material scattered throughout. Polished movement planes, dark grey to black, moderate hard.																		
				0.61	146.79	Sandstone	siltstone (60/40) - medium bedded to fine. Light grey quartzitic sandsone. Coaly fragments and lenses as well as plant fragments at base. No fizz.																		
	31	32		1.03	147.40	Sandstone	fine to almost medium grained, light grey, well sorted quartzitic. Very broken + fractured in bottom 1/3. No fizz.	50																	
47			487	2.35	148.44	Sandstone	light and dark bands, fine grained minor medium bed of darker siltstone. Moderately fractures and borken coal near base. Some polishing and slickensides. No fizz.	45	3.04	3.04	19	14	31	12	15	10	10	10	13	35					
	32	33		0.69	150.79	Sandstone	siltstone - grades to siltstone in bottom 1/2. Sandstone fine to very fine grained. No fizz.	40																	
48			497	0.76	151.49	Sandstone	siltstone (50/50) - thin to medium interbeds. SST is fine to very fine light grey. Some darker muddy carbonaceous bands. Minor thin calcite filled fractures core more broken up in bottom half. No fizz.	35-50	3.04	3.04	33	11	14	20	11	41									
				0.8	152.25	Mudstone	silty mudstone - dark grey more muddy and carbonaceous near base minor coaly fragments and lense. No fizz.																		
				0.48	153.05	Sandstone	silstone - very fine to fine grained sandstone interbedded with siltstone. Hard competent and well indurrated. No fizz.																		
49			507	0.28	154.53	Sandstone	silstone - continued. May be more sandstone as well as darker muddy siltstone bands hard.	35	3.04	3.04	28	26	27	19	11	21	20	16	59						
	33	34		2.76	154.81	Sandstone	wavy thin siltstone bands and some muddy carbonaceous laminations SST is very hard, fine to vey fine grained.	50																	
					157.57		Some calcite in thin fractures and minor oil in three fracture. No fizz. [oil]	30																	
50			517	1.32	157.58	Sandstone	cotninued from previous polishing and slickensides on movements and oil in vugs in two calcite filled fracture zones. No fizz. [oil]	35	3.04	3.04	52	36	10	24	12	24	53	14	12	17					
	34	35		1.72	158.90	Sandstone	continued with thin siltstone bands throughout more sandy to bottom 2/3. some calcite filled fracture areas polishing on a couple of slippage planes. Some variable bedding and minor cross-bedding. No fizz.	35																	
51			527	2.56	160.63	Sandstone	continued with silty mudstone for 0.18 in middle with coal bands and lense and carboanceous. Calcite in fizz in many fracture 1/3 up from the base. Some polishing and broken up in bottom 1/3. No fizz.	55	3.04	3.04	17	63	14	18	10	14	16	10	10	13	15				
	35	36		0.48	163.19	Siltstone	sandstone (60/40) - sandstone in thin to medium beds and very fine grained to fine grained. Thin coaly veins and calcite filled gractures throughout. Getting muddy toward base. No fizz.	4																	
52			537	1.26	163.68	Mudstone	silty mudstone - carbonaceous coaly material throuhgout as fragments, lenses, thin beds. Fairly broken with polishing and slickensides on broken surfaces. No fizz.	30	3.04	3.04	14	15	13	10	12	15	66	33	12						
				1.78	164.94	Siltstone	sandstone (50/50) - fine grained light grey quartizitic sandstone inter bedding medium to thin beds with siltstone. Thin coaly bands scattered throuhgout. Competent massive well indurated. No fizz.	35																	
53			547	0.4	166.73	Siltstone	sandstone - continued.	45	3.04	3.04	40	60	46	36	12	24	53								

	36	37		2.64	167.13	Sandstone	Siltstone (70/30) - thin siltstone beds in sandstone. Sandsotne light grey, quartzitic fine to very fine grained. Minor cross-bedding and bioturbation. Calcite files fractures with one major zone in center. Competent well indurated unit siltier towards bottom. No fizz.	45																	
54			557	1.23	169.77	Sandstone	fine to very fine grained in top 1/3 and fine to almost emdium in bottom 2/3. thin siltstone interbeds also in top 1/3. SST quartzitic with scattered thin mudstone and coaly bands. Thin calcite filled fractures acorss-bedding and high angle fracture near top. small 0.03 bard of mudstone at base at coal contact. MDD fizz on some SST ...	45	3.04	3.04	10	38	65	26											
				0.18	171.00	Coal	fairly hard, dull + bright band calcite on polished movement surfaces [coal] [seam 8 - roof]																		
	37	38		0.27	171.18	Coal	continued. [coal] [seam 8]																		
				0.31	171.45	Mudstone	at top 0.05 and silty for rest black and carboanceous and medium grey hard almost muddy siltstone for reminder. [parting]	40																	
				1.05	171.76	Coal	hard, fairly, bright with bright bands, ground broken and softer at base. [coal] [seam 8]																		
55			567	1.24	172.82	missing	missing (coal most likely.) [coal?] [seam 8]		1.8	3.04	14	10	14	13	12	12	17								
				0.08	174.06	Coal	ground and rounded by washing into small pebbles. [coal] [seam 8 - floor]																		
				1.58	174.14	Mudstone	dark grey to black coaly moderately hard to soft. Carbonaceous top 1/2 quite broken - sharp basal contact with sandstone.	50																	
				0.14	175.72	Sandstone	fine grained, light grey, quartzitic, thin muddy laminar. Slight fizz.																		
56			577	0.51	175.87	Sandstone	fine to very fine with scattered thin silstone interbeds and minor mudstone. Some very thin coaly bands.	40	3.04	3.04	34	15	66	13	10	43	42	10	48						
	38	39		2.53	176.38	Sandstone	siltstone - load casts show right way up. Also bioturbation, wavy irregular bedding + thurbation. Thin bands or siltstone + some mudstone and coal throuhgout the fine grained quartzitic sandsotne thin 0.02 coal lense at the very base.	45																	
57			587	1.08	178.92	Sandstone	with siltstone interbeds continued from above.		2.78	3.04	23	27	12	12	16	36	22	22							
				0.3	180.00	Coal	bright greasy, ground into pieces - friable. [coal]																		
				0.26	180.30	missing	(most likely coal) [coal]																		
				0.1	180.56	Mudstone	coaly, carboanceous polished slip surfaces, moderately hard, black.																		
	39	40		0.35	180.66	Mudstone	coaly mudstone - black, carboanceous coaly fragments throuhgout soft.																		
				0.95	181.01	Mudstone	silty mudstone - moderately hard, medium grey to dark grey. Thin fine grained sandstone bands in middle. No fizz.	40																	
58			597	3.04	181.97	Siltstone	muddy at top and more sandy at bottom. Thin calcite fined fractures. Coaly fragments + rooting throuhgout. Fairly competent a few thin sandstone beds. TD 607 Feet.		3.04	3.04	11	11	23	25	11	10	10	57	57	28					
					185.01		**TD. 607 FEET**																		

2011-Ja
2011-02a

Diamond Drill

Ron Swaren

Core	Box		Top (ft)	Recovery	Depth (m)	Lithology	Core Description	Apparent Dip of Bedding	Core cut (m)		RQD (cm)														Note
	From	To							Recovery	Run	core sticks ≥10cm														
					0.00	casing	Cased to 20 feet.																		
1			20	2.14	6.10	Mudstone	silty, coal lenses and thin 0.01 beds throught carbonaceous with coaly fragment. Broken up, polishing on slip faces and slickensides. No fizz.	60	2.14	2.14	15	10	12												
2			27	1.62	8.23	Mudstone	slightly silty as above. Coal lenses, fragments and 0.03 beds. Rooting in evidence throughout. Medium to dark grey to black. Carbonaceous medium hard and broken up. No fizz.	65																	
	1	2		0.64	9.85	Mudstone	continued but badly broken up and some is missing. No fizz.																		
				0.78	10.49	Missing	(most likely mudstone possibly some coaly.)																		
3			37	3.04	11.28	Mudstone	silty at top to no silt in bottom half . Coaly fragments throuhgout but less than in core No.2 carboanceous, medium hard, dark grey. Some ground lumps at top are coal. Calcite on some top are coal. Calcite on some fracture faces with some polishing and slickensided on slip faces. No fizz.		3.04	3.04	10	13	17	24	11	18	10	11	10	10	9				
4			47	0.36	14.33	Mudstone	medium hard, slightly silty, carbonaceous, polishing on slip faces.		2.9	3.04	13	15	11	46	24	17	54	19							
	2	3		0.56	14.69	Mudstone	cotninued from above thin coal at base and sharp contact with siltstone. Polishing and slickensides on slip planes. Coal at base 0.03 thick.																		
				1.85	15.25	Siltstone	sandstone (50/50) - thickly interbedded with some thin + medium beds too. Interclasts and turbid wavy bedding in upper sandstone. Thin carbonaceous bands in lower sandstone. Siltstone at base grades in silty mudstone siltstone is hard and medium grey. sandstone is light grey quartzitic hard, fine to very fine grained and well sorted. No fizz.	65																	
				0.13	17.10	Mudstone	silty mudstone - medium to dark grey. Carbonaceous, medium hard.																		
5			57	0.75	17.37	Mudstone	silty bottom third. Carbonacerous broken fractured polished and slickensided in center of interval. Minor very thin silty layers.	70	3.04	3.04	22	15	43	37	57	33									
				0.66	18.12	Siltstone	muddier center with 0.01 and smaller coal beds and lenses fairly sharp contact with underying sandstone. Medium grey to slightly brownish. Some slippage with polishing. No fizz.	65																	
				0.95	18.78	Sandstone	light grey, minor bross-bedding. Thin carbonaceous bottom, hard, fine to very fine grained. Grades into siltstone in bottom section. One fracture zone with calcite infill in center. No fizz.	60																	
				0.32	19.73	Siltstone	medium grey brown, hard thin sandstone laminations scattered. Grades down into silty mudstone. No fizz.	60																	
				0.36	20.05	Mudstone	silty mudstone - carbonaceous slippage is polished, dark grey to black in center. Grades back down to more silty at top and bottom. No fizz.																		

6			67	2.58	20.42	Sandstone	siltstone (70/30) - main to medium interbeds, sandstone light grey, quartzitic, fine to very fine grained, minor cross-bedding areas of fine carbonaceous laminations. Grade into muddy siltstone at base. No fizz.	60	3.04	3.04	40	42	26	21	30	50	21	17	10	16					
				0.27	23.00	Siltstone	muddy siltstone - muddy half, medium grey, more muddy at bottom.																		
	4	5		0.19	23.27	Mudstone	silty mudstone - siltier at bottom medium grey medium hard.																		
7			77		23.47	Sandstone	siltstone (50/50) - thickly interbedded siltstone medium grey hard. Sandstone light grey, very hard, fine to very fine grained, minor cross-bedding. Minor thin carbonaceous laminations. Unit is competent and well indurated. No fizz.	60	3.04	3.04	31	19	26	31	35	19	63	22	13	26					
8			87	0.84	26.52	Sandstone	siltstone (50/50) - as above continued with sandston in top half and siltstone bottom half. Cross-bedding. No fizz.	70	3.04	3.04	23	23	17	32	61	19	27	12	45	16					
	5	6		2.20	27.36	Siltstone	muddy siltstone/silty mudstone - silted at top and bottom middle. Muddier at bottom and uppe middle. Siltier is medium grey, muddier is dark grey and carbonaceous very uniform with no visible bedding.																		
9			97	1.89	29.57	Mudstone	sitly mudstone - more silty at top medium to dark grey. Minor very thin very fine grained sandstone laminations near the top. No fizz.	60-65	3.04	3.04	36	18	66	17	42	18	33	14	36						
	6	7		1.15	31.46	Mudstone	dark grey to black, carboanceous coaly lenses near top.																		
10				3.04	32.61	Mudstone	slightly sity in parts. Fairly uniform. A few thin siltstone laminations thin calcite filled fractures in bottom 1/3 as well as vertical fractures with polishing. Core more broken up at bottom. No fizz.	60	3.04	3.04	25	135	12	22	20										
11	8		117		35.66	Mudstone	siltier at top, dark grey. Carboanceous, coaly debris and fragments scattered. Some calcite filled fractures. Slippage shows polishing. Most coaly lenses in bottom third. No fizz.	60	3.04	3.04	78	23	16	12	12	17	15	14	20	11	15				
12				0.92	35.86	Mudstone	silty mudstone - medium to dark grey minor very fine grained sandstone laminations. More silty towards base to a muddy siltstone.	55	3.04	3.04	12	15	30	11	18	10	25	13	15	11	22	16			
	8	9		0.52	36.78	Siltstone	muddy siltstone - medium grey, hard, minor thin light grey sandstone laminations near bottom grading down into sandstone. No fizz.	65																	
				0.41	37.30	Sandstone	light grey with thin interbedded siltstone near top. Sandstone hard and whiter near bottom. Minor carboanceous laminations scattered throughout SST fine to very fine grained. Minor fizz at bottom SST.	55																	
				0.25	37.71	Sandstone	muddy siltstone - broken and fractured and mized up. Small pieces of core. Some mud and small angular pieces of rock. May be fault gouge? Of from drilling core above and below relatively undisturbed so is most likely a minor fracture zone.																		
				0.94	37.96	Sandstone	fine grained with minor thin siltstone and some carboanceous bands. Hard SST is light grey, quartzitic, well sorted. More carbonaceous at the base. No fizz.	55																	
13			137	0.41	41.76	Sandstone	siltstone - siltstone in top with coaly stringers. Sandstone in bottom half with thin carbonaceous laminations. Sandstone light grey fine to very fine grained and hard to very hard. No fizz.	65	3.04	3.043	22	14	31	36	18	12	84	19							

				1.35	42.17	Siltstone	many thin fine grained sandstone bands in top half. Broken half partly muddy. Medium grey hard.	55																	
				0.09	43.52	Sandstone	thin silty and carbonaceous laminations.																		
	9	10		1.19	43.61	Siltstone	muddy siltstone/sandstone (70/30) - thin siltstone bands scattered in top 3/4 and more concentrated at base. Thin cabonaceous laminations in basal sand. Sandstone light grey fine grained siltstone hard medium grey. Competent well indurated core. No fizz.	65																	
14			147	2.16	44.81	Mudstone	silty mudstone - minor thin sandstone beds, muddier in center sandier towards base. Medium to dark grey, medium hard.	55	3.04	3.04	24	31	52	22	23	25	13	49	47	14					
	11			0.88	46.97	Sandstone	siltier at top, fine to very fine grained very light grey at bottom. Minor fractures across bedding with calcite fill + oil seepage from two. No fizz.[oil]	55																	
15			157	0.77	47.85	Sandstone	competent well indurated core fine to very fine grained sandstone in top half with thin siltstone interbeds bottom half is pure light grey. Fine to almost medium grey very hard quartzitic sandstone with salt + pepper texture: true calcite filled fractures across-bedding minor carboanceous laminations in middle. minor fizz in bottom 1/2.	60	3.04	3.04	60	87	12	82	22	14									
				2.27	48.62	Siltstone	slightly muddy in parts with thin fine grained sandstone bands throuhgout more muddy to mudstone in bototm third.	55																	
16			167	1.50	50.90	Siltstone	slightly muddy with third sandstone bands. Massive competent well indurated core piece. No fizz.	55	3.04	3.04	133	28	19	31	48	13									
	11	12		1.54	52.40	Siltstone	medium grey, medium hard with thin scattered bands with thin scattered bands of fine to very fine grained light grey sandstone.	55																	
17			177	1.58	53.95	Siltstone	muddy siltstone- medium grey medium hard, thin SST bands near bottom. No fizz.	60-65	3.04	3.04	10	72	26	45	79	10									
				1.09	55.53	Sandstone	silstone (60/40) - medium thick interbeds. Sandstone light grey quartzitic fine grained salt and pepper texture.																		
	12	13		0.37	56.62	Sandstone	fine, grained, light grey, hard, minor cross-bedding minor thin carbonaceous bands one calcite filled fracture across bedding with oil seepage. Minor fizz. [oil]	60																	
18			187	0.55	57.00	Siltstone	muddy siltstone - muddy grey medium hard grained down into sandstone.		3.04	3.04	33	27	12	13	56	30	30	18	29	44					
				2.49	57.55	Sandstone	siltstone (40/60) - thin to medium interbeds sandstone is light grey, quartzitic very fine to fine to almost finely medium grained. Scattered carbonaceous laminations in sandstone thin SST layers in siltstone. Minor cross-bedding. No fizz.	60																	
19			197	0.58	60.05	Siltstone	medium grey slightly muddy, medium hard to hard. Thin fine grained sandstone beds in bottom half. No fizz.	55	3.04	3.04	14	33	22	19	10	25	35	20	22	34					
	13	14		1.45	60.63	Siltstone	contineud as above. More sandy beds in upper 2/3. muddier towards bottom. No fizz.	60																	
				1.01	62.08	Mudstone	slightly silty more silty at top dark grey and more carbonaceous in bottom half medium hard one calcite filled fracture near base.																		
20			207	1.53	63.09	Mudstone	silty mudstone - more silty to muddy siltstone in center part. Thin sandy band in bottom half moderately hard to soft in bottom. No fizz.	60	3.04	3.04	13	15	19	17	17	18	10	35	50	54					

	14	15		1.51	64.62	Siltstone	slightly muddy in top 1/3. fine to very fine grained light grey sandstone bands throughout. Bottom half is much sandier. No fizz.	55																	
21			217	1.50	66.14	Siltstone	sandstone (60/40) - siltstone hard + medium grey, SST very hard light grey with carbonaceous bands. Sandstone fine to grey fine grained light grey quartzitic calcite filled fractures across-bedding. No fizz.	60	3.04	3.04	13	50	33	30	10	27	33	26	13						
				1.09	67.64	Sandstone	fine to medium fine, light grey, very hard quartzitic. Thin interbeds of carbonaceous mudstone and siltstone. Many bedding with some coaly lenses fractures filled with calcite across-bedding. Core is more broken up in bottom 1/3. No fizz.	65																	
	15	16		0.45	68.73	Sandstone	continued from above.																		
22			227	3.04	69.19	Siltstone	Sandstone (25/75) - sandstone light grey, quartzitic with thin laminations of coaly carbonaceous and siltstone minor cross-bedding. Hard competent, well indurated unit. Minor thin calcite filled fractures across-bedding. No fizz.	60-65	3.04	3.04	10	50	10	77	15	22	18	10	51						
23			237	0.62	72.24	Siltstone	sandstone (50/50) - as above.	55	3.04	3.04	10	38	48	22	41	18	37	36	10						
	16	17		0.31	72.86	Siltstone	Sandstone (50/50) continued.																		
				1.28	73.17	Sandstone	fine to almost emdium grained well sorted salt and pepper textures. Light and dark banding minor cross-bedding. More borken at bottom with muddy siltstone interclasts, slippage with polishing and slickensides as well as calcite filled fractures. No fizz.	55																	
				1.10	74.45	Siltstone	SST (70/30) - fine grained sandstone and siltstone interbedded. No fizz.	65																	
24			247	0.50	75.29	Sandstone	Siltstone (80/20) - light grey, quartzitic, hard fine to very fine grained SST with fine to medium siltstone interbeds grades down into siltstone to muddy siltstone. No fizz.	60	3.04	3.04	11	37	21	17	12	31	16	24	27	19	15	21	10	13	
				1.15	75.79	Mudstone	silty mudstone - silty top and bottom and more muddy in middle. Muddy portion more carbonaceous and blacker high angle slip faces are polishied.																		
	17	18		1.39	76.94	Mudstone	silty mudstone - dark grey, carbonaceous medium hard, minor very thin siltstone bands. No fizz.	65																	
25			257	0.14	78.33	**Coal**	**moderately hard, dull with minor, birght fleck. [coal?] [seam 12T]**																		
				0.07	78.47	Mudstone	coaly mudstone, partly silty brown streak. [parting]																		
				2.50	78.54	**Coal**	**Broken - some portions hard dull core others friable pieces and some powedered. Mostly badly broken exact recovery unknown. [coal?] [seam 12 - roof]**																		
				0.33	81.04	Missing	(most likely coal) [coal?] [seam 12]																		
26				3.04	81.37	**Coal**	**(possibly in seam?) moderately hard - dull with bright bands - good core, good recovery. Some parts more broken with some calcite some is friable. [seam 12]**	60	3.04	3.04															
27			277	1.20	84.43	**Coal**	**good solid coal cores. Dull coal moderately hard bright bands more bright when broken up. [seam 12]**		2.7	3.04															
	19	20			85.00	**Coal**	**good core more broken at bottom where some is missing probably fell out of core carrel. [seam 12]**	60																	
					86.00	**Missing**	**missing (coal for sure) [coal?] [seam 12]**																		

28			287	2.90	87.48	**Coal**	**more friable, brighter, broken into flakes, softer, good looking coal. [seam 12]**		2.9	3.04															
				0.14	90.38	**Missing**	**missing (coal for sure) [seam 12]**																		
29	21		297	1.95	90.53	**Coal**	**broken friable bright and dull flackes and pulverided at bottom. [seam 12]**		1.95	3.04															
				1.09	92.48	**Missing**	**missing (coal for sure) [seam 12]**																		
30				0.90	93.57	**Coal**	**hard, dull rounded lumps at top, ground, bright and dull pieces and powder at bottom [seam 12]**		0.9	3.04															
				2.14	94.47	**Missing**	**missing (coal) [seam 12]**																		
31			317	0.50	96.62	**Missing**	**missing (coal) [seam 12 - floor]**		2.64	3.04	16	22													
				1.50	97.12	Mudstone	dark grey black, brown, soft broken up. Many coal lenses, bands and fragments throuhgout. Carboanceous polished and clikcensided slip planes. [parting]	55																	
	21	22		1.14	98.62	**Coal**	**hard, blocky, good core all in one piece. Dull and bright banded. [seam 11 - roof]**	60																	
32			327	3.04	99.67	**Coal**	**good core solid pieces and some broken up. Minor amounts powdered. [seam 11]**	60	3.04	3.04															
33			337	0.26	102.72	**Missing**	**missing (coal probably) [seam 11]**		2.78	3.04	10	25	12	52	23	48									
				0.20	102.98	**Coal**	**hard, dull blocky. [seam 11]**																		
	22	23		0.56	103.18	**Coal**	**hard, dull. [seam 11]**																		
				0.06	103.74	**Mudstone**	**with coaly lenses medium brown grey with brown strea. [parting]**																		
				0.15	103.80	**Coal**	**dirty at base? [seam 11]**																		
				0.08	103.95	**Mudstone**	**coaly mudstone - brown streak black. [parting]**																		
				0.08	104.03	**Coal**	**{No Description} [seam 11 - floor]**																		
					104.11	Coal	muddy coal - dirty with brown streak. [parting]																		
				0.17	104.31	Mudstone	Floor. Brownish medium grey, medium hard, carbonaceous.																		
				0.28	104.48	Sandstone	silstone (50/50) - thinly interbedded. More sandy at top and silty at base. Sandstone light grey, quartzitic, fine to very fine grained. No fizz.	65																	
				1.12	104.76	Siltstone	fine to very fine grained sandstone bands throughout upper half. Thin, coaly lenses, fragements, debris throughout. Hard - medium grey. No fizz.	60																	
34			347	1.55	105.77	Siltstone	sandstone (50/50) - coaly lenses and rooting at top 1/3. sandstone very fine grained and thinly interbedded with siltstone. Coaly lenses and fragments throuhgout. No fizz.	60	3.04	3.04	10	10	11	52	23	48	10	33	40	20	19	16			
	23	24		1.49	107.32	Siltstone	sandstone contineud with one 0.03 coaly bed near the top. Hard competent well indurated core. Some bioturbation. Warm tubes. Coaly lenses, fragments, debris throughtout.	60-65																	
35			357	2.64	108.81	Siltstone	Sandstone (30/70) - sandstone light grey quartzitic fine to very fine thin to medium interbeds. Calcite filled fracture has oil traces. Other fine calcite filled fractures across-bedding competent, well indurated beds. No fizz. [oil]	65	3.04	3.04	61	51	13	83	24	30	12								
	24	25		0.40	111.45	Siltstone	sandstone continued.																		
36			367	2.50	111.86	Siltstone	sandstone - sandier at top and siltier near bottom. Sandstone fine grained to very fine grained and light grey. Large 0.02 coal band near bottom. Calcite filled fractures run across-bedding and one has oil seepage. [oil] No fizz.	55	3.04	3.04	46	24	20	13	12	18	23	42	20	11	32				
				0.24	114.36	Ironstone	brown, hard, very dense and heavy.																		

				0.30	114.60	Siltstone	sandstone - thinly interbedded. No fizz.	50																	
37			377	0.61	114.91	Sandstone	fine to very fine grained with very thin siltstone interbeds. Calcite filled fractures across-bedding. Competent and well indurated. Some cross-bedding. No fizz.	55	3.04	3.04	61	19	70	10	23	15	14	30	20	10	12				
				1.95	115.52	Siltstone	sandstone (50/50) - thin to medium interbeds some carbonaceous bands some cross-bedding. No fizz.	60																	
				0.48	117.47	Sandstone	fine grained, light grey very hard, competent, well indurated. Minor calcite filled fracures across-bedding. No fizz.																		
38			387	1.50	117.96	Sandstone	oil seepage from 3 calcite. Filled fractures across-bedding, corss-bedding throughout dark + light fine grained sandstone layers. Uneven wavy bedding competent, well indurated, minor carbonaceous inclusions. No fizz.	55	3.04	3.04	32	46	17	51	47	93	10								
	26	27		1.54	119.46	Sandstone	continueds competent massive well indurated unit. No fizz.	60																	
39			397	2.63	121.01	Sandstone	siltstone/muddy siltstone - thickly to thin interbeds more sandy at top and bottom. Highly fractures. "fracture zone" and broken in center and bottom with polished planes slickensides with calcite on planes. Many calcite filled cracks and off set beds during movement. No fizz.	55	3.04	3.04	44	11	16	12	31	20	12	12	21	10					
	27	28		0.41	123.64	Sandstone	fine to very fine grading light grey. Cross-bedding thin calcite filled fractures across-bedding. No fizz.	55																	
40			407		124.05	Sandstone	siltsotne (65/35) - thin to medium beds of medium grey siltstone interbeded in light grey fine to very fine grained well sorted quartzitic sandstone. Thin calcite filled fractures across-bedding. Very hard well indurated. No fizz.	55	3.04	3.043	17	26	41	10	31	16	11	12	29	37	12	42			
41			417	0.76	127.10	Sandstone	siltstone (70/30) - as above but more calcite fractures near top and minor carbonaceous laminations near base. Polishing and slickensides on slip planes. No fizz.	60	3.04	3.04	23	21	23	42	18	14	12	16	20	54	12				
	28	29		2.28	127.86	Sandstone	siltstone (80/20) - fine to very fine grained lgiht very well sorted quartzitic sandstone thin to medium interbedded with medium grey siltstone. Some thin SST band almost medium grained calcite filled fractures scattered and a thin coaly band near bottom. No fizz.	60	3.04	3.04	23	21	23	42	18	14	12	16	20	54	12				
42			427	1.90	130.15	Sandstone	siltstone (60/40) - medium to thickly interbeded. Thick sandstone bed near base. Siltstone darker grey and muddy in parts. Wavy irregular bedding contacts with loading of sandstone on muddy siltstone. No fizz.	65	3.04	3.043	21	29	14	16	40	37	12	14	14	15	41	45			
	29	30			132.05	Sandstone	siltstone - as above with minor slippage and polishing on bedding. No fizz.	65-70																	
43			437		133.20	Sandstone	siltstone (60/40) - thinly interbedded at bottom and thickly interbedded near top. Thin coaly lenses scattered core broken, polished and slickensided in bottom 0.20. minor cross-bedding, sandstone is fine to very fine grained. Calcite in thin fractures across-bedding in bottom half. No fizz.	65	3.04	3.04	20	14	10	72	18	19	29								
44	31		447	1.66	136.25	Sandstone	fine grained dark and light bands, well sorted and indurated. Core large vertical fractures very hard, light grey. No fizz.	65	3.04	3.04	40	41	19	24	28	64									
				1.36	137.91	Sandstone	salty pepper texture, almost medium grained very hard, competent and well indurated dark + light banding near base and very uniform well sorted for the upper 75%. No fizz.	65																	

45			457	1.29	139.29	Sandstone	fine to very fine grained, dark and light banded with thin coaly and carbonaceous bands at top. More thicker coaly beds near base as well as rooting and bioturbation as well as interlasts of mudstone which is silty. Some calcite filled fractures in bottom third. Minor cross-bedding. No fizz.	65	3.04	3.04	18	49	39	13	10	30	24	15	14	18					
	31	32		1.03	140.58	Sandstone	fine to almost medium grained, salt and pepper texture. Many coal lenses and roots throughout broken half broken up and interclasts found near bottom. Sandy polishing and slippages on coaly bands coaly broken core. No fizz.	65																	
				0.72	141.61	Sandstone	siltstone (70/30) - thin to medium bedding. Sandstone is fine to very fine grained. Cross-bedding. Minor fine calcite filled fractures. No fizz.	60																	
46			467	1.21	142.34	Sandstone	siltstone - coninutes from above. No fizz.	55	3.04	3.043	38	55	15	23	16	11	18	11	19	17					
				0.42	143.55	Sandstone	siltstone - thinly grained and broken with calcite, polishing and slickensides.																		
				0.62	143.97	Mudstone	silty mudstone/siltstone (60/40) - silty in center, medium grey siltstone, dark grey mudstone silty carbonaceous muddy calcite filled fractures, hairline in 3mm.																		
				0.79	144.59	Sandstone	fine grained to very fine grained. Light grey, large calcite filled fractures throughout up to 0.02m. Uniform competent and well cemented.																		
47			477	2.86	145.39	Siltstone	partly muddy, uniform no discernable bedding. Mainly calcite filled fractures throughout at 60° which is most likely bedding top. Some coaly debris near top where core is broken up irregular black with minor polishing. No fizz.	60	3.04	3.04	13	35	25	22	28	24	52	18							
	33	34		0.18	148.25	Siltstone	continued from above.																		
48			487		148.44	Siltstone	muddy siltstone - uniform sadier in middle no bedding except on very thin carboanceous laminations. Also coaly debris and fine fragments scattered throuhgout. Calcite filled fractures vary in thickens and are common. Hard, medium grey. No fizz.	60	3.04	3.04	42	23	17	19	23	20	32	23	23	20	11				
49			497	0.94	151.49	Siltstone	muddy top hard and sandier down many calcite filled fractures throughout as all different angles. Coaly fragements and debris throughout polishing on slip surfaces.		3.04	3.04	25	35	10	20	19	10	34	55	24						
	34	35		1.85	152.43	Siltstone	slightly muddy thin sandstone in fractures scattered throuhgout. Sandstone interclasts in middle (very minor) more sandstone beds near base and sharp contact with underyling sandstone at the base.	45																	
				0.25	154.28	Sandstone	fine to almost medium grained at top. Salt + pepper texture, quartzitic light grey minor cross-bedding. Oil seepage from nuggs in calcite filled fracture. [oil]	60																	
50			507	2.02	154.53	Siltstone	sandstone (90/10) - sandstone interbeds at top and broken. Sandstone light grey fine grained siltstone medium grey, hard. Calcite filled gractures predominant in middle section. No fizz.	60	3.04	3.04	57	17	17	12	10	30	28	23	23	53					
				1.02	156.55	Siltstone	sandstone (80/20) - turbionation in sandstone at top thin sandstone beds top and in some of the bottom fracture of the core. Siltstone medium grey, hard, sandstone light grey quartzitic. Minor calcite filled cracked across-bedding. No fizz.																		

51			517	3.04	157.58	Sandstone	siltstone (60/40) - sandstone fine to very fine grained, hard, quartzitic, light grey, cross-bedding and load casing at top indurated beds right way up. Sandstone at bottom is waby bedding and a turbio environment. Mainly medium grey siltstone in middle minor thin calcite filled fractures scattered. one irregular polished fracture plane.																		
52			527	3.04	160.63	Sandstone	siltstone (50/50) - siltstone is in part sandy. Siltstone medium grey, hard, sandstone light grey. Thin to medium interbeds. Some turbioty in upper sandstone, sandstone light grey quartzitic, very hard. Very thin calcite filled fractures scattered throughout at various angels. unit is competent and well indurated. Some polishing and slickensides on movement planes at bottom. No fizz.	50	3.04	3.04	104	32	33	87	14										
53			537	1.25	163.68	Siltstone	sandstone (50/50) - minor coaly fragments and lenses scattered. Siltstone and coaly hard, SST vert fine to fine grained and light grey, coaly filled fractures thin fine common at various operations. No fizz.	55	3.04	3.04	56	37	14	16	43	26	22	17	27						
	37	38		1.79	164.93	Sandstone	siltstone (60/40) - thinly interbeded, minor thin carbonaceous stringers calcite filled fractures across-bedding and polished fractures planes. Sandstone beds defeat on old fractures. No fizz.	50																	
54			547	2.16	166.73	Siltstone	minor thin sandstone bands in middle. Siltstone more muddy to base. Almost silty mudstone in bottom 0.20m hard competent unit well indurated. Mainly very fine calcite filled fractures at different angles throughout medium grey getting darker and more carbonaceous towards to base. Coaly lenses and fragments throughout broken half. No fizz.	65	3.04	3.04	28	18	25	14	93	13	32	16	20	11					
	38	39		0.88	168.89	Siltstone	muddy with sandstone thinly interbedding upper half lots of coaly beds and lenses in bottom half and muddier. Minor calcite filled fractures across-bedding.	65																	
55			557	0.51	169.77	Mudstone	Roof. silty mudstone - medium to dark grey, carbonaceous, hard, thin sandstone beds throuhgout. Coaly debris, fragments and lenses throughout indistinct basal contact with coal seam.	60	2.36	3.04	32	18													
				1.85	170.28	**Coal**	**broken, friable, soft some pieces of harder and duller, moderately bright. [seam 10R - roof]**																		
				0.68	172.13	**Missing**	**(coal probably fell out of bottom of barrel) [seam 10R]**																		
56			567	0.93	172.82	**Coal**	**moderately hard and bright broken up and exact thickners unknown. [seam 10R]**	60	2.51	3.04	27														
	39	40		0.06	173.75	**Coal**	**hard medium bright. [seam 10R]**																		
				0.07	173.81	**Mudstone**	**brownish, meidum grey. [coal 7?] [parting]**																		
				0.54	173.88	**Coal**	**friable broken a bit soft and medium hard, medirum bright. [seam 10R]**																		
				0.12	174.42	**Mudstone**	**sitly mudstone. [parting]**																		
				0.34	174.54	**Coal**	**muddy coal/coal - undetermined percentage, bround and powdered. Most likely some missing unknown what without E-log. [coal + parting] [seam 10R]**																		
				0.53	174.88	**Missing**	**[coal + mudstone]?? [coal+parting] [seam 10R - floor]**																		

				0.45	175.41	Siltstone	muddy siltstone - hard coaly lenses throuhgout. Medium to dark grey carbonaceous. Broken badly broken some of this may be missing instead of all from above. No fizz.	50																	
57				0.06	175.86	Siltstone	muddy siltstone - as above may be dropped out of barrel from precious core run.		2.89	3.04	23	11	40												
				0.15	175.92	Missing	[coal?]																		
				0.43	176.07	Coal	broken, moderatly hard, dull calcite on fractures. [coal]																		
				1.10	176.50	Mudstone	carbonaceous dark grey to black - soft to moderately are broken up. Siltier at base.																		
							Drill stem may be deviating. Some thing structural happening in precious 2m as bedding goes to vertical now.																		
				1.17	177.60	Mudstone	silty mudtstone/sandstone - thin sandy to beds in mudstone. Bedding is vary but vertical. This coal beds are vertical and polished movement planes are also vertical.																		
	40	41		0.13	178.77	Mudstone	silty mudstone continues.																		
58			587	3.04	178.92		top-vertical, silty mudstone with thin sandstone and coaly beds. Slippage happens along coal bands and core is split in half length wise with polishign and slickensides. Mudstone is dark grey to black with carbonacoeus material coaly gragments throuhgout. [seam No. 10]	60	3.04	3.04	17	20	11												
59			597	0.30	181.97	Mudstone	silty mudstone with thin SST and carbonaceous laminations. [seam 10 - roof]	75	1.73	3.04	10	18	28	23											
				1.43	182.27	Mudstone	silty mudstone with thin coaly interbeds and minor sandstone medium hard, medium to dark grey and carbonaceous. Slippage on bedding is polished also calcite filled fractures across-bedding bottom is badly broken and coal at bottom is missing. [seam 10] - {T Nunn}	70																	
				1.31	183.70	**Missing**	**missing [coal? - next run is coal so bottom of this run was more likely lost core.] [seam 10]**																		
60			607	2.30	185.01	**Coal**	**moderately bright, moderately hard to friable, soft and flaky broken up with very little solid core. Measurements are estimate. Missing is from softed zones probably. [seam 10]**		2.3	3.04															
				0.74	187.31	**Missing**	**missing [coal most likely] [seam 10]**																		
61			617	0.35	188.06	**Coal**	**moderately hard, dull to medium brgiht, in solid core still. [seam 10]**		1.8	3.04	14														
	42	43		0.90	188.41	**Coal**	**broken, pull to medium bright in top half and ground into powder and small pieces in bottom half. [seam 10]**																		
				1.24	189.31	**Missing**	**missing (probably from soft powdered coal washing away) [seam 10 - floor]**																		
				0.24	190.55	Ironstone	medium brown, very dense and heavy contact of coal overlying is at 70°.	70																	
				0.31	190.79	Mudstone	silty mudstone - medium to dark grey, carbonaceous broken up.	70																	
62			627	2.24	191.11	Mudstone	silty mudstone - dark grey, carbonaceous, coaly lenses up to 2cm throughout. Coaly fragments and debris common. Rooting in dense. High angle slippage on bedding lenses polished and slickensided surfaces. Moderately hard to soft and fairly broken up.	75	3.04	3.04	15	17	17	20	22	22	13	20	12						
				0.14	193.35	Ironstone	dense heavy, medium brown, very fine grained.	55																	

				0.20	193.49	Mudstone	sitly mudstone - carbonaceous with rooting. Polsihed slip planes with slickensides.																		
	43	44		0.46	193.69	Mudstone	silty mudstone as above continued.																		
63				3.04	194.15	Mudstone	parting silty, coaly bands vertical + at 70° but may vary up to vertical. Rooting throuhgout middle part polishing + silikensides on movement surfaces. Core is fairly broken up. Mustone is medium hard, dark grey to black carbonaceous. Possibly some vertical.	70	3.04	3.04	13	20	11	22	28	22	16	15	10						
64			647	0.13	197.21	Mudstone	continued from last core.		2.48	3.04	10														
	44	45		0.15	197.34	**Coal**	**ground rounded dull lumps [seam 9 - roof]**																		
				1.50	197.49	**Coal**	**broken, dull to medium bright medium hard, some pulverized and podery. Some missing most likely from bottom? Ir softer zones [seam 9]**																		
				0.10	198.99	**Siltstone**	**muddy siltstone, medium brown, heavy, ferric. [parting]**																		
				0.60	199.09	**Coal**	**moderately hard. Broken, medium bright calcite visible [seam 9]**																		
				0.56	199.69	**Missing**	**(coal but from above or below parting unknown) [seam 9]**																		
65			657	0.26	200.25	**Missing**	**(coal possibly) [coal?] [seam 9]**			3.04	10	12	16												
				0.33	200.51	**Coal**	**broken, medium bright, cleatign, moderately hard. [coal] [seam 9 - floor]**																		
				0.35	200.84	Mudstone	silty mudstone parting - fairly dense, heavy and brownish may be ferric.																		
				0.33	201.19	Coal	fairly hard in chunks along with powder. Moderately bright. [coal]																		
				1.12	201.52	Mudstone	soft to moderately hard, carbonaceous. Coaly lenses, bands and debris throughout bottom broken and in small pieces mixed with coal from pieces mixed with coal from bands and lenses.																		
	45	46		0.65	202.64	Mudstone	silty mudstone - coaly lenses and bands throughout. Polishing and slickensides on movement surfaces.	55																	
			667	0.94	203.30	Siltstone	muddy siltstone and carboanceous mudstone in lower hafl. Many coal lenses, fragments. Core is broken and hard to tell. How much, but probably only thin coal. Siltsotne medium grey with sandy and coaly bands.	65	3.04	3.04	23	10	23	16											
				0.20	204.24	Coal	small band dull with bright bands - pieces + powder. Exact thickness unknown.																		
				1.90	204.44	Siltstone	mudstone - with thin sandy bands 1/3 up from base very broken and ground up. Coaly lenses, bands and fragments thgoughout. Polishign and slickensides on slippage surfaces.	65																	
67			677	0.36	206.35	Mudstone	silty in top half and medium grey - dark grey to black in bottom half and carbonaceous.		3.04	3.04	23	11	27	11	15	10									
	46	47		1.10	206.71	Mudstone	silty mudstone - medium hard medium to dark grey, carbonaceous coaly material throuhgout. Polishing and slickensides on slip faces. Bottom half broken up.	60																	
				0.40	207.81	Coal	moderately hard, broken, moderately bright. Friable.																		
				0.16	208.21	Mudstone	parting soft to moderately hard, carbonaceous.																		
				0.66	208.37	Coal	broken, soft, bright + dull, powder, pulverrized.																		
				0.36	209.03	Mudstone	broken fractured with polishing and slickensides. Silty, hard, coaly fragments throughout.																		

68				0.43	209.39	Siltstone	with thin sandstone bands hard. Carboanceous laminations movement with polishing and slickensided on slippage planes.	60	3.04	3.043	10	17	10	47	39	13									
				0.43	209.82	Siltstone	mudstone/coal - ground and broken and mixed up. Cannot tell thickness of each.																		
				0.40	210.25	Mudstone	silty mudstone - moderatley hard could stringers, lenses throughout medium to dark grey.																		
	47	48		1.87	210.65	Siltstone	slightly muddy at top. Medium grey, hard. Competent massive well indurated thin sandstone bands in center. Thin fractures filled with calcite at various angles.	65																	
69			697	2.12	212.45	Siltstone	with thin sandstone bands scattered throuhgout minor thin calcite filled fractures. Medium grey, hard, competent, massive. Some movement with polishing. No fizz.	60	3.04	3.043	42	15	91	22	20	37	20	29							
	48	49		0.92	214.57	Siltstone	continued. Thin calcite vertical fractures.																		
70			707		215.49	Siltstone	sandstone (60/40) - SST very fine grained to fine grained light grey. Siltsotne is medium grey, calcite filled fractures throughout. Polishing and slickensides on slip planes thin calcite filled fractrues scattered.	70	3.04	3.04	27	15	39	23	27	17	10	70	12						
71			717	0.19	218.54	Siltstone	SST (50/50) - thin coaly laminations thinly interbedded overlies coal.		3.04	3.04	19	58	18												
	49	50		0.79	218.73	Siltstone	sandstone - continued. Roof. Sharp basal contact with core.																		
				2.06	219.52	Coal	in part broken up into small pieces and about 1/2 is while core: head, blacky with bright bands. [coal]																		
72			727	0.24	221.59	Missing	[coal?]		3.8	3.04	16	12	11	15	16	20									
				0.20	221.83	Coal	broken and grained into small pieces. [coal]																		
	50	51		0.93	222.03	Mudstone	silty mudstone - borken up one coaly bed 3cm and thin coaly bands and laminations. Polished and slickenside on slippages surfaces. Medium to dark grey and carbonaceous.	65																	
				1.67	222.96	Mudstone	silty mudstone - slightly silty core 0.05 coal band 0.55 from top. Broken up pieces bottom. Medium grey, medium half, carbonaceous coaly lenses thoughout. Fracture and slip surfaces shown polishing and slickensides. No fizz.	60																	
73				2.43	224.63	Mudstone	sitly mudstone - minor thin grey fine grained sandstone bands + dark carbonaceous bands, coaly debris and laminations. Mudstone medium grey and medium ahrd. Slippage surfaces show polishing and slickensides. No fizz.	55-60	3.04	3.043	10	15	10	16	34	27	12	16	18						
	51	52		0.62	227.06	Mudstone	silty mudstone - continued. Thin calcite filled fractures throuhgout. No fizz.																		
74			747	1.92	227.69	Siltstone	muddy siltsotne - moderately hard to hard where siltier. Some parts broken and carbonaceous. Medium grey with coaly debris and fragments throughout. Slippry planes polished and slickensided. Thin fine to very fine grained sandstone bards fine grained sandstone bards center part. SST light grey. No fizz.	55	2.57	3.04	19	24	53	14	10	10									
				0.83	229.61	Mudstone	coaly mudstone - broken into small pieces fractures with polishing + slickensides on mamy surfaces.																		
				0.29	230.44	Missing	(coaly mudstone/muddy coal?)																		
75			757	0.80	230.73	Mudstone	silty mudstone - coaly mudsgtone at very top. Dark grey to black, carboanceous, fairly bards throuighout slippage on bedding with polishing + slickensides. Calcite on slight faces sandy at very bottom.		3.04	3.04	17	64	12	10	56	14									

	52	53		2.24	231.53	Sandstone	minor silstone thinly interbedded. Many coal laminations in bottom 1/3. Core are along coaly beds with polishing + slickensids. Some sandstone about 1/2 is about medium grained and thin remainder varies from fine to very fine hard light grey, quartzitic calcite filled fractures across-bedding. No fizz.	55-60																	
76			767	0.64	233.78	Sandstone	fine grained light grey, hard, quartizitic. Thinly coals laminations common throughout. Polishing + slikensides on bedding slippage. No fizz.	65	3.04	3.04	33	10	50	14	13	28	15	21	24	10	14				
				0.24	234.42	Ironstone	brown heavy dense.																		
				0.21	234.66	Sandstone	grained to very fine, calcite filled fracture minor siltstone bands.	60																	
				0.13	234.87	Ironstone	brownish, very fine, heavy dense.																		
				0.59	235.00	Sandstone	light + dark banding with coal laminations. Fine grained light grey.	55																	
	53	54		1.23	235.59	Sandstone	continued but is almost medium grained as it goes downwards. More thick calcite filled fractures across bedding many very thin carboanceous laminations. No fizz.	55-60																	
77				0.84	236.82	Sandstone	continues with coaly laminations common but black to a fine grained to very fine grained at base. No fizz.	60	3.04	3.04	16	14	10	13	14	11	14	10	18						
				1.80	237.66	Mudstone	dark grey carbonaceous. More silty in middle with thin fine grained sandstone bands.	50-55																	
	54	55		0.19	239.46	Mudstone	medium grey, hard, carbonaceous.																		
				0.25	239.65	Mudstone	coaly mudstone - broken, polished and slickensided on slippage faces calcite.																		
				0.16	239.90	**Coal**	**brown ground throuhgout hard, dull. [seam 8 - roof]**																		
78			787	1.25	239.88	**Missing**	**(Cored coal missing. Here or coaly mudstone ft bottom?) [seam 8]**		1.79	3.04															
				0.66	241.13	**Coal**	**medium, bright, medium hard, blocky in part. [seam 8]**																		
				1.13	241.79	**Mudstone**	**coaly mudstone - carboaneous, black, moderately hard to soft, broken up with lots of poishign and slickensides on planes. [seam 8]**																		
				1.25	242.92	**Missing**	**coal? May be from here or top of run. Top has harder coal so probably from here. [seam 8]**																		
79			797	1.13	242.93	**Missing**	**No Description. [seam 8]**																		
				1.12	244.06	**Coal**	**soft, friable very brown and pulverized in part, flacky more grained. Bright, good basal contact with underlying siltstone. [seam 8 -floor]**																		
				0.79	245.18	Siltstone	slightly muddy, medium hard, meidum grey.	65																	
80	55	56	807	1.10	245.97	Sandstone	silty at very top rooting. In middle, light grey, fine grained, hard, dark bands. More broken at bottom where bottom contacts polished and slickensided.	60	3.04	3.04	22	15	11	30	68	26	27								
				0.46	247.07		badly broken soft, polished + slickenside pieces of coaly carboanceous mudstone.																		
				0.74	247.53	Sandstone	fine to very fine with dark bands and thin carbonaceous laminations.																		
				0.74	248.27	Mudstone	silty mudstone - many coaly fragments dark grey. Broken polished and slickensided at the top.																		
81			817	0.63	249.02	Mudstone	carbonaceous, dark grey, coal lenses and bands some up to 1cm. Medium hard.	65		3.04	20	24	10	20	33	17	11	13	23						
	56	57		0.08	249.65	Coal	soft friable, flacky, moderately bright.																		

				0.67	249.73	Mudstone	dark grey, black, carboanceous, coaly bands, some slippage and polishing on coaly baeds.																		
				0.84	250.40	Siltstone	muddy siltstone/sandsotne - interbeds at top and bottom some turbiosty.	60																	
				0.28	251.24	Mudstone	coaly mudstone - broken polished, slickensided. Carbonaceous, coaly material throuhgout.																		
				0.54	251.52	Siltstone	muddy siltstone - coal band 2cm near top. Thin coaly laminations.	55																	
82				1.40	252.06	Siltstone	massive with coal stems lenses + debris scattered throuhgout medium grey, hard, competent, well indurated, no fractures.	55	3.04	3.04	76	61	12	17	22	49	23	10							
	57	58		0.80	253.46	Siltstone	continued with vertical polished slickensided fractures.																		
				0.84	254.26	Sandstone	siltstone (80/20) - fine to very thin grained SST light grey with thinly siltstone interbeds. No fizz.	65																	
83			837	0.40	255.12	Sandstone	continued from above.																		
				1.73	255.52	Siltstone	muddy siltstone - dark grey, carboanceous, coaly debris and rooting. Polishing on slip faces sandy at base.	60																	
				0.25	257.25	Siltstone	medium grey, hard sandy, more sandstone																		
	58	59			257.50	Siltstone	SST - medium grey to light grey. Sandy in bottom half. Coaly band near top and near vertical polished fractures.	55																	
84			847		258.17	Sandstone	siltstone (85/15) - fine grained light grey SST with scattered thin interbedded of siltstone sadnstone. Almost medium grained at base. More broken, polished + slickensided in one zone 1/2 up from bottom.	60	3.04	3.04	52	33	20	24	44	10	22								
85			857	0.72	261.21	Sandstone	continued as above.	70	3.04	3.043	23	20	10	23	11	22	11	12	12	24	10				
				1.32	261.93	Mudstone	slightly siltstone, carbonaceous, black, broken polished slickensides, medium hard. Coal lenses + bards throughout.																		
				1.00	263.25	Sandstone	turbio. Some is fine to very fine grained, light grey quartzitic.	65-70																	
86			867	0.78	264.26	Sandstone	silty at top fine, grained, light grey. Some cross-bedding and turbiotic near base. No fizz.	60	3.04	3.04	14	27	13	20	10	10									
	60	61		0.88	265.04	Sandstone	grained, silty at top, high angle slippage/fractures with polishing and siltstone. No fizz.	70																	
					265.92		**Fracture zone**																		
87				1.38	265.92	Sandstone	siltstone (80/20) - siltstone near bottom. Top has sandstone with a somewhere of calcite filled cracks - very eoncentrarted belong is fractured rock with fault gouge of mud + rock fragments, more fine grained SST and broken siltstone to silty mudstone at bottom. No fizz.																		
			877		267.31	Siltstone	hard, medium grey massive, competent, with indurated. Broken at top and 1/3 from top but mostly good core. Sandstone thinly interbedded in bottom. No fizz.	60	3.04	3.04	56	12	16	35	35	15	37								
88			887	2.25	270.36	Sandstone	siltstone (80/20) - sandstone, light grey, very fine to fine grained. Minor carbonaceous bands. Oil guage in on fracture with calcite. [oil]	55	3.04	3.043	18	32	12	20	12	11	10	21	23	17	33	20			
	62	63		0.79	272.61	Sandstone	with thin siltstone and carbonaceous bands on calcite filled fractures across-bedding. No fizz.	60																	
89			897		273.41	Sandstone	siltstone (85/15) - fine grained silty in bottom half thin 0.05 coal bed at bottom of top third. Broken at bottom with polishing and slickensides on slip faces. Thin coaly laminations throughout.	60	3.04	3.04	18	20	14	18	13	29	15	17	19						

90			907	0.87	276.45	Sandstone	siltstone - thin sandstone beds interbedded at top. More silty at bottom minor carbonaceous banding. Coaly debris and fragments throuhgout. No fizz.	55-60	3.04	3.04	28	13	10	24	20	16	18	21							
				2.17	277.32	Mudstone	silty at very top, carbonaceous, medium hard about 1/3 down is very broken polished, slickensided. Fault gouge.	70																	
					279.49		**Fracture zone**																		
91			917	0.88	279.50	Siltstone	slightly muddy at top. Medium grey thin calcite titled fractures across-bedding. Some polished slickensided planes.		3.04	3.04	12	47	16	10	16	26	10								
	64	65		2.16	280.38	Mudstone	silty center totally broken fracture with vertical polished slickensided. Planes calcite coaly lenses and bedding throughout.	55																	
92			927	1.40	282.55	Siltstone	thin sandstone bands throuhgout. Also minor coaly laminations medium grey. Calcite filled fractures throuhgout.	55-60	3.04	3.04	46	17	23	37	24	15	32	31	21						
	65	66		1.64	283.95	Siltstone	sandstone - thin to medium interbeds/SST fine grained light grey, minor grey laminations bioturbation and load casts.	60																	
93			937	2.62	285.60	Siltstone	sandstone (20/80) - bioturbation, turbioty, load casts. Thin carbonaceous laminations SST is grey fine to very fine grained interclasts competent, well indurated. No fizz.		3.04	3.04	87	21	86	35	10	16	21								
	66	67		0.42	288.22	Sandstone	fine to very fine light laminations of siltstone. Minor cross-bedding. No fizz.	65																	
94			947	3.04	288.65	Siltstone	sandstone (50/50) - thin to medium interbeds with turbioation, load casting fine, calcite filled fractures across-bedding.	60	3.04	3.043	24	29	22	13	56	18	26	11							
95			957	0.50	291.69	Sandstone	fine to almost medium grained, salt + pepper texture, thin siltstone and muddy carbonaceous laminations.	60	3.04	3.04	26	16	10	37	12										
	67	68		0.90	292.19	Mudstone	minor sandstone at very top slightly sandy in upper third. Medium to dark grey, medium hard carboanceous.																		
				0.66	293.09	Coal	hard, medium, bright. Bright bands - core all there [coal]																		
				0.90	293.75	Mudstone	carbonaceous, thick medium hard, coaly bands and beds up to 2cm near base.	65																	
				0.08	294.65	Coal	hard blocky, medium coal [coal]																		
96			967	1.11	294.74	Coal	hard, blocky, medium bright. Not borken up. [coal]		1.71	3.04															
				0.26	295.85	Mudstone	soft to medium hard, carboanceous, coaly, laminations - dark grey black. [partng]	60																	
				0.15	296.11	Coal	broken medium dull with bright bands, medium hard. [coal]																		
	68	69		0.19	296.26	Coal	as above continued. [coal]																		
				1.33	296.45	Missing	(coal most likely.) [coal?]																		
97			977	0.44	297.79	Missing	(probably coal) [coal]		2.63	3.04	10	21	20	27	24	30	26								
				0.14	298.23	Coal	broken rounded, washed medium bright. [coal]																		
				1.34	298.37	Mudstone	carbonaceous, black, coaly laminations + fragments siltier towards base. Bottom has vertical polished slickensided irregular fractures minor thin calcite filled fractures.	60																	
				1.15	299.71	Sandstone	fine to grey fine grained, bioturbation (warm tubes) cross-bedding. Light grey, quartzitic well sorted, well indurated calcite filled fractures across-bedding.	60																	
98			987	1.40	300.84	Sandstone	fine to very fine grained with thin interbedded siltstone waving bedding, bioturbation.	65	3.04	3.04	89	10	40	29	12	17									

	69	70		1.64	302.24	Sandstone	very fine to fine grained, light grey, bioturacation throuhgout undulating bedding. Calcite filled fractures across-bedding. Oil seepage from fracture in middle from vugas in calcite. Coaly carbonaceous laminations near base. No fizz. [oil]	65																	
99			997	1.14	303.89	Coal	broken, blocky, dull birhgt bands bottom 1/2 friable and flacky. [coal]		3.04	3.04	30	20	15	48	32										
				1.10	305.03	Mudstone	silty mudstone - silter towards base and sandstone in bottom 0.16m. Medium gery, carbonaceous broken at top …coal with polished slip faces. Small thin calcite filled fractures. [coal]																		
	70	71		0.80	306.13	Sandstone	siltstone (85/15) - light grey, fine to very fine grained polishing + slickensides on slip planes. Thin calcite filled fractures across-bedding.	65																	
100			1007	1.61	306.93	Mudstone	silty at top medium grey, thin sandstone bands scattered throughout.	55	3.04	3.04	20	10	18	16	16	26	10	17	94						
				1.43	308.54	Siltstone	sandstone - fine to very fine grained. Thin to medium grained. Thin fracture filled with calcite across-bedding.	65																	
101			1017	0.25	309.98	Siltstone	muddy, medium hard, thin carboanceous coaly lenses.	65	3.04	3.04	26	61	19	19	18	23	32	24	20	14					
				2.79	310.23	Siltstone	with sandstone interbeds. Vertical polished fractures. Fractures more near base. Thin lense of coal and scattered fragments.	65																	
102			1027	0.81	313.03	Siltstone	thin sandstone bands. Calcite in fractures medium grey.	65	3.04	3.04	16	26	28	10	25	77	38	20							
				0.22	313.84	Coal	dull birght bands-hard.																		
				0.28	314.06	Mudstone	carbonaceous, coaly lenses and bands.																		
	72	73		1.73	314.34	Siltstone	sandier at bottom unknown competent, well indurate.																		
103			1037	2.62	316.08	Siltstone	medium grey very hard, uniform, no bedding competent, well indurated.		3.04	3.043	55	43	12	21	45	52	21								
	73	74			318.70	Siltstone	same unit.																		
104			1047	0.86	319.13	Siltstone	medium grey, hard well indurated. Minor thin light grey quartizic sandstone and coaly bands. Thin calcite filled fractures across-bedding. No fizz.	60	3.04	3.04	37	29	14	31	42	50	10	26							
				0.08	319.99	Mudstone	silty mudstone with vugage calcite filled fractures and plenty of oil seepage [oil]																		
				2.10	320.07	Mudstone	silty mudstone - dark grey to black in parts, carbonaceous coaly lenses, laminations and fragments throuhgout. Minor calcite filled fractures some plishing and slickensides on slippage planes. No fizz.	65																	
105			1057	0.72	322.17	Mudstone	silty in top half muddy and carboanceous in bottom half.		3.04	3.04	48	22	24	73	24	11	22	46							
	74	75		2.32	322.89	Mudstone	silty mudstone - medium grey, hard coaly lense and fragments scattered some slippages faces polished, carboanceous.																		
106				1.94	325.21	Mudstone	silty mudstone - carbonaceous coaly fragments throuhgout. No fizz.	65	3.04	3.04	15	32	46	43	11	15	12	19	17	31	25				
				1.10	327.15	Mudstone	silty mudstone - medium to dark grey carbonaceous, coaly lenses and stringers throughout. Some slippages and polishing.																		
107			1077	3.04	328.27	Mudstone	silty at top more muddy down. Carbonaceous medium to dark grey hard vertical polished/slickensided fracture and horizontal calcite filled fracure. More broken up in center. Coaly fragments and lenses throughtou.	60	3.04	3.04	16	22	15	10	33	15	18	25	20	20	10	12			
108	77		1087	1.20	331.32	Mudstone	Roof. slighty siltier, dark grey, carbonaceous hard. Coaly debris and fragments throughout. Broken up at base just above coal. Some slippage with polishign in broken pieces.		2.89	3.04	55	32	13												

				0.15	332.52	Missing	(coal)[coal 10?]																		
				0.44	332.67	Coal	powdered at top and dull with bright bands bright borken in reminders. [coal]																		
				0.04	333.11	Mudstone	carbonaceous and lots of coaly fragments. [parting]																		
				0.85	333.15	Coal	broken + hard dull blocks. [coal]																		
				0.36	334.00	Mudstone	moderately hard, carboanceous, black, coaly fragments and debris throughout. [coal]																		
109			1097	0.86	334.37	Mudstone	carbonaceous, broken up polishing on slip faces. Coaly fragments, lenses and bards throughout. Exact thickness unknown without E-log.	65	1.22	3.04	10	12													
				0.26	335.23	Coal	broken into small dull pieces and lumps. Some rounded from was high.																		
	77	78		0.10	335.49	Coal	small broken pieces.																		
				1.82	335.59	Missing	(coal - likely say 5.0 feet) [coal]																		
110			1107	1.09	337.41	Coal	exact thin unknown without E-logs. Some hard dull come pieces, ground small pieces and powders dull + bright. [coal]		3.04	3.04	21	10													
				0.30	338.50	Mudstone	carbonaceous, coal fragments, broken up into many pieces black. True thicknessunknown with one E-log. [parting]																		
				0.24	338.80	Coal	powder - external thickness without E-log. May be powdered coal from above? [coal]																		
				1.41	339.04	Mudstone	black, carboanceous, coaly except sandy and medium grey in middle bottom and to broken with polished and slickensided slip faces.	65																	
111			1117	0.52	340.46	Mudstone	silty mudstone /sandstone - thinly bedding in top 1/3 Some more lighty grey, hard, quartizitic silty mudstone medium hard, medium grey. Slippage along bedding with polishing and slickensides.	65	3.04	3.04	10	10													
	78	79		3.52	340.98	Mudstone	silty mudstone - totally broken and fractures up into pieces. Vertical and bedding slippages with polishing and slickensided. Carbonaceous with coaly bands, lenses and fragments throuhgout. Medium grey medium hard. Some soft sharp core.	60																	
112			1127	0.10	343.51	Mudstone	silty mudstone - broken pieces on above some may be from previous run that filled out of bards.		1.63	3.04															
				1.38	343.61	Coal	broken, flacky and some powdered - may be some missing here. [parting]																		
				0.10	344.99	Mudstone	soft medium round broken, exact thickness unknown without E-log. [parting]																		
				0.05	345.09	Coal	powder and fragments. [coal]																		
				1.41	345.14	Missing	coal. [coal?]																		
112			1137	0.26	346.56	Coal	powdered, dull and bright. [coal]		3.04	3.04															
	79	80		1.50	346.82	Coal	powdered dull and bright. [coal]																		
				0.10	348.32	Mudstone	medium grey broken. [parting]																		
				0.88	348.42	Coal	powdered dull and bright. [coal]																		
				0.30	349.30	Mudstone	siltstone (50/50) - mudstone bottom sandy siltstone. Coaly material scattered throuhgout. Borken with light angle slip and polishing. [coal]																		

113			1147	1.56	349.61	Mudstone	medium to dark grey, broken into small pieces, sheared all faces polished and slickensided, coaly debris, bands, lenses throughout carbonaceous. Medium hard and some zone powdered and soft.		3.04	3.04															
	80	81		1.48	351.17	Mudstone	continued as above.																		
114			1157	0.30	352.65	Mudstone	cotinued thin broken exactly unknown. Very broken into flacky, polshing slickensided sheared		2.12	3.04															
				1.30	352.95	Coal	broken, soft tored hard medium bright. [coal]																		
				0.92	354.25	Missing	coal bright on mudstone. (no E-log to tell) [coal?]																		
				0.52	355.17	Mudstone	powder shaly mudstone (exact thickness?)																		
115	82		1167	0.28	355.70	Missing	(coal) most likely. [coal?]		2.76	3.04															
				2.40	355.98	Coal	some hard dull pieces - most is broken, flacky + powdered a bit muddy on top. Dull and bright. [coal]																		
				0.36	358.38	Mudstone	medium to dark grey, broken up, carbonaceous, coaly fragments and pieces throughout.	50																	
116			1177	0.90	358.75	Mudstone	medium hard, medium to dark grey, carboanceous with coaly material throuhgout. Some sheasing with polishing and slickensides along bedding and thin angle.	50	1.65	3.04															
				0.50	359.65	Coal	powdered and small bright and dull pieces. A mud in the core box sludgy [coal]																		
	83	84		1.39	360.15	Missing	(coal most likely.) [coal?]																		
				0.25	361.54		broken shaly type mudstone lots of polishing stream planes and small pieces Medium grey soft to medium hard.																		
116			1187	0.63	361.80	Mudstone	silty mudstone - fairly hard medium grey, coaly material throuhgout sheaning has polishing.		2.87	3.04	22	10	18												
				0.24	362.43	Ironstone	dense, broken to medium grey, heavy.																		
				1.60	362.67	Mudstone	coaly, shaly mudstone - carbonaceous medium to dark grey, sheared and broken, polishing and slickenside planes. Powdered on broken very broken with coaly material throughout.																		
				0.17	364.27	Missing	missing as above.																		
					364.85		**T.D. 1197FEET. END OF HOLE.**																		

2011-03A

2011-38a

Diamond Drill

Ron Swaren

Core	Box		Top (ft)	Recovery	Depth (m)	Lithology	Core Description	Apparent Dip of Bedding	Core cut (m)		RQD (cm)												Note
	From	To							Recovery	Run	core sticks ≥10cm												
						x	Overburden and till to 100'-110'																
	1					x	starts at 107 feet and has 5 feet overburded.																
							The core fell off truck during transport and was totally mized up along with intervals, footag blocks etc.																
							See attached driller's log since there is no E-log.																
						x	What I can observe + photo grained is a mix of sandstone/siltstone, mudstone with thin coal to 267 feet.																
						x	In the last box (Box17) is a main coal seam starting at 267 feet. There is 7 feet of coal in the box.																
						x	The drillers drilled from 267 feet to 307 feet (40feet) in coal but had in recovery and due to drilling problems pulled off the hole. I was not present and this is word of mouth drillers log and what I can see in the core as it is.																
	17					x	Measured apparent dip is 40° throught the hole.																
			0			Mudstone	Mudstone, overburden and till to 100'-110'; The core fell off truck during transport and was totally mized up along with intervals, footag blocks etc.																
			35		10.675	Mudstone	Mud Stone & Boulder																
			100		30.50	Clay																	
			101		30.805	Coal	[seam No. 23]																
			104		31.72	Mudstone	Mud Stone & Sand Stone; starts at 107 feet and has 5 feet overburded.																
			147		44.835	Coal	[seam No. 22]																
			152		46.36	Mudstone																	
			162		49.41	Coal	Likely Coaly mudstone																
			163		49.715	Mudstone	Mud & Sand Stone																
			175		53.375	Coal	Likely coaly mudstone																
			177		53.985	Mudstone	Mud & Sand Stone																
			187		57.035	Coal	[seam No. 21R]																
			188		57.34	Mudstone	Mud & Sand Stone																
			217		66.185	Sandstone	What I can observe + photo grained is a mix of sandstone/siltstone, mudstone with thin coal to 267 feet.																
			226		68.93	Coal	Likely coaly mudstone																
			227		69.235	Mudstone	Mud & Sand Stone; In the last box (Box 17) is a main coal seam starting at 267 feet. There is 7 feet of coal in the box.																
			267		81.435	Coal	The drillers drilled from 267 feet to 307 feet (40feet) in coal but had in recovery and due to drilling problems pulled off the hole. I was not present and this is word of mouth drillers log and what I can see in the core as it is. [seam No. 21]																
			307		93.635		Hole caved in at 307 feet, still in coal, but steel stuck. Took over 12 hours to get steel free and remove from hole. Measured apparent dip is 40° throught the hole. TD=307 ft.	40°															

Hole 2011-01A

PIC 1: Box 1 to Box 3

Pic 2: Box 4 to Box 6

Pic 3: Box 7 to Box 9

Pic 4: Box 10 to Box 12 (#12 and #11 seam)

Pic 5: Box 13 to Box 15

Pic 6: Box 16 to Box 18

Pic 7: Box 19 to Box 21

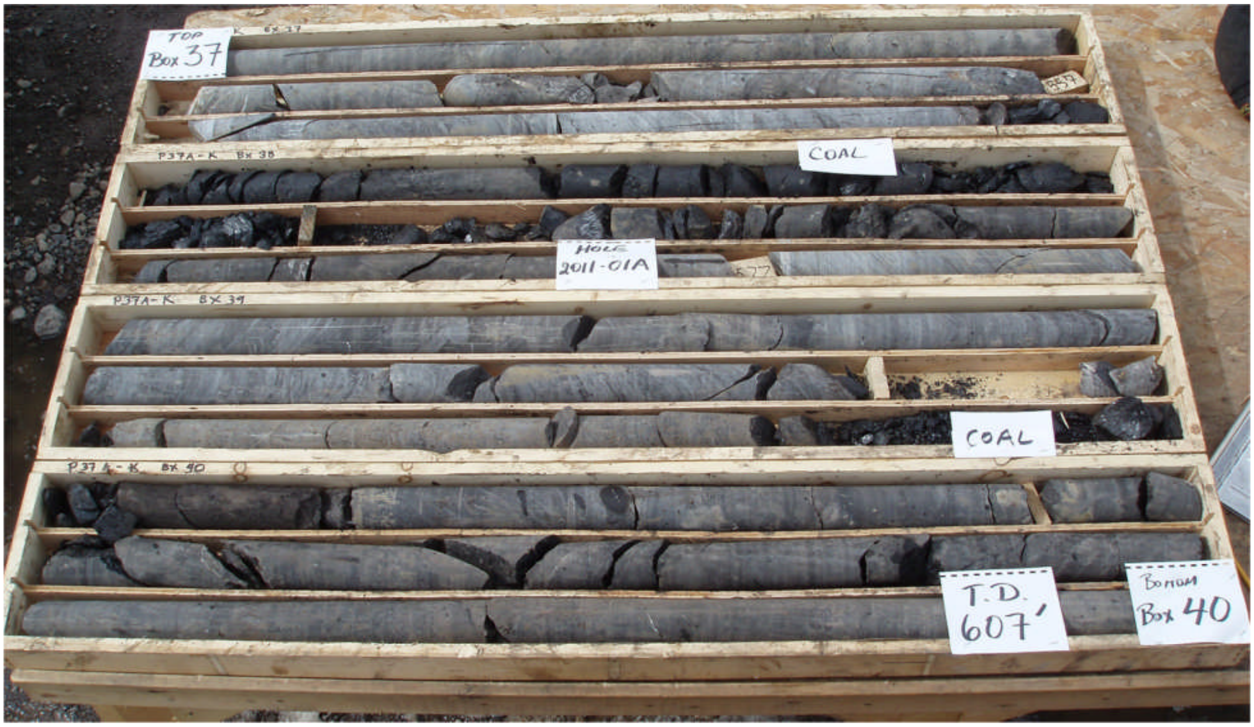
Pic 8: Box 22 to Box 24 (#10 and #9 seam)

Pic 9: Box 25 to Box 27

Pic 10: Box 28 to Box 30

Pic 11: Box 31 to Box 33

Pic 12: Box 34 to Box 36

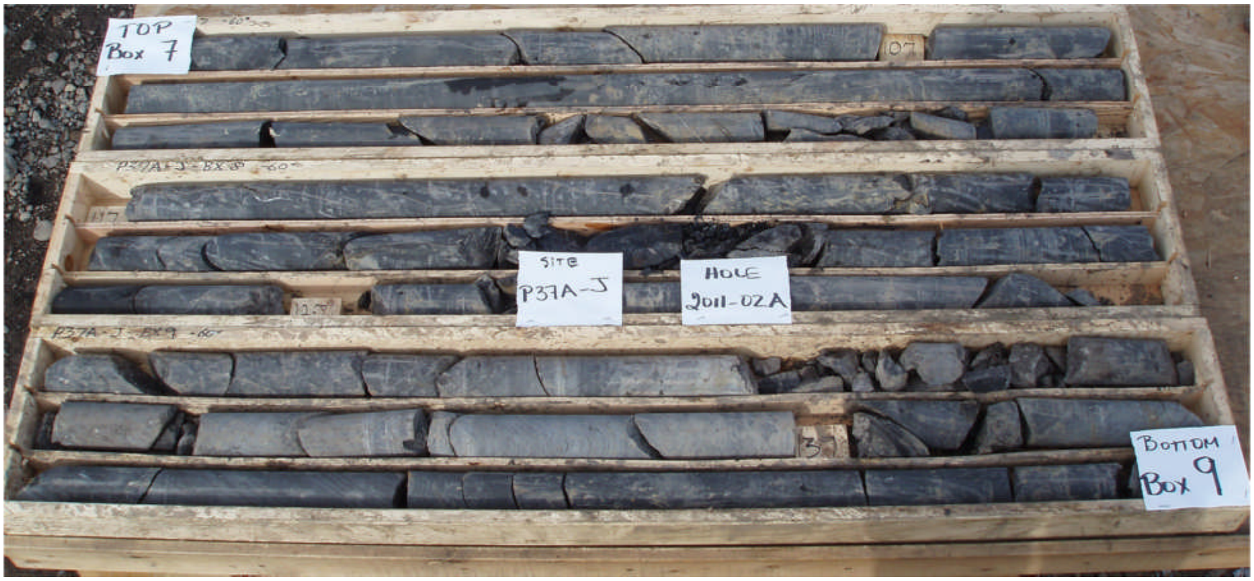


Pic 13: Box 37 to Box 40 (#8 seam. TD=607 ft)

Hole 2011-02A

Pic 1: Box 1 to Box 3

Pic 2: Box 4 to Box 6



Pic 3: Box 7 to Box 9

Pic 4: Box 10 to Box 12

Pic 5: Box 13 to Box 15

Pic 6: Box 16 to Box 18 (#12T seam)

Pic 7: Box 19 to Box 21 (#12 seam)

Pic 8: Box 22 to Box 24 (#11 seam)

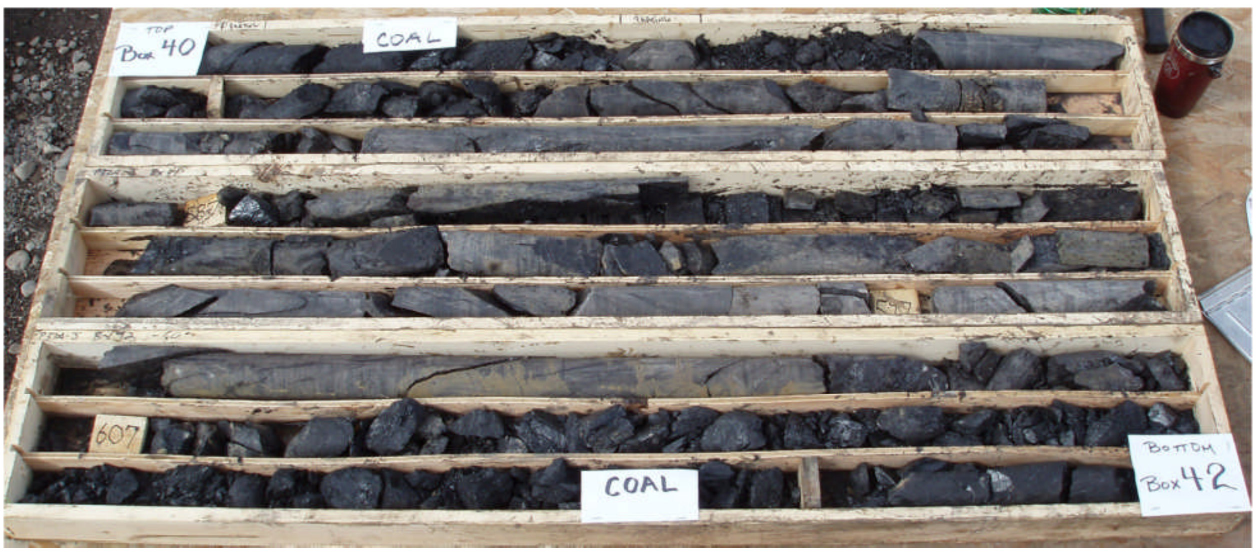
Pic 9: Box 25 to Box 27

Pic 10: Box 28 to Box 30

Pic 11: Box 31 to Box 33

Pic 12: Box 34 to Box 36

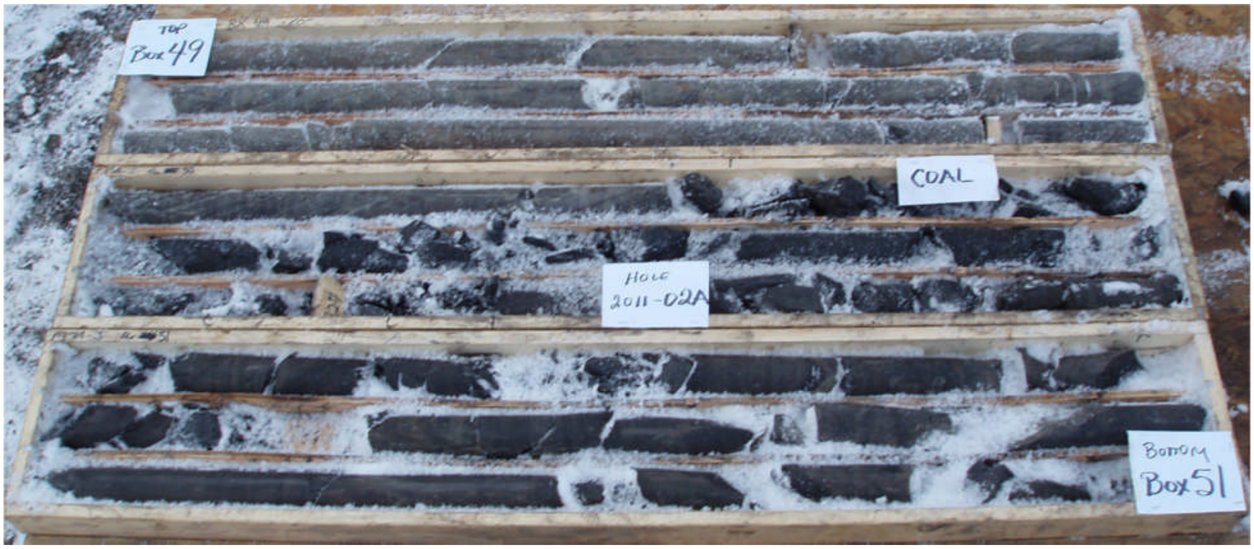
Pic 13: Box 37 to Box 39 (#10R seam)



Pic 14: Box 40 to Box 42 (#10 seam)

Pic 15: Box 43 to Box 45 (#9 seam)

Pic 16: Box 46 to Box 48



Pic 17: Box 49 to Box 51

Pic 18: Box 52 to Box 54

Pic 19: Box 55 to Box 57 (#8 seam)

Pic 20: Box 58 to Box 60

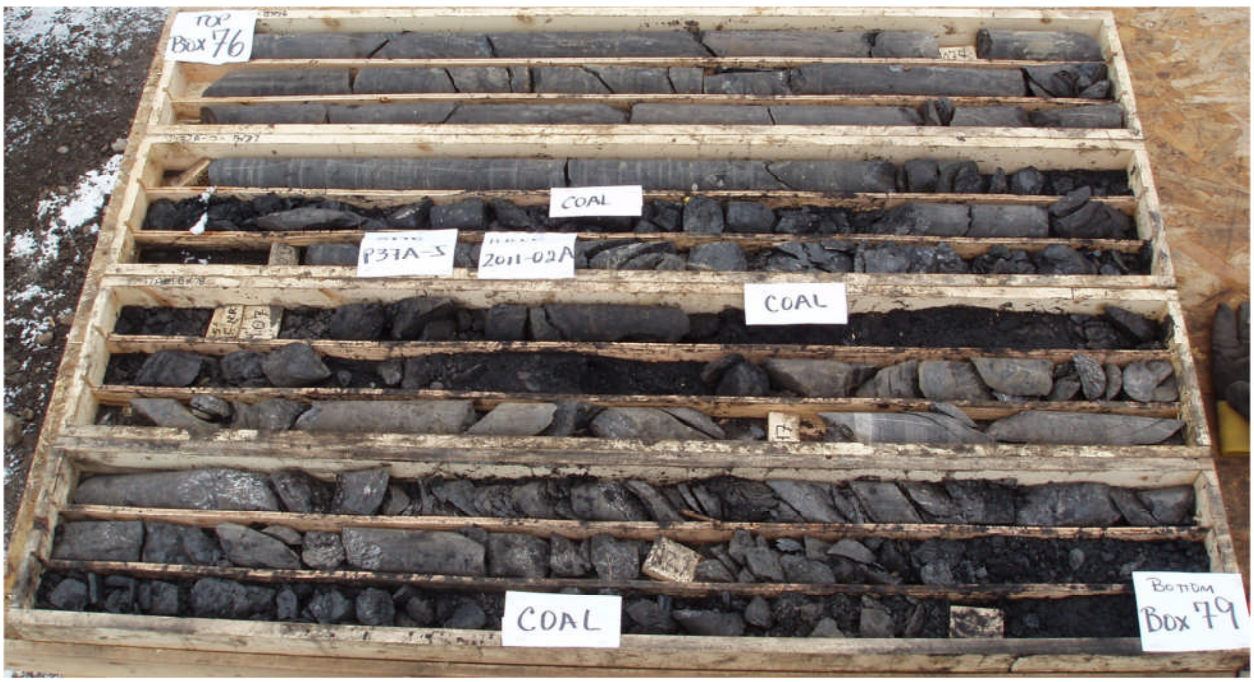
Pic 21: Box 61 to Box 63 (Fracture zone)

Pic 22: Box 64 to Box 66 (Fracture zone)

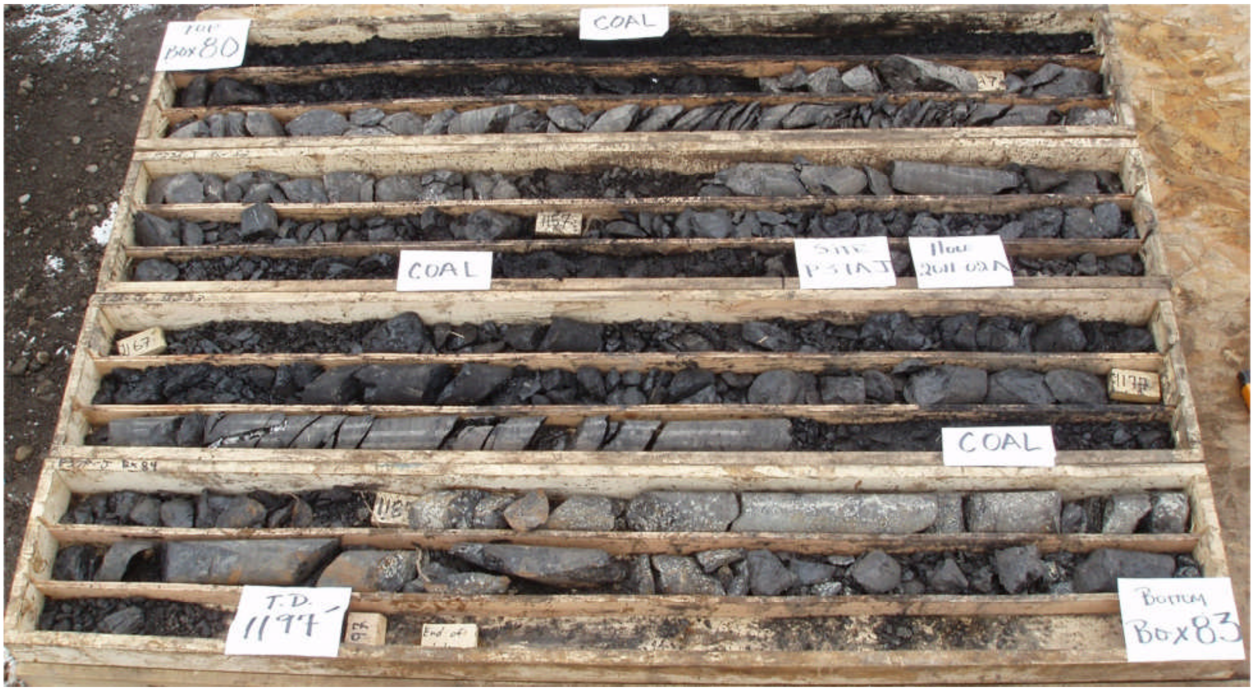
Pic 23: Box 67 to Box 69

Pic 24: Box 70 to Box 72

Pic 25: Box 73 to Box 75



Pic 26: Box 76 to Box 79



Pic 27: Box 80 to Box 83 (TD=1197 ft)

Hole 2011-03A (38A)

Pic 1: Box 1 to Box 3 (#23 & #22 SEAM)

Pic 2: Box 4 to Box 5

Pic 3: Box 6 to Box 9

PIC 4: Box 10 to Box 14

Pic 5: Box 15 to Box 17 (#21L SEAM) TD=307ft.

Appendix IV

2011 Hydrogeological Monitor Hole Logs

2011 Bingay Water Monitoring Wells

Hole ID	Northing	Easting	Elevation (m)	Dip	Hole Depth (m)	Hole Depth (ft)
MW-11-1D	5562270.0	644050.0	1419.50	90	102.11	335
MW-11-2D	5562318.0	644325.0	1399.50	90	109.73	360
MW-11-3D	5562524.1	644429.3	1390.50	90	117.35	215
MW-11-4D	5563366.4	644344.6	1388.50	90	151.18	496
MW-11-5D	5562562.2	644348.0	1397.50	90	102.41	336
MW-11-5S	5562760.0	644460.0	1392.00	90	6.40	20

HOLE ID	FROM (m)	TO (m)	Lithology	Description
MW-11-1D	0.00	7.62	Till	Dense clay till water/gravel
MW-11-1D	7.62	11.58	Gravel	Sand & gravel, approx 10GPM water production
MW-11-1D	11.58	36.58	Siltstone	Siltstone/mudstone, soft, brown, coal layers 4 to 8 inches, max 2 ft (Bedrock hit at 38ft)
MW-11-1D	36.58	51.82	Siltstone	Silstone/shale - No coal. @150ft - 2 gpm water
MW-11-1D	51.82	102.11	Sandstone	Gray, dense. 174ft/53m - 4 gpm water: gradual increase to 5 gpm with depthbto 335ft/102m. Hole terminated at 102.1m

Other

10 gpm at 25-38ft/ 7.6-11.6m

2 gpm water at 150ft/45.7m

4 gpm water at 174ft/35m, gradual increase to 5 gpm to 335ft/102m.

HOLE ID	FROM (m)	TO (m)	Lithology	Description
MW-11-2D	0.00	5.79	Gravel	Silty, sandy gravel, dry, tan to light grey
MW-11-2D	5.79	109.73	Sandstone	Grey, dense, hard drilling, very dry. Hole terminated at 109.7m

Other

No water

HOLE ID	FROM (m)	TO (m)	Lithology	Description
MW-11-3D	0.00	5.49	Gravel	Sand and Gravel, dry, loose
MW-11-3D	5.49	6.10	Bedrock	Bedrock (Logged by driller)
MW-11-3D	6.10	6.71	Coal	
MW-11-3D	6.71	31.09	Mudstone	Brown-gray Mudstone - casing set at 36ft/~11m
MW-11-3D	31.09	32.92	Coal	Possible coal seam, soft drilling
MW-11-3D	32.92	39.01	Mudstone	Brown-gray, harder drilling than previous interval
MW-11-3D	39.01	45.72	Coal	soft, common thin gray brown apparently mudstone layers, soft drilling
MW-11-3D	45.72	46.63	Mudstone	Brown, soft
MW-11-3D	46.63	59.44	Shale	Coaly shale, brown, harder drilling, samples almost all coal
MW-11-3D	59.44	117.35	Sandstone	gray with abundant coal, possible thin coal seams, possible thin mudstone layers, slow drilling below approx 215 ft/~66m

Other Notes

Hole terminated at 385 ft/~118 m due to increasing slow drilling, repeatedly needed to lift bit and clear coal slough from downhole hammer

Trace possible water at about 180 ft/~ 55m

Encountered groundwater at about 205 ft/~63 m, 10 to 15 gpm, gradually increasing to about 20-25 gpm with depth.

HOLE ID	FROM (m)	TO (m)	Lithology	Description
MW-11-4D	0.00	6.71	Gravel	Silty gravelly sand and sandy gravelly silt, scattered sand and gravel layers, loose to moderately compact, dry to damp
MW-11-4D	6.71	16.15	Gravel	Sandy gravelly silt, increasing clay with depth, compact, damp. Likely glacial till
MW-11-4D	16.15	21.34	Clay	Sandy clay, soft to firm, damp, scattered gravel layers
MW-11-4D	21.34	24.38	Coal	Coal with mudstone and sandstone, soft, fast drilling, dry
MW-11-4D	24.38	28.35	Sandstone	Sandstone with minor mudstone with thin coal seams
MW-11-4D	28.35	33.53	Mudstone	Mudstone with common coal layers, soft drilling, dry, increasing coal with depth
MW-11-4D	33.53	35.97	Shale	Grading to shaly coal/coaly shale, fast drilling, dry
MW-11-4D	35.97	38.10	Coal	
MW-11-4D	38.10	52.73	Shale	Layered coaly shale and mudstone, dry
MW-11-4D	52.73	75.59	Shale	Dark gray shale and brown mudstone, dry. Slight groundwater at 180ft/54.9m
MW-11-4D	75.59	78.64	Coal	
MW-11-4D	78.64	83.82	Mudstone	Dry, no water
MW-11-4D	83.82	88.39	Coal	
MW-11-4D	88.39	100.58	Mudstone	Dry, no water
MW-11-4D	100.58	132.89	Sandstone	Gray, dry, no water
MW-11-4D	132.89	134.11	Coal	Possible coal, soft drilling
MW-11-4D	134.11	151.18	Shale	Black shale and mudstone, dry, no water

Other

Surface casing set at 81ft/24.7m
Depth to water on 7/7/11 - 40 ft/12.2m
Depth to water on 7/8/11 - 26.1ft/7.95m
Installed 60ft 10-slot screen at hole bottom, blank casing to ground surface

Hole ID	From (m)	To (m)	Lithology	Description
MW-11-5D	0.00	13.11	Gravel	Sandy gravel
MW-11-5D	13.11	16.46	Till	Till and clay
MW-11-5D	16.46	24.38	Bedrock	
MW-11-5D	24.38	30.48	Coal	
MW-11-5D	30.48	32.00	Rock	
MW-11-5D	32.00	35.05	Coal	
MW-11-5D	35.05	42.67	Bedrock	
MW-11-5D	42.67	45.72	Coal	
MW-11-5D	45.72	51.82	Bedrock	Shaly bedrock
MW-11-5D	51.82	53.34	Coal	
MW-11-5D	53.34	57.91	Bedrock	2 gpm water at 185ft/56.4m
MW-11-5D	57.91	58.52	Coal	
MW-11-5D	58.52	90.83	Bedrock	
MW-11-5D	90.83	93.27	Coal	
MW-11-5D	93.27	102.41	Bedrock	

Other

Hole terminated at 102.4m

2gpm water producation at 185ft/56.4m

Hole ID	From (m)	To (m)	Lithology	Description
MW-11-5S	0.00	3.96	Gravel	Silty sandy gravel, loose, dry to damp
MW-11-5S	3.96	5.49	Sand	Sands and gravelly sand, loose, damp, no silt or clay
MW-11-5S	5.49	6.10	Gravel	Silty sandy gravel, loose, damp. Weathered bedrock
MW-11-5S	6.10	6.40	Bedrock	Hole terminated

OTHER

No water encountered

Hole was abandoned and backfilled with cuttings

Appendix V

2011 Hydrogeological Monitor Hole Geophysical Logs

Century WIRELINE SERVICES

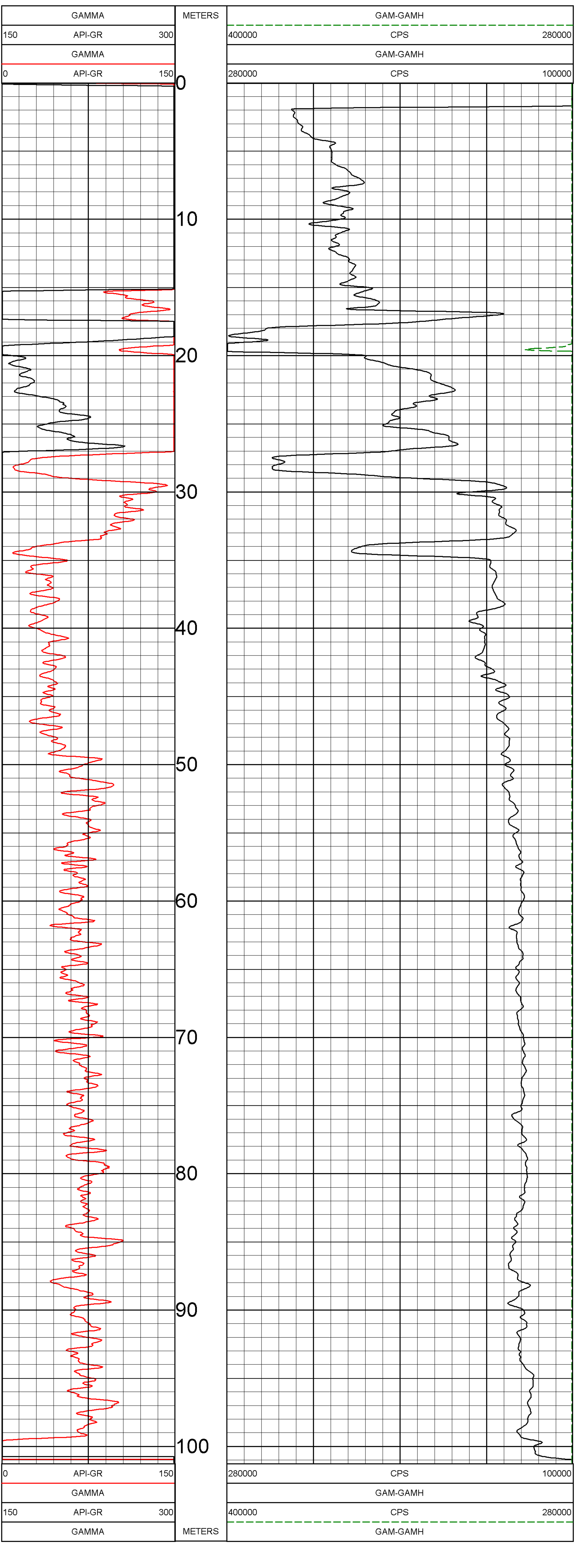
GAMMA-DENSITY (CPS)
LOG THRU DRILL PIPE
MW11-D1

COMPANY	CENTERMOUNT COAL	OTHER SERVICES: 9058	
WELL	MW11-D1		
FIELD	:		
COUNTRY	CANADA		
PROVINCE	BRITISH COLUMBIA		
LSD	:		
SECTION	N/A		
TOWNSHIP	N/A		
RANGE	N/A		
LICENSE NO.	N/A		
UNIQUE WELL ID.	N/A		
PERMANENT DATUM	GL	ELEVATION KB	N/A
LOG MEASURED FROM	GL	ELEVATION DF	N/A
DRL MEASURED FROM	GL	ELEVATION GL	N/A
DATE	10/14/12	RIG NUMBER	JR DRILLING
DEPTH DRILLER	102.00	LOGGER TD	101.60
BIT SIZE	146.05	ARRIVAL TIME	12:20
LOG TOP	0.00	DEPARTURE TIME	14:00
LOG BOTTOM	101.21	CIRC STOPPED	N/A
CASING LOGGER	18.3		
CASING DRILLER	18.3		
CASING TYPE	STEEL		
BOREHOLE FLUID	WATER		
RM TEMPERATURE	N/A		
MUD RES	N/A		
MUD WEIGHT	1.0		
WITNESSED BY	B.EDGREN		
RECORDED BY	B.HILL		
REMARKS 1	VERTICAL HOLE		
REMARKS 2	:		

GAMMA DENSITY THRU PLASTIC 1:100 MW11-D1 10/14/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/29/2011VERSION = 3.64KF



GAMMA DENSITY THRU PLASTIC 1:100 MW11-D1 10/14/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/29/2011VERSION = 3.64KF

TOOL CALIBRATION MW11-D1 10/14/12 13:06
TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun01,12	13:18:24	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Jun01,12	13:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

Century WIRELINE SERVICES

GAMMA - NEUTRON
IN PIPE
MW-11-1V-D

COMPANY	:CENTERMOUNT COAL
WELL	:MW-11-1V-D
FIELD	:N/A
COUNTRY	:CANADA
PROVINCE	:BRITISH COLUMBIA
LSD	:N/A
SECTION	:N/A
TOWNSHIP	:N/A
RANGE	:N/A
LICENSE NO.	:N/A
UNIQUE WELL ID.	:N/A

OTHER SERVICES:
DEN
DEV

PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:10/22/12	RIG NUMBER	:OK #24
DEPTH DRILLER	:317.00	LOGGER TD	:316.80
BIT SIZE	:104.00	ARRIVAL TIME	:15:15
LOG TOP	:0.00	DEPARTURE TIME	:18:00
LOG BOTTOM	:316.51	CIRC STOPPED	:N/A
CASING LOGGER	:2.70		
CASING DRILLER	:3.00		
CASING TYPE	:SURFACE		
BOREHOLE FLUID	:WATER		
RM TEMPERATURE	:N/A		
MUD RES	:N/A		
MUD WEIGHT	:1.00		
WITNESSED BY	:B. EDGREN		
RECORDED BY	:M. LEBEDA		
REMARKS 1	:VERTICAL		
REMARKS 2	:WATER LEVEL @ 11.0M		

GAMMA NEUTRON TP 1:200 MW-11-1V-D 10/22/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.20 ELECT. CUTOFF : 99999 BIT SIZE : 104.00
PRESENTATION NAME/DATE = NEUTRON_CRM.0 10/22/2012 VERSION = 3.64KG

GAMMA	METERS	NEUTRON
150 API-GR 300	<-VOLUME	1800 API-N 3600
GAMMA		NEUTRON
0 API-GR 150	SPEED->	0 API-N 1800

0 API-GR 150	SPEED->	0 API-N 1800
GAMMA		NEUTRON
150 API-GR 300	<-VOLUME	1800 API-N 3600
GAMMA	METERS	NEUTRON

GAMMA NEUTRON TP 1:200 MW-11-1V-D 10/22/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.20 ELECT. CUTOFF : 99999 BIT SIZE : 104.00
PRESENTATION NAME/DATE = NEUTRON_CRM.0 10/22/2012 VERSION = 3.64KG

TOOL CALIBRATION MW-11-1V-D 10/22/12 15:50
TOOL 9058A TM VERSION 3
SERIAL NUMBER 2631

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
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	May15,12	10:05:16	GAMMA	545.000	[API-GR]	560.000	[CPS]
2	Jan19,12	10:47:24	TEMP	3.500	[DEG_F]	330443.000	[CPS]
	Jan19,12	10:47:24	TEMP	51.000	[DEG_F]	396853.000	[CPS]
3	May15,12	10:19:19	NEUTROI	Default	[CPS]	Default	[CPS]
	May15,12	10:19:19	NEUTRC	271.000	[API-N]	94.000	[CPS]
4	May16,11	09:08:18	POR(NEI	100.000	[PERCENT]	35.000	[CPS]

Century WIRELINE SERVICES

GAMMA-DENSITY (CPS)
LOG THRU PLASTIC PIPE
MW-114D

COMPANY	CENTERMOUNT COAL	OTHER SERVICES:	NEU
WELL	MW-114D		
FIELD	:		
COUNTRY	CANADA		
PROVINCE	BRITISH COLUMBIA		
LSD	:		
SECTION	N/A		
TOWNSHIP	N/A		
RANGE	N/A		
LICENSE NO.	N/A		
UNIQUE WELL ID.	N/A		
PERMANENT DATUM	GL	ELEVATION KB	N/A
LOG MEASURED FROM	GL	ELEVATION DF	N/A
DRL MEASURED FROM	GL	ELEVATION GL	N/A
DATE	10/10/12	RIG NUMBER	JR DRILLING
DEPTH DRILLER	153.00	LOGGER TD	152.30
BIT SIZE	146.05	ARRIVAL TIME	15:30
LOG TOP	0.00	DEPARTURE TIME	18:00
LOG BOTTOM	151.92	CIRC STOPPED	N/A
CASING LOGGER	75.00		
CASING DRILLER	21.3		
CASING TYPE	STEEL		
BOREHOLE FLUID	WATER		
RM TEMPERATURE	N/A		
MUD RES	N/A		
MUD WEIGHT	1.0		
WITNESSED BY	JR DRILLING		
RECORDED BY	B.HILL		
REMARKS 1	VERTICAL HOLE		
REMARKS 2	:		

GAMMA DENSITY THRU PLASTIC 1:100 MW-114D 10/10/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/29/2011VERSION = 3.64KF

GAMMA DENSITY THRU PLASTIC 1:100 MW-114D 10/10/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/29/2011VERSION = 3.64KF

TOOL CALIBRATION MW-114D 10/10/12 16:31
TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun01,12	13:18:24	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Jun01,12	13:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

Century WIRELINE SERVICES

GAMMA - DENSITY THRU PLASTIC MW11-5D

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WELL	:MW11-5D		
FIELD	:		
COUNTRY	:CANADA		
PROVINCE	:BRITISH COLUMBIA		
LSD	:		
SECTION	:N/A		
TOWNSHIP	:N/A		
RANGE	:N/A		
LICENSE NO.	:N/A		
UNIQUE WELL ID.	:N/A		
PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:10/14/12	RIG NUMBER	:JR DRILLING
DEPTH DRILLER	:102.0	LOGGER TD	:99.80
BIT SIZE	:146.05	ARRIVAL TIME	:11:00
LOG TOP	:0.00	DEPARTURE TIME	:15:00
LOG BOTTOM	:99.42	CIRC STOPPED	:N/A
CASING LOGGER	:12.2		
CASING DRILLER	:12.2		
CASING TYPE	:STEEL		
BOREHOLE FLUID	:WATER		
RM TEMPERATURE	:N/A		
MUD RES	:N/A		
MUD WEIGHT	:1.0		
WITNESSED BY	:B.EDGREN		
RECORDED BY	:B.HILL		
REMARKS 1	:VERICAL HOLE		
REMARKS 2	:		

OTHER SERVICES:
9068

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

GAMMA DENSITY THRU PLASTIC 1:100 MW11-5D 10/14/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A.0 05/06/2011 VERSION = 3.64KF

GAMMA DENSITY THRU PLASTIC 1:100 MW11-5D 10/14/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A.0 05/06/2011 VERSION = 3.64KF

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TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
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	Jun01,12	13:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

Century WIRELINE SERVICES

GAMMA-DENSITY (CPS) LOG THRU PLASTIC MW11-28VD

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WELL	:MW11-28VD		
FIELD	:		
COUNTRY	:CANADA		
PROVINCE	:BRITISH COLUMBIA	OTHER SERVICES: 9058	
LSD	:		
SECTION	:N/A		
TOWNSHIP	:N/A		
RANGE	:N/A		
LICENSE NO.	:N/A		
UNIQUE WELL ID.	:N/A		
PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:10/14/12	RIG NUMBER	:JR DRILLING
DEPTH DRILLER	:219.00	LOGGER TD	:218.90
BIT SIZE	:146.05	ARRIVAL TIME	:14:20
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CASING LOGGER	:24.4		
CASING DRILLER	:24.4		
CASING TYPE	:STEEL		
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MUD RES	:N/A		
MUD WEIGHT	:1.0		
WITNESSED BY	:B.EDGREN		
RECORDED BY	:B.HILL		
REMARKS 1	:VERTICAL HOLE		
REMARKS 2	:		

GAMMA DENSITY THRU PLASTIC 1:100 MW11-28VD 10/14/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/29/2011VERSION = 3.64KF

GAMMA DENSITY THRU PLASTIC 1:100 MW11-28VD 10/14/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/29/2011VERSION = 3.64KF

TOOL CALIBRATION MW11-28VD 10/14/12 15:44
TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun01,12	13:18:24	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Jun01,12	13:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

Appendix VI

2011 Preliminary Hydrogeological Investigation

By Watterson Geoscience Inc.

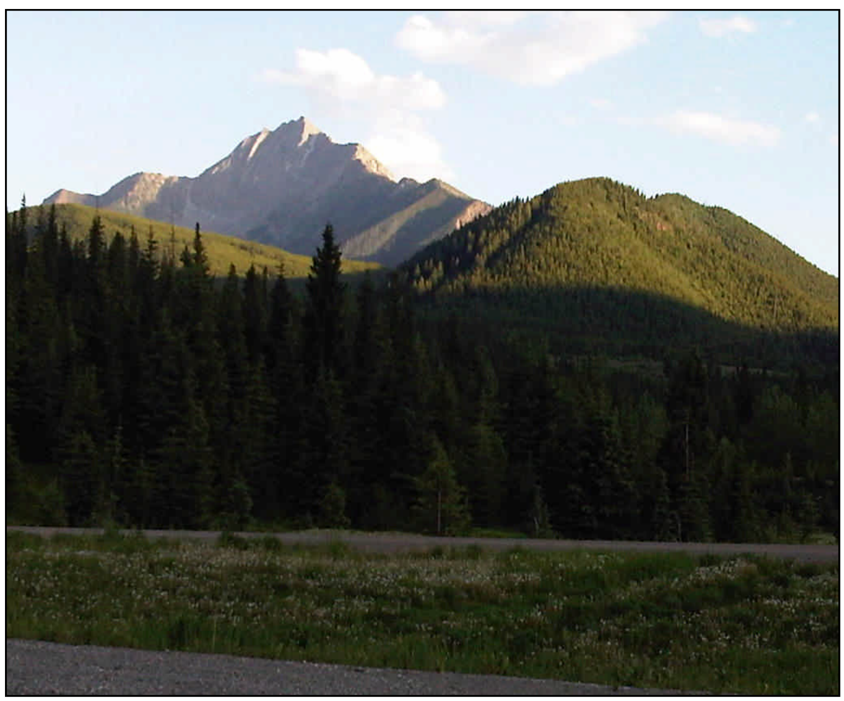
December 18, 2011

PRELIMINARY HYDROGEOLOGICAL INVESTIGATION

PROPOSED BINGAY COAL MINE, ELKFORD, BC

Prepared for:
Centermount Coal Ltd.

Prepared by:
Watterson Geoscience Inc.
WGI Project No. 11-007
December 18, 2011



Watterson Geoscience Inc.

Table of Contents

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Figures

TABLES

APPENDICES

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EXECUTIVE SUMMARY

Centermount Coal Ltd. (Centermount) has proposed to develop a metallurgical coal mine located approximately 22 km north of Elkford, BC. This Preliminary Hydrogeological Investigation Report has been prepared for Centermount by Watterson Geoscience Inc. as a component of ongoing environmental baseline and mine permitting studies for the proposed mine.

The Preliminary Investigation was completed to provide initial hydrogeological data regarding groundwater occurrence in the proposed mine area, provide preliminary evaluations of potential effects from mine operation on nearby surface and groundwater, and to support ongoing mine planning activities including mine design, operation, closure and reclamation.

The preliminary hydrogeological investigation findings include the following:

- Geological data, topographic mapping, field observations, well installation and aquifer testing and analysis indicate that groundwater in the proposed Bingay Mine area occurs in distinct bedrock and overburden hydrostratigraphic units;

- Groundwater flow in both units can be expected to generally follow local and regional topographic slope, with flow downslope from topographic highs towards discharge into Bingay Creek, the Elk River and other smaller surface water bodies. A groundwater divide is likely present on the southwest side of Bingay Hill, where groundwater flow from further upgradient to the west flows down slope beneath Bingay Creek, and also towards the north and northeast;

- Groundwater recharge from precipitation in the proposed mine area is estimated at about 4,980 m^3/day, or about 263 mm/year. This volume is about 22% of total precipitation which corresponds favorably with groundwater recharge studies conducted by others for areas in the Elk Valley;

- Initial aquifer testing and analysis results for overburden suggest that the hydraulic conductivity for this unit is within generally accepted values for these sediments. This hydrostratigraphic unit may produce groundwater from the western side of the proposed pit area, with mean flows estimated at 9,200 m^3/day. Low flow is estimated at 359 m^3/day and estimated maximum flow is 72,000 m^3/day, depending upon local sediment thickness and hydraulic conductivity;

- The bedrock aquifer test data suggest that aquifer flow characteristics are heterogeneous, with flows from this unit potentially ranging between 85 m^3/day to 10,400 m^3/day, with an estimated mean flows ranging between 918 and 2,300 m^3/day. Field observations and aquifer test results indicate that actual flows from bedrock will probably be towards the low end of this range.

These rocks are not likely to generate significant amounts of water, unless currently unknown areas with significantly higher conductivities are encountered;

- Based on estimated flow, open pit mine bedrock dewatering can likely be accomplished without dewatering wells and using sumps. However, it is possible that overburden situated along the southern and western sides of the proposed pit area may produce significant volumes of water; and

- Chemical analysis of two bedrock and one overburden groundwater samples indicates that the water is predominately calcium-magnesium bicarbonate type, which indicates that the water may originate from relatively recent precipitation. Several total metals concentrations were above CWQG established for protection of aquatic life, however these concentrations may be a result of elevated turbidity or total dissolved solids in these samples.

Therefore, based on available data, operation of the proposed open pit mine is unlikely to significantly affect adjacent surface water bodies including the Elk River and Bingay Creek because of the following:

- In general, the bedrock has very low permeability with few fractures to serve as pathways for adjacent surface waters to enter the pit or underground workings. No or very little groundwater was produced from most monitoring wells during drilling and testing, and bedrock well testing results strongly suggest that continued pumping will result in decreased water production with time, although locally more fractured and water-producing areas may be present;

- Bedrock is located at or very near the ground surface along the eastern side of the proposed pit between the pit and the Elk River, and on the south side of the pit along Bingay Creek. With proper pit wall design, this low permeability bedrock could be used as a dam to prevent significant lateral flows between the river, creek, underlying water-bearing sediments and the adjacent open pit;

- Most of Bingay Hill is covered by thin overburden (mostly sand, gravel and silt) that only contains water seasonally during freshet. No significant groundwater flow from these sediments is expected;

- Surficial sediments on the north side of the proposed pit consist of thick and very low permeability clay/till sediment which should prevent significant flow from overburden into the pit from this area;

- Surficial sediments on the southwest and west sides of the proposed pit appear to be very permeable and may produce significant amounts of groundwater during open pit mining. However, they appear to be relatively thin and geotechnical groundwater control methods, such as dewatering wells or grout curtains, may be suitable to prevent overburden groundwater flow from entering the pit.

Specific recommendations to improve understanding of hydrogeological conditions at the proposed mine area, to refine the estimated flows to identify potential effects of long-term mine dewatering on adjacent surface water bodies, and predict post-closure groundwater conditions, groundwater flow and impact estimates include:

- Characterize hydraulic properties and groundwater flow characteristics of individual bedrock stratigraphic units using a drilling program targeted at specific locations with packer tests conducted in stratigraphic and structural targets;

- Identify and characterize potential high-production zones in bedrock specifically including the Bourgeau Fault possibly located on the west side of the proposed pit area using dedicated monitoring wells and aquifer testing;

- Investigate the potential to use geophysical exploration tools including seismic, resistivity and magnetotelluric surveys to assess the thickness, depth to water and composition of overburden sediments in the proposed mine area. This information will be particularly useful to identify the sediment thicknesses beneath the Elk River and Bingay Creek which would support detailed characterization of potential effects from open pit and underground mining on surface water flows;

- Drill, install and test additional monitoring wells on the southern and western side of the pit area to refine estimates of potential groundwater inflow from overburden, and to identify the hydraulic connection, if any, between shallow groundwater and Bingay Creek flow, including potential seasonal variations;

- Use nested monitoring wells and aquifer tests in overburden, shallow bedrock and deep bedrock to investigate the vertically upward hydraulic gradients present in the northeast mine area. Use this information to characterize the gradient occurrence, amount and to support estimates of potential upward groundwater flow into the pit area from these gradients;

- Further characterize the occurrence and characteristics of total selenium, cadmium, aluminum, iron, barium, fluoride and mercury in local runoff and groundwater by collecting groundwater samples from crushed waste rocks, and overburden and bedrock wells. Use this information to predict waste rock leachate quality, to predict produced groundwater quality, to identify potential effects from long-term groundwater discharge into the receiving environment, and to identify appropriate groundwater and leachate mitigation and management practices and procedures;

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- Evaluate the feasibility for using physical barrier geotechnical methods to reduce groundwater flow from overburden into the pit from upslope recharge;

- Develop a numerical model of the proposed Bingay mine site including the Elk River, Bingay Creek and No-Name Creek, and use this model to refine estimates of groundwater flow into the pit from bedrock and overburden, as well as estimates of potential effects of pit dewatering on adjacent surface water bodies.

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1.0 INTRODUCTION

Centermount Coal Ltd. (Centermount) has proposed to develop a metallurgical coal mine located approximately 22 km north of Elkford, BC (Figure 1). This Preliminary Hydrogeological Investigation Report has been prepared for Centermount by Watterson Geoscience Inc. (WGI) as a component of ongoing environmental baseline and permitting studies for the proposed mine.

The Preliminary Investigation was completed to provide initial hydrogeological data regarding groundwater occurrence in the proposed mine area, provide preliminary evaluations of potential effects from mine operation on nearby surface and groundwater, and to support ongoing mine planning activities including mine design, operation, closure and reclamation.

This preliminary investigation is intended to provide a foundation for additional detailed hydrogeological and environmental assessments that will be completed during mine feasibility studies and planning.

1.1 Project Understanding

The proposed 304 hectare (ha) mine is situated at the southern end of a northwest-trending block of Crown coal exploration licenses totaling 1,157 ha and is located at the conjunction of Bingay Creek and the Elk River.

At full build-out, the proposed open pit will be roughly centered at the current Bingay Hill and is expected to extend for approximately 1.4 km in the north-south direction, approximately 900 m to the east and west and extend approximately 400 m below ground surface.

Due to the close proximity of Bingay Creek and the Elk River, and adjacent environmentally sensitive lands, developing a thorough knowledge of hydrogeological and related environmental conditions in the proposed mine will be of key importance to successfully permit this project. The proposed open pit mine will need to be designed to minimize or eliminate effects to adjacent water quality or quantity during mine operations and post-closure. Of specific interest will be controlling selenium concentrations in surface and groundwater discharged to the Elk River, as concentrations of this metal in river water have increased over the previous three decades due to historic coal mining activities in the Elk Valley.

1.2 Preliminary Hydrogeologic Investigation Program Work Scope

The preliminary hydrogeological investigation's overall purpose and design was intended to meet the following objectives:

- Broadly characterize overburden characteristics in the proposed mining area, including composition, thickness and distribution;

- Provide an initial characterization of bulk bedrock hydraulic characteristics primarily focusing on groundwater production potential;
- Utilize groundwater monitoring wells and piezometers to obtain initial hydraulic characteristics data for the overburden and bedrock, to obtain initial depth to groundwater data, and to obtain water samples for baseline bedrock and overburden water quality characterization;
- Use the collected data and analyses to characterize baseline groundwater conditions in the proposed mining area including groundwater occurrence in overburden and bedrock, flow pathways and flow direction, and groundwater elevations;
- Use the collected data to develop initial estimates of potential effects from pit excavation on surrounding ground and surface water including the Elk River and Bingay Creek, including preliminary estimates of potential groundwater produced during pit dewatering; and
- Use the collected data to develop recommendations for detailed and focused hydrogeological characterization of overburden and bedrock, including identification of specific areas or stratigraphic intervals which may produce significant groundwater flow, to characterize potential effects from mine operation and pit dewatering on nearby surface water bodies including the Elk River and Bingay Creek, and to provide data for use in mine planning, operation and reclamation.

Work completed to achieve these objectives included

- Conducting two field reconnaissance efforts to visually assess features and characteristics related to hydrogeological characteristics and groundwater occurrence;
- Groundwater exploration drilling and monitoring well installation;
- Groundwater elevation measurements;
- Aquifer testing and analysis;
- Groundwater sample collection and analysis;
- Development of a conceptual hydrogeologic model including characterization of hydrostratigraphic units;
- Approximate water balance and groundwater flow analysis;
- Baseline groundwater chemistry characterization; and
- Preparation of this report including recommendations for future hydrogeological assessments conducted as part of planned feasibility studies.

2.0 PROJECT BACKGROUND

2.1 Area Topography

The proposed mine area is situated on the broad western flank of the Elk Valley with the Elk River bordering the area on the east and Bingay Creek on the south (Figure 2). The proposed Bingay open pit is roughly centered on Bingay Hill and is expected to extend into topographically flat lands on the east and west. The proposed waste rock storage area is situated west of the open pit on the western mountain range slope.

Elevations in the proposed pit area range from approximately 1,430 m above mean seal level (amsl) in the west to approximately 1,390 m amsl on the east, while elevations in the proposed waste disposal area range from approximately 1,410 m amsl on the east to approximately 1,750 m amsl n the west.

Bingay Hill is locally prominent and trends in a roughly north-south direction with steep sides on the west, south and east with a gentle slope to the north. The top of Bingay Hill is at approximately 1,490 m amsl with approximately 115 m of topographic relief on the east and about 65 m of relief on the west. A prominent topographic plain or bench with a generally flat and gentle slope to the northeast is situated west of Bingay Hill.

The braided Elk River channel is situated below a prominent topographic bench approximately 200 m east of the proposed mine area. Bingay Creek, an east-flowing tributary of the Elk River, joins the Elk River southeast of the proposed mine area. Approximately 100 m south of the proposed mine area, the Creek valley is incised into sediments to a maximum depth of 16 m.

2.2 Geologic Setting

Surficial sediments occur as discontinuous veneers and blankets of hummocky to rolling, glacially and fluvially-derived sandy morainal, fluvioglacial, glacial till and organic deposits. Thin deposits of colluvial sediments are present on Bingay Hill and on the western topographic slope, while sandy, gravelly glacio-fluvial materials are located in the topographic plains on the east, west and northwest sides of Bingay Hill.

All known coal is included with the Early Cretaceous Mist Mountain Formation which generally consists of siltstone with included coal beds and thin interbeds of mudstone, siltstone, limestone and ironstone. These rocks overlie Jurassic and Cretaceous aged marine sandstones of the Morrisey Formation and marine shales of the Jurassic-aged Fernie Group.

The Bingay property is situated within the geologic Bingay Syncline, a steeply dipping bedrock fold which dips to the northeast beneath the Elk River. The syncline's southern nose extends along the southern slope of Bingay Hill above the north bank of Bingay Creek. Because of the synclinal structure, the bedding in the proposed mining area ranges between generally sub-vertical (45 to 65 degrees) to vertical. The eastern syncline limb is known to be significantly less steep than the western limb (Cathyl-Bickford, 2005).

The mudstone, siltstone and coal layers appear relatively soft, however coal-bearing erosion resistant sandstone layers form prominent bedrock ridges in the southwestern part of the proposed mining area and also along Bingay Creek.

Numerous small faults have been observed in exploration rock core and geologic maps show the west-dipping Bourgeau Thrust Fault extending along the west part of the proposed mine area (Grieve, et al, est. 1987).

Additional bedrock and geologic information is provided under separate cover.

3.0 FIELD INVESTIGATION

3.1 Field Reconnaissance

On June 29 and July 1 2011, Watterson Geoscience Inc. (WGI) and Centermount conducted a field reconnaissance to visually characterize and document shallow soil characteristics, bedrock occurrence and potential effects of bedrock on groundwater occurrence and flow, and groundwater spring and seepage locations. Coal exploration trenches were also visually assessed for evidence of overburden characteristics and shallow groundwater occurrence.

The field reconnaissance was used to examine the condition, accessibility and suitability of exploration boreholes drilled by Hillsborough Resources Ltd. in 2004 and 2005, and by JR Drilling Ltd. (JR) in 2010 for use as groundwater monitoring wells.

3.2 Monitoring Well Installation

Between June 27 and July 15, 2011, under the supervision of WGI and Centermount, JR drilled five bedrock and two overburden holes, with four completed as groundwater monitoring wells. Four existing vertical holes originally drilled for core exploration were also recompleted as groundwater piezometers and one shallow test hole was completed. All new holes were drilled vertically using a Foremost D-24 air-rotary rig. Geologic logging services were provided by WGI and JR.

The monitoring well locations are shown in Figure 3 and were selected to obtain initial lithological, stratigraphical and hydraulic characteristics of bedrock and alluvial sediment in and downgradient of the proposed mine area, with specific focus on characterizing the hydraulic connections, if any, between the proposed mine area and adjacent Bingay Creek and Elk River.

All wells were constructed using 120 mm (4.5 in) ID Schedule 20 PVC casing and 120 mm (4.5 in) ID Schedule 20 PVC screen with 0.010-inch slots. Six inch (152 mm) diameter steel casing was used during drilling to maintain hole integrity. Depending upon well design, this casing either remained in the hole or was pulled to above the static water level.

Wells completed into overburden sediments were constructed using 10-20 filter pack sand installed from the hole bottom to at or above the screen, with hydrated bentonite chips emplaced above the sand. Native cuttings or backfill was generally emplaced above the bentonite to the ground surface or surface casing. Wells completed into bedrock were generally constructed by installing the PVC screen and casing to the hole bottom, installing a packer around the PVC casing below the steel casing, with bentonite installed above the packer into the steel casing. All wells were protected with a lockable steel cap.

Hole depths varied widely and were dependent upon location and sediment and bedrock characteristics. The overburden holes ranged in depth between 6.7 m and 70.1 m below top of casing (btoc) and bedrock holes ranged between 101.8 m and 270 m btoc. The drilling findings and well installation rationale are further discussed below. A well construction summary table is provided as Table 1, and geologic logs and well construction diagrams are provided in Appendix A.

Unstable bedrock and sediments was encountered in several holes. Drilling in monitoring well MW11-3D was abandoned due to excessive caving and sloughing of coal encountered between approximately 39 and 45 m bgs. No well was installed in this hole, however casing extending to 10.97 m was left in place to facilitate access for depth to water measurements. In addition, unstable conditions in reconstructed well MW11-43vS resulted in only exposing approximately 12 m of open hole around the installed screen. Existing hole 2010-24v was also planned for reconstruction, but slough in this well was measured at approximately 73 m btoc inside the casing, which indicated that highly unstable hole conditions were present beneath the casing, thus reconstruction of this well was not attempted.

3.3 Aquifer Testing Program

Between July 7 and July 22, 2011 step-drawdown tests and 24-hour aquifer tests were conducted on several wells to obtain overburden and bedrock hydraulic characteristics data. The test parameters for each well were designed by WGI and conducted under WGI supervision by Thompson Drilling Ltd. (Thompson).

The step-drawdown tests were conducted by pumping the well for short time periods at increasing flow rates and observing water level responses in the well. The step drawdown tests generally consisted of three 0.5 to 1-hour steps at flow rates based on estimated groundwater flows observed during drilling.

The 24-hour test rate was selected by projecting water level drawdowns from the step-test data. The 24-hour tests were initiated after water levels in the wells had recovered to at least 95% of pre-test level, except for wells MW11-1D (84%) and MW11-5D (75%) due to slow water recovery rates. Due to the extremely low productivity from most wells, flow rates frequently needed to be adjusted downward during the 24-hour tests because of excessive drawdown during the tests. Produced water was monitored for quality and evidence of pump and flow meter plugging, and was discharged at least 40 m away from the test well to prevent recirculation. Water level data in the tested well and adjacent wells, where available, were recorded manually and using down-hole electronic data loggers. Flow was measured using an in-line flow meter.

A 24-hour test was attempted in well MW11-43vS, however as noted above, this well was completed in both shallow bedrock and overburden because of excessive sloughing during construction. The flow rate was continually reduced to maintain water flow and water level above the pump intake, however at about 8 hours into the test, the flow rate declined to the point where the test was stopped to protect the pump.

A 3-hour pumping test was also conducted by JR in well MW11-1vD. This test was conducted similarly to the 24-hour tests except that no step-drawdown test was completed. Manual depth-to-water measurements were collected in this well only.

As part of the well reconstruction process, groundwater in well MW11-28vD was removed to near the well bottom using air from the drill rig to allow fresh aquifer water to enter the well and to measure bedrock groundwater elevation in this area. However, groundwater did not re-enter the hole after it was emptied. Therefore, to obtain aquifer hydraulic data, a falling head instantaneous-displacement test (slug test) was conducted in this well. The test was conducted by pumping groundwater from adjacent monitoring well MW11-28vS at approximately 32 US gpm for approximately 4 minutes to rapidly increase the water level in the well, and then allowing the water level to decline to static level.

Well test summary data are presented in Table 1, manual water level data, where collected, are presented in Appendix B and the manual and logger test data were plotted as semi-logarithmic graphs shown as Figures B1through B21 in Appendix B.

4.0 BINGAY MINE HYDROGEOLOGY

4.1 Conceptual Hydrogeological Model

A conceptual hydrogeologic model (CHM) has been developed for the proposed mine and general hydrogeologic conditions and characteristics in and surrounding the proposed mine area. The CHM was developed for use as a framework for understanding baseline hydrogeological conditions and to support assessments of how surface and groundwater levels in the mine vicinity will respond to the proposed operations.

Based on the field observations and drilling data, two hydrostratigraphic units are present at the Bingay Mine site: an unconsolidated overburden hydrostratigraphic unit with limited extent in the proposed mine area and a fractured bedrock hydrostratigraphic unit. In general, local shallow groundwater is stored within unconsolidated sediments and near-surface bedrock fractures, which generally decrease in openness and density with depth. Shallow groundwater flow directions generally follow surface topography, with generally radial flow from the topographic uplands down towards lower elevations.

Deep groundwater is contained within bedrock fractures, with the amount of contained water directly proportional to the fracture density, while the rock's ability to transmit water directly is related to the fracture characteristics. Flow in deep bedrock generally follows macro-scale topographic trends, with flow from elevated topography on the west towards the lower valley bottom expected in this area. In addition, deep groundwater will also likely flow southward as the Elk valley slopes gently towards the south.

Shallow groundwater is likely hydraulically connected with and commonly discharges to adjacent surface water bodies, marshes, ponds and bogs, while deep groundwater may flow downgradient significant distances before discharging to shallow groundwater or surface water. The hydraulic connections between surface water features and shallow and deep fractures in the Bingay area will need to be established.

The nature of hydraulic connections, if any, between Bingay Creek, the Elk River and adjacent overburden sediments and underlying bedrock will be characterized as part of planned feasibility studies.

Inferred hydrogeologic characteristics and groundwater occurence in each hydrostratigraphic unit based on data obtained from field observations, historic and recent drilling investigations, and from hydraulic tests completed using previously constructed and newly installed piezometers are presented below.

4.2 Overburden Hydrostratigraphic Unit

Overburden characteristics and thickness at the Bingay Mine site varies with elevation, location and topographic slope. The overburden is generally quite thin on Bingay Hill and along the ridge which forms the northern hill slope. Surficial materials appear to mostly consist of a thin layer of coarse-grained colluvium and regolith, mixed with large talus blocks below prominent sandstone ledges. Isolated swales near the hill are floored by wet, organic-rich silty muck; other than these areas, overlying organic-rich topsoils appear to be patchy and generally very thin, being present mainly along stream channels.

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The low and generally flat topography flanking Bingay Hill on the west appears to consist of extensive sand and gravel deposits into which the Bingay Creek channel is incised. Exploration holes completed in this area encountered silty sand and gravel thickness ranging between about 30 m in hole 2010-22v and over 141 m in hole 2010-27v. These sediments thicken to the north and may have originated as an alluvial fan from the elevated topography further to the west or as glacio-fluvial sediments deposited when surface waters were at a higher elevation than at present.

Based on visual observations and topographic mapping, the landforms located on the east and south sides of Bingay Hill suggest that local sediments occur as a succession of gravel terraces of glaciofluvial origin which step down to the east. However, contrary to expectations, field and drilling observations from exploration holes and MW11-1S/D, MW11-2, MW11-3, MW11-5 and TH11-1, found between essentially none and 7 m of sand and gravel with common silt present above bedrock (Figure 3) in this area. These findings suggest that in general, sand and gravel deposits on this side of the proposed pit area are minimal. This finding is supported by numerous locations where bedrock is exposed at the ground surface at the eastern base of Bingay Hill and along the east bank of the Elk River on the southeast mine area boundary.

On the north slope of Bingay Hill, and extending northeastward towards the synclinal axis, field observations suggest that patchy shoestring channel-fills of cobbly gravel locally follow the eroded subcrop traces of coal beds. Where explored by test pits and new road cuts, these gravels are several meters thick (Cathyl-Bickford, 2005). In addition, monitoring well MW11-4D, drilled north of the proposed pit, encountered dense dry to damp sandy gravelly silt (glacial till) directly above bedrock (Figure 3). Drilling conducted further to the north also encountered thick clay and till deposits.

4.3 Groundwater Occurrence in Overburden

Groundwater was encountered in shallow overburden on the south and west sides of the project area, but not on the east and north sides of the project area. Monitoring well MW11-1S produced about 5 US gpm during drilling while MW11-28vS produced about 15 US gpm during drilling. However, of key significance to this characterization, shallow groundwater was not encountered in monitoring wells MW11-2D, MW11-3D, MW11-4D, and TH11-1, all located on the east side of the proposed pit area. Shallow groundwater was also not found in well MW11-4D located on the north side of the proposed pit area. As shallow groundwater was not encountered at these locations, monitoring wells were not installed in these holes.

Naturally occurring springs are located on the northwest and northeast sides of the proposed mining area. As shown in Figure 3, one spring is located at the base of the western hill (northwest spring). Although the locally saturated area extended over several m^2, flow from this spring was estimated at less than 5 US gpm, with flow infiltrating back into the subsurface a few meters downslope from the origin. In contrast, flow from the spring (also called No-Name Creek) located northeast of the pit area (Figure 3) was measured in 2010 to range between 13 and 17 L/s (206 and 270 US gpm) (Masse, 2010). The northeast spring is known to flow continuously throughout the year; however the flow characteristics for the northwest spring are presently unknown.

Groundwater seeps from exploration boreholes on the northeastern part of the proposed pit area were also observed during the field reconnaissance program. Seepage occurred from several holes clustered around 2005-7v, 2004-3v and 2010-45v (Figure 3). Flows ranged from trickles to approximately 0.1 US gpm. The source of this artesian water is presently unknown, however due to the shallow or impermeable overburden in this area, it likely originates from underlying fractured bedrock. Groundwater seepage from the historic 10-seam adit located in the northeast slope of Bingay Hill was also observed. As the depth and orientation of this adit is unknown, the source of this seepage cannot be determined. However, it is likely related to downslope flow through shallow fractures from upgradient groundwater recharge, and/or to seepage from deeper bedrock fractures.

As discussed below, due to the inferred presence of generally more permeable sediments and greater sediment thickness, shallow groundwater flow from overburden in the west side of the proposed mine area will likely be more significant compared to flow from the south, north and east sides of the proposed pit. In addition, exploration drilling conducted north of the proposed mine area encountered several areas where significant amounts of groundwater were produced from thick sand and gravel sequences, and several occurrences of artesian flow from sand and gravel aquifers through thick overlying clay and silt confining units were also encountered further to the north. These observations suggest that increased groundwater production may be expected as mining activity moves northward.

4.4 Bedrock Hydrostratigraphic Unit

Groundwater storage and flow in bedrock is generally dominated by fracture characteristics including openess, density, connectedness, and distribution. Bedrock fracture network characteristics commonly vary based on several factors including bedrock type, degree of alteration, proximity to penetrative structural elements, and proximity to faults and fault systems, joints, and local or regional structures.

As discussed in Section 2.2, the coal-bearing Mist Mountain formation in the project area consists of interbedded sandstone, mudstone and siltstone, and coal. Compared to other units in the Mist Mountain Formation, the coal seams may act as barriers to groundwater flow (aquitards), with lower hydraulic conductivities normal to bedding. Gentiz (2006) observed that perched water tables commonly occurred at the contact between coals seams and overlying sedimentary rocks in Elkview mine in Sparwood.

In addition, Ryan and Gentzis found that coals which are sheared can be expected to have a greatly reduced permeability in compared to less deformed coals with well developed cleating (Ryan 2004; Gentzis 2006). As such, joint and fractures in the more coherent sedimentary units are expected to be the primary contributor to the bulk permeability of the Mist Mountain Formation.

Consistent with the available literature, it also appears that structural controls may play a large role in the permeability of a given strata in the Bingay area. The synclinal bedrock structure may dominate macroscopic groundwater flow paths in the proposed mine area with greater flow along the syncline axis and parallel with bedding planes, and reduced flow perpendicular to bedding planes.

The west-dipping Bourgeau Thrust Fault is located on the western part of the proposed mine area. Information regarding the location, structural characteristics or groundwater flow characteristics of this fault in the mine area is not available.

Collection of additional project area-specific hydrogeological information will serve to advance the conceptual model, and additional information regarding structural and stratigraphic controls on groundwater occurrence and flow in the Bingay area will be obtained during mine feasibility studies.

4.5 Groundwater Occurrence in Bedrock

Based on recovered core, bedrock in the proposed mine area is not believed to be highly fractured, although locally more fractured intervals are present. Historic and recent exploration drilling notes suggest that few exploration holes drilled into bedrock encountered significant groundwater. This finding was confirmed by the 2011 drilling program as very little bedrock groundwater was encountered while drilling these holes. Borehole MW11-1D produced about 2 US gpm during drilling, while MW11-2D encountered no water during drilling and thus a groundwater monitoring well was not installed in this well. Bedrock encountered in MW11-3D produced about 5 to 10 US gpm during drilling, while drilling of MW11-4D and MW11-5D each produced approximately 1 to 2 US gpm.

Sustainable flow rates during testing were generally very low and as noted above, flow rates in several wells needed to be decreased during the tests to maintain water levels above the pump intake or transducer. Except for recompleted well MW11-1vD, sustainable flow rates ranged between 0.76 to 2.5 US gpm. Well MW11-1vD produced water at approximately 28 to 30 US gpm for the 3-hour test, although it is unknown whether this flow rate would be sustainable for longer time periods. Groundwater in recompleted hole MW11-28vD was removed to near the hole bottom with no recovery observed after about 12 hours, which suggests very low ability for bedrock to transmit water in this area.

As noted above, the topographic terraces that extend along the east side of the proposed pit area and adjacent to the Elk River appear to consist primarily of low-permeability bedrock. As such, this bedrock appears capable of potentially forming a barrier between shallow groundwater contained within the Elk River fluvial sediments and groundwater or an open pit further to the west.

Except for the central proposed pit area near MW11-1vD, these findings indicate that the ability for bedrock in the proposed mine area to store and transmit significant volumes of groundwater appears to be low.

As shown in Figure 3, a spring located on the northwest side of the proposed pit area may be located along the possible Bourgeau fault trace. If the spring flow is related to the fault, the fault may serve as a conduit for groundwater flow along the western side of the proposed pit.

Additional information regarding bedrock fracture characteristics and groundwater flow potential along structural features in the Bingay area will be obtained during mine feasibility studies.

5.0 PRELIMINARY BINGAY HYDROGEOLOGY

5.1 Groundwater Occurrence

Depth-to-water (DTW) measurements were collected by WGI, JR, Centermount and Thompson using electronic depth-to-water meters and submersible electronic data loggers from all wells immediately after drilling, well installation and hydraulic testing to help identify hydraulic gradients and assess groundwater flow direction and velocity. Additional DTW measurements were collected by Thompson after water levels in each well had stabilized.

Groundwater in overburden well MW11-28vS was present at 20.87 m below top of casing (btoc) or roughly 1399 m amsl, which is roughly 8 m below the adjacent Bingay Creek elevation at 1408 m amsl. This observation suggests that Bingay Creek along this reach may be a losing stream, where creek water is lost to the underlying aquifer, at least seasonally.

Groundwater was also encountered in MW11-1S at 5.3 m btoc (1413.7 m amsl) which is about 17 m above the nearby Bingay Creek elevation of 1396 m amsl. This water appeared to be perched above underlying bedrock.

Bedrock groundwater elevations ranged from +0.4 m above top of casing (artesian conditions - i.e. groundwater elevation above the ground elevation) at MW11-4D, located in the northeastern part of the proposed mining area, to 24.14 m btoc in MW11-2D although groundwater in this well required several days to reach this elevation after drilling. Groundwater was measured at 24.45 m btoc in

MW11-43vS, however this well was completed in both shallow bedrock and overlying sediments. In addition, the depth to water in MW11-29vD was measured at approximately 202 m btoc, however groundwater in this well is likely to gradually increase with time. Groundwater elevations for overburden and bedrock wells are provided in Table 2.

Groundwater flow within and adjacent to the proposed mine area can be expected to generally follow local surface topography. As shown in Figure 4, groundwater from Bingay Hill will likely flow radially away from the highest point, with flow towards the Elk River on the east, towards Bingay Creek on the south, towards the topographic bench on the west and towards topographically flat areas on the north. Groundwater in areas north of the proposed mine site likely flows to the east and discharges into the Elk River.

Groundwater flow beneath the Elk River will generally follow the river grade with flow towards the south, while flow down the Bingay Creek drainage may vary depending upon location and season. As also illustrated in Figure 4, groundwater flow beneath Bingay Creek may bifurcate uphill from the proposed mine area, with some flow east down the Creek channel and some flow towards lower topography to the northwest.

The locations of conceptual hydrogeological cross-sections through the mine pit are presented on Figure 3 and cross-sections A-A' and B-B' are provided as Figures 5 and 6. The interpreted A-A' cross-section is oriented approximately west to east, and interpreted cross-section B-B' is oriented generally north-south. As shown in the Figures, depths to water confirm the CHM with groundwater flow within the overburden and bedrock generally mimicking surface topography, consistent with typical unconfined flow conditions.

Vertically upward and downward gradients were also identified by the field reconnaissance and monitoring well installation and testing program. A vertical downgradient is apparent in the southern project area, with groundwater elevations in the overburden wells hydrostatically above groundwater elevations in the underlying bedrock. In contrast, vertically upward gradients are present in the northern project area, as evidenced by the numerous bedrock springs and artesian groundwater elevation in MW11-4D.

Additional information regarding bedrock fracture and groundwater flow characteristics in the Bingay area will be obtained during mine feasibility studies. This data will be used to refine the conceptual hydrogeologic model.

5.2 Aquifer Analysis

Aquifer response data obtained by the well testing program discussed in Section 3.3 was analyzed using the Cooper-Jacob (1946) straight-line time-drawdown and Theis recovery (1935) methods. Manually collected water level measurements are presented in Appendix B, with the drawdown and recovery data graphs included as Figures B1 through B21 in Appendix B.

The step drawdown test data was plotted as linear graphs with drawdown and flow rates versus elapsed time in minutes since pumping started. The 3-hour and 24-hour drawdown data were plotted as semi-logarithmic plots, according to standard straight-line methods of analysis, in which drawdown during pumping is plotted against log of time in minutes since pumping started. For the recovery data, residual drawdown was plotted versus log of the ratio of time in minutes since pumping started/time in each well using the Cooper & Jacob method (1946) and the Theis recovery method (1935) based on the radial flow periods observed during the pumping tests.

The aquifer test results are summarized in Table 3. Bedrock hydraulic conductivities (K) for the bedrock and overburden were estimated using the relationship K = T/b where T is aquifer transmissivity, estimated from the aquifer tests, and b is the aquifer thickness, assumed to be the test well depth.

Measured bedrock conductivities range from extremely low in well MW11-28vD to 4.6 x10^{-3} m/day in well MW11-1vD. Included in this table are ranges of hydraulic conductivities that are commonly accepted for the bedrock and overburden materials (Fetter, 1994). As noted in Section 3.2, no water was observed during drilling of MW11-2D however water slowly entered this well to 24.14 m btoc several days after drilling was completed. Based on the assumption that this recovery required 5 days to occur, the hydraulic conductivity for MW11-2D rocks is estimated at approximately 7.5 x 10^{-3} m/day. As water level decline was not observed during the falling head test in well MW11-28vD (Figure B19 in Appendix B), no test data were available for analysis. Overburden conductivity was measured at 2.76 x 10^{1} m/day in well MW11-28vS, which is also within the range of commonly accepted values for these materials.

As shown in drawdown graphs B3 and B10, drawdowns in several wells abruptly declined several hours into the tests. This response to pumping is consistent with groundwater withdrawal from a dual porosity fracture network where more open fractures drain relatively quickly into the borehole, with slower leakage from finer fractures and matrix porosity. This drawdown response is also consistent with the presence of a barrier to groundwater flow situated at a distance from the pumped well, which restricts the flow of water into the well capture zone.

Further, a significant difference in hydraulic conductivity values based on water level drawdown compared to recovery data are evident in wells MW11-4D and MW11-5D, where estimated K values based on recoveries are an order of magnitude greater than those based on drawdown. The recovery data may also reflect recharge from bedrock secondary porosity into the rock's primary fracture porosity. As such, K values estimated from late-time drawdown data are considered to be more representative of bedrock characteristics and have been used for this analysis.

These findings are supported by a recent comprehensive hydrogeological evaluation of the Mist Mountain and Morrisey Formations in the Weary Creek area, located approximately 20 km north of the project site conducted by Harrison (Harrison et al. 2000). Hydrogeological data obtained from depth-to-water and hydraulic head measurements, drill-stem tests, pumping tests and single well tests in this area were used to estimate "bulk" conductivity values for thick and varied stratigraphic sections in the Mist Mountain Formation. Hydraulic conductivities estimated for these rocks in this area range from 6.4 X 10^{-5} m/day to 8.6 X 10^{-6} m/day, with higher conductivities measured in coal and sandstone units (8.6 X 10^{-4} m/day) and lower values in finer-grained sediments (8.6 X 10^{-4} to 8.6 X 10^{-6} m/day).

As many of the Bingay wells could not maintain consistent pumping rates and as several wells showed evidence of negative recharge barriers or dual porosity flow behavior, the lower hydraulic conductivity values are likely more representative of overall bedrock conductivity in the proposed mine area.

Hydraulic conductivities of various stratigraphic units have yet to be identified for the project area. Additional information regarding bedrock fracture and groundwater flow characteristics in the Bingay area will be obtained during mine feasibility studies.

5.3 Groundwater Recharge/Discharge

Groundwater recharge for the proposed mine area will occur from infiltrating precipitation on hydraulically up-gradient (topographically higher or up-slope) areas and through direct precipitation into the mine area. As shown in Figure 4, recharge originating within and above the mine area will flow downslope east towards Bingay Creek or northeast beneath the bench area, depending on where the recharge originates with respect to the groundwater flow divide.

The amount of recharge is governed by the relationship

$\Delta S = P - ET - R$ where

ΔS = Change in storage, otherwise referred to as groundwater recharge
P = Precipitation
ET = Evapotranspiration
R = Surface Water Runoff

The rate of groundwater recharge in the proposed mine area will be controlled by the rate of precipitation and evapotranspiration, as well as the permeability and runoff characteristics of surface cover. As the recharge area consists of both generally flat and steeply sloping land that includes both vegetated and exposed rock areas, runoff was estimated at approximately 70% of precipitation, which is considered reasonable for these surface characteristics.

Climate normal data for precipitation and temperature collected between 1971 and 2000 in the Fernie station were obtained from Environment Canada (Environment Canada, 2011). Total average annual precipitation in the Fernie area is measured at 1,217.4 mm/yr, with most (860 mm/yr) occurring as precipitation and the remainder as snow (357 mm/yr). Mean temperatures ranged between -7.3^{o}C in January to 16.3^{o}C in July, however extreme temperature variations have been observed, with highs of 15.5 ^{o}C observed in February and lows of -2 ^{o}C observed in August. Due to the proximity of Fernie to the proposed mine location, this climate data is considered to be reasonably representative of conditions in the mine area.

General estimates of evapotranspiration were developed using the U.S. Soil Conservation Service Blaney-Criddle equation (Blaney, et al, 1950):

$ET = p\,(0.46 * T_{mean} + 8)$, where

ET = estimated evapotranspiration
p = mean daily percentage (number of daylight hours/24 hours) of average daily hours,
T_{mean} = mean daily temperature

Based on an average upslope groundwater recharge area of approximately 2.4 km^2, approximately 22% of annual precipitation or 263 mm/yr may recharge ground water (Table C1 in Appendix C). Precipitation falling into the open pit is assumed to be immediately removed by pit dewatering. Based on water balance estimates for the mine area, the net recharge in the proposed mine area averages about 4,980 m^3/day or about 913 US gpm (Table C1).

The Bingay recharge estimate is reasonably supported by other estimates of groundwater recharge conducted for the Elk Valley. Summit Environmental Ltd. recently evaluated hydrogeology in the Mist Mountain area near Fernie, where groundwater recharge in this area was estimated at about 12% of precipitation with about 22% of groundwater recharge contributing to stream flow (Summit, 2008). Summit also found that although small amount (6%) of recharge occurs in the spring, most recharge occurs in the fall when evapotranspiration declines and precipitation increases but the ground is not frozen. In addition, a comprehensive regional hydrogeological study recently conducted by Harrison near Weary Creek, located on the east side of the Elk Valley approximately 22 km north of the proposed Bingay Mine area, found that 20-30% of precipitation contributes to groundwater recharge (Harrison, et al 2000).

Potential groundwater flux through bedrock in the pit from recharge originating on the elevated topography to the west was also estimated using Darcy's Law (Q=KiA), where

- Q is the groundwater flux,
- K is the bedrock hydraulic conductivity (ranging between approximately 4.6×10^{-5} to 5.6×10^{-3} m/day)
- i is the hydraulic gradient (0.2 m/m). and
- A is the cross-sectional area on the hydraulically upslope side of the mine pit, estimated at approximately 1400 m long m by 350 m thick,

groundwater flow through the pit area using is estimated to range between about 4.5 m^3/day (9 US gpm) to about 550 m^3/day (about 100 US gpm) depending upon bedrock conductivity values. Field and well test observations suggest that actual flows will be on the low end of this range. The groundwater flux calculations along with their inherent assumptions are included in Appendix C.

Some groundwater from the mine area will discharge east down the Bingay Creek drainage, with some discharge directly into the creek and also flow in sediments beneath the creek. However, based on the likely groundwater divide location (Figure 4), most groundwater will flow north and northeast with eventual discharge into the Elk River.

Base flow in Bingay Creek during the late summer, fall and early winter originates as groundwater discharge from upgradient recharge. Stream flow measurements in Bingay Creek were collected between May 2010 and January 2011[1] collected by Masse Environmental Ltd. as part of the project's surface water hydrology study. Peak flows in Bingay Creek occur in June, with significantly reduced subsequent flows during summer, fall and winter. This bimodal distribution, and low flows observed after freshet, suggests that most precipitation runs off during the spring, with little contribution to groundwater recharge. Low post-freshet flows measured in Bingay Creek decline to less than 0.1 m^3/second during winter months, which originate from discharge of groundwater held in storage, further indicate that limited groundwater recharge to overburden and bedrock and limited discharge from these materials occurs in the proposed project area.

However, mountain streams commonly both lose and gain water along their reach and based on measured groundwater elevation in MW11-28vS, it is possible that for part of its reach, Bingay Creek is a losing stream with runoff lost to underlying sand and gravel aquifer. As shown in Figure 4, this flow may contribute to flow from overburden into the pit area.

As noted above, field and drilling observations and aquifer test results suggest that bedrock conductivities and potential groundwater production are likely on the low end of the possible range,

[1] The data logger froze in January, 2011 thus no spring discharge flow data are available

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although locations or rock intervals capable of greater production may be locally present. Initial analysis of potential flows through overburden and bedrock suggest that most flows will occur from sediments located on the western side of the proposed pit with relatively minor contributions from bedrock.

Additional information regarding groundwater recharge and discharge areas and rates, as well as the hydraulic connections between overburden, bedrock and surface water bodies including Bingay Creek, other creeks and the Elk River will be obtained during mine feasibility studies.

6.0 BASELINE GROUNDWATER QUALITY

6.1 Groundwater Sample Collection and Analysis

Groundwater samples were collected by Thompson under direction from WGI in July 2011 from three wells to obtain initial baseline groundwater quality data in the proposed mine area. Bedrock groundwater samples were collected from MW11-1D and MW11-4D, and an overburden sample was collected from MW11-28vS. Due to the thin or impermeable overburden in east and north sides of the project area, no wells were installed solely in unconsolidated materials in these areas. Groundwater seepage originating within the old 10-seam mine adit was also sampled by Masse Environmental Ltd. Data from this sample is reported by Masse under separate cover.

Groundwater samples were analyzed for anions, nutrients, general water chemistry parameters, and total and dissolved solids including

- pH and conductivity
- alkalinity
- hardness
- total suspended solids
- total dissolved solids
- dissolved fluoride
- turbidity
- nitrate and nitrite
- sulphate
- chloride
- phosphates (ortho and total)
- ammonia
- carbonate and bicarbonate
- dissolved sulfate

The well groundwater samples were also analyzed for extractable petroleum hydrocarbons as historic drilling information indicates that liquid hydrocarbons have historically been associated with Mist Mountain Formation coals.

Total metals analyses serves to identify potentially elevated metal concentrations in unfiltered and often turbid groundwater generated during mine exploration activities, while dissolved metals are generally more indicative of native groundwater quality. General water chemistry parameters are used to identify and classify water composition, provenance, and to support future evaluation of potential environmental impacts from mine dewatering and discharge.

Groundwater samples were collected using standard protocols at the end of each 24-hour test to ensure representative groundwater quality. The samples were field-filtered and acid-stabilized where applicable. The samples were collected directly into laboratory-supplied containers and shipped under chain-of-custody procedures to Maxxam Analytical Laboratory Ltd. in Calgary, Alberta for analysis. The sample analytical results are summarized in Table D1. Analytical reports are included in Appendix D.

Applicable Canadian Water Quality Guidelines (CWQG) including working and approved values for protection of aquatic life are included for each analyzed parameter. These guidelines are directly applicable to the assessment of potential environmental consequences of groundwater and surface water interactions as the primary receptor for potentially affected groundwater will likely be the Elk River and perhaps Bingay Creek.

6.2 Analytical Results

As shown in Table D1, except for dissolved fluoride, no anions, nutrients or general parameters exceeded CWQG. Fluoride was present in groundwater from wells MW11-28vS (overburden) and MW11-1D (bedrock) at concentrations (0.35 mg/L and 0.32 mg/L, respectively) slightly above the guideline of 0.3 mg/L. Fluoride was present in MW11-4D above the guideline at 0.66 mg/L. Carbonate values were below the analytical method detection limit of 0.5 mg/L, however bicarbonate values ranged between 270 mg/L in MW11-28vS to 480 mg/L in MW11-4D. Total dissolved solids (TDS) values were low and ranged from 250 mg/L in MW11-28vS to 360 mg/L in MW11-4D. Alkalinity values ranged between 220 at MW11-28vS and 390 mg/L at MW11-4D.

Turbidity was measured at 1.6 NTU in MW11-28vS, 36 NTU in well MW11-1D and 50 NTU in MW11-4D. Groundwater from all three wells was hard with hardness ranging from 230 mg/L in overburden well MW11-28vS to 330 mg/L in MW11-4D. Dissolved sulfate was present in MW11-28vS at 7 mg/L and not-detected in the other two wells. pH in the three wells was basic and ranged from 7.9 in MW11-4D to 8.0 in MW11-28vS. Nutrient concentrations were all low, except for ammonia in MW11-4D which was present at 4.7 mg/L.

Groundwater from the three wells contained several total metals above CWQG values. Total cadmium was present above the CWQG of 0.005 µg/L in all three wells at 0.010 µg/L in MW11-28vS, 0.045 µg/L in MW11-1D, and 0.26 µg/L in MW11-4D. Total barium was present above the working CWQG of 1 mg/L in the bedrock wells MW11-1D and MW11-4D at 8.6 and 2.9 mg/L, respectively. Total copper was detected in all three wells above the CWQG of 0.04 µg/L, with concentrations of 0.3 µg/L in MW11-28vS, 2.9 µg/L in MW11-1D and 2.5 µg/L in MW11-4D.

Total iron in the two bedrock wells also exceeded the CWQG value of 1 mg/L with 2.8 mg/L present in MW11-1D and 6.5 mg/L present in MW11-4D. Total aluminum was detected above the CWQG value of

0.1 mg/L in bedrock wells MW11-1D and MW11-4D at 1.1 and 0.11 mg/L, respectively. Total mercury was present above the guideline (0.001 µg/L) in both MW11-28vS and MW11-4D at 0.003 µg/L.

Although selenium has been reported as being ubiquitous in Mist Mountain Formation rocks and coal deposits and at elevated concentrations in the Elk River (Env. Canada, 2001), total selenium was not present above the applicable CWQG (0.002 mg/L) in any well and was only detected in MW11-28vS at 0.0002 mg/L.

No CWQG have been developed for dissolved metals, however the dissolved metals concentrations were similar or below to the total concentrations. In addition, extractable petroleum hydrocarbons were not detected in any well above the method detection limit of 0.08 mg/L.

6.3 Groundwater Chemistry Discussion

Groundwater is often characterized by its type, which provides an indication of its provenance and residence time in the aquifer. The identification of water type and evidence of apparent mixing of water types usually commences with plotting of the major ion proportions on a tripartite plot known as a Piper plot. The water is then characterized by the portion of major ions (Ca, Na, K, Mg, SO4, HCO3, and Cl). For example, a calcium sulfate water would contain primarily calcium and sulfate, which is common for tailings water at a sulfide metal mine. Shallow, fresh water, on the other hand is commonly sodium or calcium bicarbonate type water, resulting from a relatively short duration in the groundwater system. A Piper plot of the three samples collected from the Bingay wells are presented as Figure D1 in Appendix D, and discussed below.

Higher pH values are most common where calcite is present and can undergo some dissolution, raising the pH and increasing concentrations of calcium, magnesium, and alkalinity. The longer the residence time of water in contact with calcite-bearing aquifer material under unconfined conditions, the more calcite dissolution will take place, and the harder the waters will become. Most Ca-Mg-HCO3 waters are moderately hard to hard (Hem, 1985). The three groundwater samples can be considered to be hard to very hard.

As shown in Figure D1, all three samples are of the calcium-magnesium bicarbonate type. Calcium-magnesium bicarbonate waters indicate shorter residence times within the ground-water-flow system compared to other types. The lack of carbonates in the bedrock and overburden groundwater samples suggests that bicarbonate probably originates from atmospheric carbon dioxide.

The concentrations of most general chemistry parameters including TDS, alkalinity, pH, conductivity, as well as most total metals, increase between overburden groundwater collected from MW11-28vS and bedrock groundwater collected from MW11-4D, with concentrations in MW11-1D water generally between the other wells. Although the samples were collected after the wells had been pumped for at least 24 hours, this may be a result of increased turbidity caused by drilling or from TDS in these samples

The concentration increase could also result from local stratigraphy, where overburden water can be considered to have the shortest aquifer residence time and the most connection with recent precipitation while MW11-1D is covered by relatively thin and permeable sand and gravel, which would allow some mixing between overburden waters and deeper groundwater contained within bedrock fractures. In contrast, the fractured bedrock aquifer at MW11-4D is covered by generally impermeable dense silt and clay sediments. These sediments will not allow direct groundwater recharge from shallow groundwater or precipitation, therefore deep groundwater at this location may be older and contain less recent recharge.

A comprehensive evaluation of surface water and groundwater chemistry in the Elk Valley and its tributaries was completed in 1995 (Harrison, 1995). This study used samples collected from outcrops and subcrops of the Mist Mountain Formation to establish major trends in water geochemistry in the study area. The waters were characterized by relatively low total dissolved solids ranging between 100 mg/L in streams to 4500 mg/L from deep groundwater. The groundwater samples were dominated by calcium-magnesium bicarbonate with pH values that ranged between 6.6 and 8.4. The geochemistry of groundwater samples collected at Bingay are consistent with those collected as part of Elk Valley study and suggests that shallow groundwater and deep groundwater may be hydraulically connected in the proposed mine area.

Although selenium in known to be associated with coal deposits in the Elk Valley, the lack of selenium and petroleum hydrocarbons in pre-mine groundwater suggests that these substances may only be present at specific areas in the proposed mine area, or they may result from disturbing the rocks with subsequent exposure to precipitation and the atmosphere.

Additional evaluation of groundwater geochemistry will be completed as part of ongoing feasibility study analyses.

7.0 POTENTIAL PROJECT EFFECTS

The identification of potential effects associated with groundwater produced during mining operations focuses primarily on groundwater quantity and quality. Aspects of groundwater-related Project activities that may impact nearby surface water flows and quality are also discussed.

7.1 Groundwater Quantity

7.1.1 Construction and Operational Effects

The primary components included within the proposed Bingay Mine footprint are the pit, haul roads, coal processing areas and various waste and storage sites. Construction activities will generally be restricted to the development of surface infrastructure and roads, which will cause local changes to soil properties, such as increased or decreased thickness, and possibly local precipitation infiltration/recharge characteristics, however these activities are not anticipated to have significant impacts on the overall groundwater system.

Potential impacts to site and downgradient groundwater resulting from active mining and the open mine pit, waste rock piles, sedimentation ponds and infrastructure are most likely to occur during the project operations phase. The pit developed during the operations phase will intersect and modify the groundwater system, reaching a maximum potential impact at the cessation of mining operations. Waste materials generated by mining operations will consist predominantly of overburden, siltstone, mudstone and sandstone with un-mineable coal. Both rock and overburden waste from stripping operations will be placed on elevated topography west of the proposed pit area. The waste materials will be underlain by low-permeability materials to restrict the downward migration of infiltrated water.

Groundwater flow directions and rates are unlikely to be affected by stockpiling and management of these materials during and post operations. However, the hydraulic conductivity and permeability of the waste will be highly variable, depending on the character of the constituent materials and the placement method. This material may have high permeability and ability to store precipitation recharge, which may discharge down gradient.

In addition, during mine construction and operations, surface runoff originating above the proposed mine area will be intercepted by constructed channels upslope of the proposed pit and flows will be diverted around the pit.

Potable water will be required to supply the mine site crew. Potable water will be supplied from on-site water wells capable of providing the required water quality according to BC Drinking Water Guidelines. On-site septic waste will be discharged to the subsurface using a conventional treatment and disposal system. As such, no significant impact to groundwater flows is expected to occur from this activity.

7.1.2 Estimated Groundwater Flow to the Pit

Long-term dewatering of the open pit at Bingay will lower the groundwater table surrounding the excavated area during the mining program. This lowering will take the general shape of a cone and will likely reach its maximum extent when mining operations reach its maximum depth. The lateral extent of reduced ground and surface water elevations caused by dewatering will depend on bedrock hydraulic characteristics and surface-groundwater interactions.

As discussed in Section 4.1, shallow groundwater is likely contained in both overburden sediments and shallow bedrock fractures, while deeper groundwater is contained solely within deep fractures. Therefore, as shallow and deep groundwater elevations are lowered adjacent to the mine workings by mine dewatering, it is possible that surface water elevations surrounding the mine workings may be also reduced. However, there are several constraints related to local hydrogeology which indicate this effect will be minimized or be a non-factor in the proposed mine area.

The primary relationship that governs the potential effects of long-term mine dewatering on surrounding surface water bodies is the degree of hydraulic connection between underlying groundwater and overlying or adjacent surface water. In the Bingay mine area, it is likely that glacially and fluvially-derived sediments underlying Elk River will serve as hydraulic barriers (aquitards) through which little or no vertical water movement will occur.

In addition, field measurements of bedrock conductivity conducted on the south and east sides of the proposed Bingay open pit indicate that the overall permeability of bedrock in this area is very low. This low permeability will serve to significantly reduce the lateral extent of groundwater dewatering and minimize any potential for surface water flow towards the pit. These factors will result in reduced or minimal potential effects from long-term mine dewatering on the adjacent Elk River.

Further, water levels in the Elk River adjacent to the mine area will be continually replenished by downstream flow so little effects on river stage at this location will be observed. Any water that does flow through the river bottom into the open pit will be captured, treated as necessary and returned to the river at the mine location, so no net loss of river flow or river dewatering will occur.

The potential surface water/ groundwater interactions on the south side of the proposed mine area may be more complex. The low bedrock permeability suggests that little groundwater will likely enter the pit on this side through bedrock, but the volume of groundwater flowing beneath Bingay Creek through underlying sediments is unknown.

As low permeability bedrock is situated above the Creek level on the pit's southern and southeastern sides, little to no groundwater inflow is expected from overburden in these areas. However, groundwater may enter the pit from overburden associated with Bingay Creek along the pit's southwestern side. The hydraulic connections between sediments beneath Bingay Creek and adjacent bedrock will be further evaluated during feasibility studies.

Groundwater may also enter the pit from overburden situated along the pit's western side, where saturated sediment may be continually recharged from elevated topography further to the west. Storage of waste rocks in this area without an underlying barrier to precipitation recharge may increase downgradient groundwater flow through the overburden.

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However, the lack of permeable overburden and shallow groundwater on the east and north sides of the proposed mining area suggests that no direct or very limited hydraulic connection is present between near-surface sediments and groundwater in the proposed pit area and the adjacent surface water bodies. As such, little or no groundwater inflow from overburden in these areas is expected.

7.1.3 Estimated Groundwater Dewatering Effects

The open pit will act as a groundwater sink until such time that the pit has refilled after mine closure. Until the pit fills, the open pit will be surrounded by a cone of depression in the groundwater table, where groundwater flow within the cone is directed towards the pit. The size of the cone of depression is dependent on the hydraulic conductivity of the ground (larger with higher hydraulic conductivity) and the groundwater recharge rate (larger with lower recharge rate). The cone of depression will diminish as the pit is allowed to fill after closure. Flows into the pit were estimated using an analytical approach, which is presented below.

The open pit will be designed to be free-draining and will therefore dewater surrounding bedrock upon excavation. In the short-term, higher discharge rates may be encountered as initial porosity in the surrounding rockmass is dewatered. Once the pit has been fully excavated, inflow rates should decline toward steady-state conditions, which may vary as a function of seasonal infiltration, recharge rates and secondary rock porosity characteristics.

The approximate steady-state discharge volume was estimated for the proposed pit using analytical models incorporating pit design dimensions, local hydrogeologic data, hydraulic conductivity information obtained by recent field assessments, and assumptions necessary to use analytical methods in a fractured bedrock setting. Steady state flow into the pit at maximum build-out was estimated using procedures provided by Marinelli and Niccoli (2000) and Powers (1992). Marinelli's method separates the flow into discrete horizontal and vertical components, while the Powers method is based on the assumption that the pit behaves as a large-diameter well. General hydrogeologic assumptions required for the calculations include:

- The pit will be roughly circular with an average radius of 800 m;
- The pit depth will be approximately 400 m with a static water level of approximately 50 m below ground surface;
- The pit will be dewatered to approximately 0.1 m above the pit floor;
- No effects on groundwater flow estimates from the sloping water table were included;
- Bulk bedrock hydraulic conductivity (K) values range from approximately 4.6 X 10^{-5} m/day to 5.6 X 10^{-3} m/day with an approximate geometric mean of 5.0 x 10^{-4} m/day;
- Bedrock characteristics within the pit area are similar to those documented by the 2011 drilling program;

- Vertical bedrock hydraulic conductivity is equivalent to the bulk conductivity;
- The estimated volumes are based on a groundwater radius of influence of approximately 1,015 m, or approximately 1.25 times the pit width as this value provides an accurate match to the proposed dewatering depth per Marinelli;
- The hydraulic system is considered to be unconfined, homogeneous and isotropic – required simplifications as information to characterize local bedrock fracture flow is not available; and
- Steady state flows are assumed to relate to pit catchment infiltration area at the final/maximum extent of the mine pit, or to the estimated groundwater radius of influence, assumed to be circular.

Summary results for each calculation method are presented in Appendix D.

Using the Marinelli method and the minimum bedrock hydraulic conductivity, steady-state inflow into proposed pit from bedrock is estimated at approximately 1,770 m^3/day (325 US gpm), with a maximum flow estimated at about 8,470 m^3/day (1,550 US gpm) and a mean flow of about 2,300 m^3/day (423 US gpm).

Modeling the pit as a large well (Powers 1992) results in generally lower flow estimates when using the estimated low bedrock K values, with a likely low flow of approximately 85 m^3/day (16 US gpm), a potential high flow of about 10,400 m^3/day (1,900 US gpm) and a mean flow of approximately 918 m^3/day (168 US gpm), again assuming a dewatering radius of approximately 1015 m.

Although the aquifer test data suggest the bedrock stratigraphic unit may be heterogeneous with respect to potential groundwater production, as noted above, field observations and aquifer test analyses suggest indicate that either or both dual porosity bedrock and/or recharge barriers will serve to reduce long-term flow from the fractured bedrock. These findings suggest that long-term flow rates from bedrock will most likely be similar to or lower than the estimated low flows.

Groundwater flow into the pit from overburden will originate from precipitation on elevated topography west and hydraulically up-gradient from the proposed pit area. Assuming that groundwater flow through overburden into the pit can be approximated by Darcy's Law (Q=KiA), where

- Q is the groundwater flow rate,
- K is the measured overburden hydraulic conductivity (approximately 1.28 x 10^1 m/day), and using published values for minimum (1 x 10^{-1} m/day) and maximum (1 X 10^2 m/day) conductivities;
- i is the hydraulic gradient (0.025 m/m). and
- A is the cross-sectional area on the hydraulically upslope side of the mine pit, estimated at approximately 575 m long m by 50 m thick,

the mean groundwater flux through overburden sediments on the western edge of the proposed pit is estimated at about 9,200 m^3/day (approximately 1,675 US gpm), with minimum and maximum flows of 359 m^3/day (65 US gpm) to 72,000 m^3/day (13,000 US gpm) depending upon the overburden hydraulic conductivity. The mean estimated flux based on the measured overburden K value range is somewhat greater than the estimated recharge available from precipitation, which suggests that average overburden conductivity values may be less than measured value and on the low end of published values.

Maximum flows may result from years of high precipitation or snowmelt causing increases in height of the water table or increased recharge, or the pit excavation encountering permeable faults or fractures which produce significantly more water that observed during recent drilling. However, flows can be generally expected to increase as the pit base extends deeper into the water table.

Higher transient inflows may be expected where the mine pit intercepts faults and fracture zones, however transient flows will likely decline with time. However, the rate of decline could vary considerably, from weeks to months, depending upon the extent of the fracture zone and its interconnection with more permeable strata within the bedrock, and the rate of pit excavation.

Due to the low bedrock permeability perimeter dewatering wells are not anticipated to be effective. Groundwater entering the pit will be removed using sump pumps and discharged to Bingay Creek or the Elk River following suitable treatment, as required. However, it is possible that water volumes produced from overburden located on the west and south sides of the pit may require dewatering wells to adequately lower the water table in this area. Alternatively, the relatively shallow overburden thickness suggests that a groundwater flow barrier could be installed around the pit through the overburden and anchored into underlying bedrock to block downgradient groundwater flow.

Insufficient information is presently available to quantify the potential effects from mine pit dewatering on surface and groundwater elevations adjacent to the proposed pit area. However, as noted above, the occurrence of generally shallow and impermeable bedrock on the pit's southern and eastern sides, the presence of low permeability overburden on the pit's north side, as well as short estimated cone of depression from pit dewatering, indicate that little effects on water levels in Bingay Creek, the Elk River or other nearby surface water bodies will occur during and post mining.

Estimates of long-term groundwater flow into the pit from overburden and bedrock, and potential effects from long-term pit dewatering on nearby surface and groundwater will be refined using stratigraphic and hydrogeological data obtained as part of the feasibility study.

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7.1.4 Decommissioning and Reclamation Effects

After open pit mining has ceased, active pit dewatering will no longer be required and impacts to groundwater flows during the decommissioning phase will be limited to continued modifications of flow gradient due to the presence of the excavated pit. Waste rock will be used to fill in the open pit after mining operations are completed. This disposal method is not expected to significantly affect groundwater flow in or downgradient of the pit.

Groundwater levels surrounding and topographically below the pit are expected to return to approximately static conditions after mining operations cease. Depending upon final pit configuration, a shallow pit lake may form in the backfilled pit by gradual groundwater inflow into the pit. Lake elevations within the pit will be controlled by the downgradient pit wall elevation. Detailed reclamation plans including expected pit refilling and lake elevations are provided by others.

Impacts related to infiltration through waste rock dumps to the groundwater system will be minimized by the design of waste rock stockpiles and by the underlying impermeable sediments. Covering and re-vegetation of waste dumps will promote shallow flow and reduced or delayed infiltration, resulting in limited potential for impacts on groundwater flow.

7.2 Groundwater Quality

7.2.1 Construction and Operation Effects

Impacts to local groundwater quality are not expected to be significant during Project construction. Construction and operational activities will generally be limited to the development of surface infrastructure including buildings and parking areas, the waste rock storage area, coal stockpiles, access roads, interception ditches, collection ditches and stormwater retention ponds. Construction and operation of these features will cause local changes to soil and surface water flow properties and subsequent infiltration/recharge characteristics, but these activities are not anticipated to have significant impacts on the overall groundwater system.

Fuel spills from construction equipment may impact local groundwater or surface water quality, depending upon spill location. However, as overburden in much of the project area is either not present or consists of dense and low permeability sandy gravelly silt and clay (glacial till) significant infiltration of spilled contaminants to underlying groundwater is unlikely to occur. Due to the depth to groundwater, large spills that occur on more permeable western and southern overburden may locally affect groundwater quality, however construction site Best Management Practices, including appropriately trained personnel and implementation of spill prevention and response plans, will be utilized during project construction and operation to minimize potential impacts on project area and downgradient groundwater quality.

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Groundwater potentially impacted by mine operation includes near surface groundwater from mining operations areas, infiltration into various waste rock stockpiles that may discharge into underlying groundwater, and deep groundwater that may discharge further downgradient into the Elk River drainage.

Minimal impacts on groundwater quality are expected in the upslope mine area as the waste rock will be stored above impermeable sediments and infiltrated water will be captured and managed appropriately before discharge. Should infiltration into waste rock result in degraded shallow groundwater quality, as noted above during mine operations most of this water will be captured by ongoing pit dewatering and managed appropriately. Detailed discussion of produced water management including mitigation and monitoring during and post mining is provided by others.

Preliminary assessments of coal and host rock chemistry indicate that limited acid-generating minerals are present and the potential for acid-rock drainage (ARD) is low (Morin, 2004). The acid generating potential for Bingay bedrock is discussed under separate cover. Additional evaluation of acid generating potential from the waste rock and potential effects from potentially acid-generating (PAG) rocks will be conducted as part of mine feasibility studies

Detailed studies of groundwater chemistry and identification of potential impacts on local and downgradient ground and surface water quality, and also including detailed groundwater monitoring and mitigation plans, will be completed as part of the mine feasibility assessment.

7.2.2 Reclamation Effects

Reclaimed areas will include surficial features such as the open pit margins, the decommissioned waste dump footprint, various coal stockpiles, overburden and organic stockpile footprints after they are removed, access roads, interception ditches, collection ditches and stormwater retention ponds.

Waste rock that is not returned to the pit will be covered with stockpiled overburden and contoured to minimize infiltration, promote surface runoff and minimize erosion. Except for the mine pit, all surficial mine features will be temporary. Where the underlying soil consists of generally impermeable silt or clay, little to no significant impacts to underlying shallow groundwater flow or quality are expected from decommissioning and reclaiming the surface features. Where the underlying soil consists of more permeable sandy gravel and silty sand, mitigation strategies similar to those discussed for mine construction and operation will be implemented. All areas where surface features were located will be graded, covered with topsoil and reseeded.

Detailed information regarding post-mine pit water quality and reclamation will be developed as part of the mine feasibility assessment

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7.2.3 Post – Closure Effects

Residual effects on groundwater flows and quality will result from the long-term presence of the pit and waste rock stockpiles. Groundwater flows will stabilize as the system equilibrates with the backfilled pit. The backfilled pit will likely be more highly conductive than bedrock and act as a long-term drain for the local groundwater system until it is filled.

Project-related effects related to groundwater include potential impacts on flows and groundwater and surface water quality in and downstream of the proposed mine area. The primary effect of mine-influenced groundwater flow variations at the mine site, caused by disruption of the pre-mining hydrogeological system, will be manifested as potentially reduced groundwater elevations surrounding the pit and possible impacts to Creek baseflows. Impacts to groundwater flow will mainly result from the change induced by pit de-watering. Groundwater flow will be influenced by modifications of the natural groundwater gradient and infiltration, as well as by groundwater diversion.

The primary effect of mine-influenced groundwater quality variations at the mine site will be impacts to baseflow water quality, which will be influenced primarily through infiltration or discharge of infiltrated surface water or groundwater that has been in contact with potentially acid or metal-generating materials.

Long-term pit water and surface water quality effects as well as post mining water quality monitoring information will be prepared during the mine feasibility assessment.

8.0 SUMMARY AND RECOMMENDATIONS

8.1 Preliminary Hydrogeological Assessment Findings

- Historic geological data, topographic mapping, field observations, well installation and aquifer testing and analysis indicate that groundwater in the proposed Bingay Mine area occurs in distinct bedrock and overburden hydrostratigraphic units;

- Groundwater flow in both units can be expected to generally follow local and regional topographic slope, with flow downslope from topographic highs towards discharge into Bingay Creek, the Elk River and other smaller surface water bodies. A groundwater divide is likely present on the southwest side of Bingay Hill, where groundwater flow from further upgradient to the west flows down slope beneath Bingay Creek, and also towards the north and northeast;

- Groundwater recharge from precipitation in the proposed mine area is estimated at about 4,980 m^3/day, or about 263 mm/year. This volume is about 22% of total precipitation which corresponds favorably with groundwater recharge studies conducted by others for areas in the Elk Valley;

- Initial aquifer testing and analysis results for overburden suggest that the hydraulic conductivity for this unit is within generally accepted values for these sediments. This hydrostratigraphic unit may produce groundwater from the western side of the proposed pit area, with mean flows estimated at 9,200 m^3/day. Low flow is estimated at about 360 m^3/day and estimated maximum flow is approximately 72,000 m^3/day, depending upon local unit thickness and conductivity;

- The bedrock aquifer test data suggest that aquifer flow characteristics are heterogeneous, with flows from this unit potentially ranging between about 85 m^3/day to about 10,400 m^3/day, with an estimated mean flows ranging between 918 and 2,300 m^3/day. Field observations and aquifer test results indicate that actual flows from bedrock will probably be towards the low end of this range, unless currently unknown areas with significantly higher conductivities are encountered;

- Based on estimated flow, open pit mine bedrock dewatering can likely be accomplished without dewatering wells and using sumps. However, it is possible that overburden situated along the southern and western sides of the proposed pit area may produce significant volumes of water; and

- Chemical analysis of two bedrock and one overburden groundwater samples indicates that the water is predominately calcium-magnesium bicarbonate type, which indicates that the water is may originate from relatively recent precipitation. Several total metals concentrations were above CWQG established for protection of aquatic life, however these concentrations may be a result of elevated turbidity or total dissolved solids in these samples.

Therefore, based on available data, the proposed open pit mine is unlikely to significantly affect adjacent surface water bodies including the Elk River and Bingay Creek because of the following:

- In general, the bedrock has very low permeability with few fractures to serve as pathways for adjacent surface waters to enter the pit or underground workings. No or very little groundwater was produced from most monitoring wells during drilling and testing, and bedrock well testing results strongly suggest that continued pumping will result in decreased water production with time;

- Bedrock is located at or very near the ground surface along the eastern side of the proposed pit between the pit and the Elk River, and on the south side of the pit along Bingay Creek. With proper pit wall design, this low permeability bedrock could be used as a dam to prevent significant lateral flows between the river, creek, underlying water-bearing sediments and the adjacent open pit;

- Most of Bingay Hill is covered by thin overburden (mostly sand, gravel and silt) that only contains water seasonally during freshet. No significant groundwater flow from these sediments is expected;

- Surficial sediments on the north side of the proposed pit consist of thick and very low permeability clay/till sediment which should prevent significant flow from overburden into the pit;

- Surficial sediments on the southwest and west sides of the proposed pit appear to be very permeable and may produce significant amounts of groundwater during open pit mining. However, they appear to be relatively thin and geotechnical groundwater control methods, such as grout curtains, may be suitable to prevent overburden groundwater flow from entering the pit.

8.2 Recommendations

Although generally sufficient information is presently available to support preliminary estimates of expected groundwater flow and produced groundwater quality, additional information will be required to refine the CHM, calibrate the model with local hydrogeologic conditions, refine the estimated flows to identify potential effects of long-term mine dewatering on adjacent surface water bodies, and predict post-closure groundwater conditions.

Specific recommendations to improve the CHM, groundwater flow and impact estimates include completing the following work:

- Characterize hydraulic properties and groundwater flow characteristics of individual bedrock stratigraphic units using a drilling program targeted at specific locations with packer tests conducted in stratigraphic and structural targets;

- Identify and characterize potential high-production zones in bedrock specifically including the Bourgeau Fault possibly located on the west side of the proposed pit area using dedicated monitoring wells and aquifer testing;

- Drill, install and test additional monitoring wells on the southern and western side of the pit area to refine estimates of potential groundwater inflow from overburden, and to identify the hydraulic connection, if any, between shallow groundwater and Bingay Creek flow, including potential seasonal variations;

- Use nested monitoring wells and aquifer tests in overburden, shallow bedrock and deep bedrock to investigate the vertically upward hydraulic gradients present in the northeast mine area. Use this information to characterize the gradient occurrence, amount and to support estimates of potential upward groundwater flow into the pit area from these gradients;

- Investigate the potential to use geophysical exploration tools including seismic, resistivity and magnetotelluric surveys to assess the thickness, depth to water and composition of overburden sediments in the proposed mine area. This information will be particularly useful to identify the sediment thicknesses beneath the Elk River and Bingay Creek which would support detailed characterization of potential effects from open pit and underground mining on surface water flows;

- Further characterize the occurrence and characteristics of total selenium, cadmium, aluminum, iron, barium, fluoride and mercury in local runoff and groundwater by collecting groundwater samples from crushed waste rocks, and overburden and bedrock wells. Use this information to predict waste rock leachate quality, to predict produced groundwater quality, to identify potential effects from long-term groundwater discharge into the receiving environment, and to identify appropriate groundwater and leachate mitigation and management practices and procedures;

- Evaluate the feasibility for using physical barrier geotechnical methods to reduce groundwater flow from overburden into the pit from upslope recharge;

- Develop a numerical model of the proposed Bingay mine site including the Elk River, Bingay Creek and No-Name Creek, and use this model to refine estimates of groundwater flow into the pit from bedrock and overburden, as well as estimates of potential effects of pit dewatering on adjacent surface water bodies.

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9.0 REFERENCES

BC Ministry of Environment. BC Water Resources Altas. http://www.env.gov.bc.ca/wsd/data_searches/wrbc/index.html

Blaney, H.F. and Criddle, W. D. 1950. Determining water requirements in irrigated areas from climatological and irrigation data. USDA Soil Conserv. Serv. SCS-TP96. 44 pp.

Cathyl-Bickford, C.G., 2005. Geological Report on the Bingay Creek Coal Property (Kootenay Land District, British Columbia) incorporating the results of drilling done in March, 2005. Hillsborough Resources Limited. Report WR 207-12. May 31, 2005.

Cooper, H. and Jacob, C., 1946. A generalized graphical method for evaluating formation constants and summarizing well field history. A. Geophys. Union Trans. Vol. 27, pp. 526-534.

Environment Canada. 2001. Water quality assessment of Elk River at Highway 93 (1968-2000). Ministry of Water, Land and Air Protection.

Environment Canada. 2011. Canadian Climate Normals or Averages, 1971 – 2000. http://climate.weatheroffice.gc.ca/climate_normals/index_e.html

Fetter,C.W. Applied Hydrogeology, 3rd Ed. Prentice Hall 1994.

Gentzis, T. 2006. Economic Coalbed methane production in the Canadian foothills: Solving the puzzle. International Journal of Coal Geology, 65: 79-92.

Greive, D.A., and Price, R.A. 1987 (est.). Preliminary Map 53, Geologic Setting of the South Half of the Elk Valley Coal Field, Southeastern British Columbia, Part of 82G/15 and 82J/2. Province of British Columbia, Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch.

Harrison, S.M. 1995. The hydrogeology and hydrochemistry of a potential coalbed methane exploration area, Elk River Valley, southeastern British Columbia. M.Sc Thesis, University of Waterloo.

Harrison, S.M., Molson, J.W., Abercrombie, H.J., Barker, J.F., Rudolph, D., Aravena, R. 2000. Hydrogeology of a coal-seam gas exploration area, southeastern British Columbia, Canada: Part 1 – Groundwater Flow Systems. Hydrogeology Journal (2000) 8: 608:622.

Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water, 3rd ed.: U.S. Geological Survey Water Supply Paper 2254, 263 p.

Marinelli F., Niccoli W.L. Simple Analytical Equations for Estimating Ground Water Inflow to a Mine Pit. 2000. Ground Water 38 (2), 311-314.

Masse, S. and de Zwart, I. 2011. Unpublished stream-flow data collected from No-Name Creek as part of the Bingay Mine Environmental Studies.

Morin, K. A. and Nutt, M.N. 2004. Bingay Creek Project – 2nd Phase ML/ARD Results and Recommendations. Hillsborough Resources Limited. Minesite Drainage Assessment Group, Surrey BC. November 29, 2004.

Powers, J.P., Construction Dewatering. New Methods and Applications. Second Edition. 1992. John Wiley and Sons.

Ryan, B. 2004. The CBM Resource of Some Prospective Areas of the Crowsnest Coalfield Mines. Resource Development and Geoscience Branch, BC Ministry of Energy and Mines.

Summit et al. 2008. Final Report. Mist Mountain Project Surface Water Hydrology & Groundwater Baseline Studies: 2007. Matrix Solutions Inc., Calgary, AB. Summit Environmental Consultants Ltd. Vernon, BC.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage. Trans. Amer. Geophys. Union, Vol. 16, pp. 519-524.

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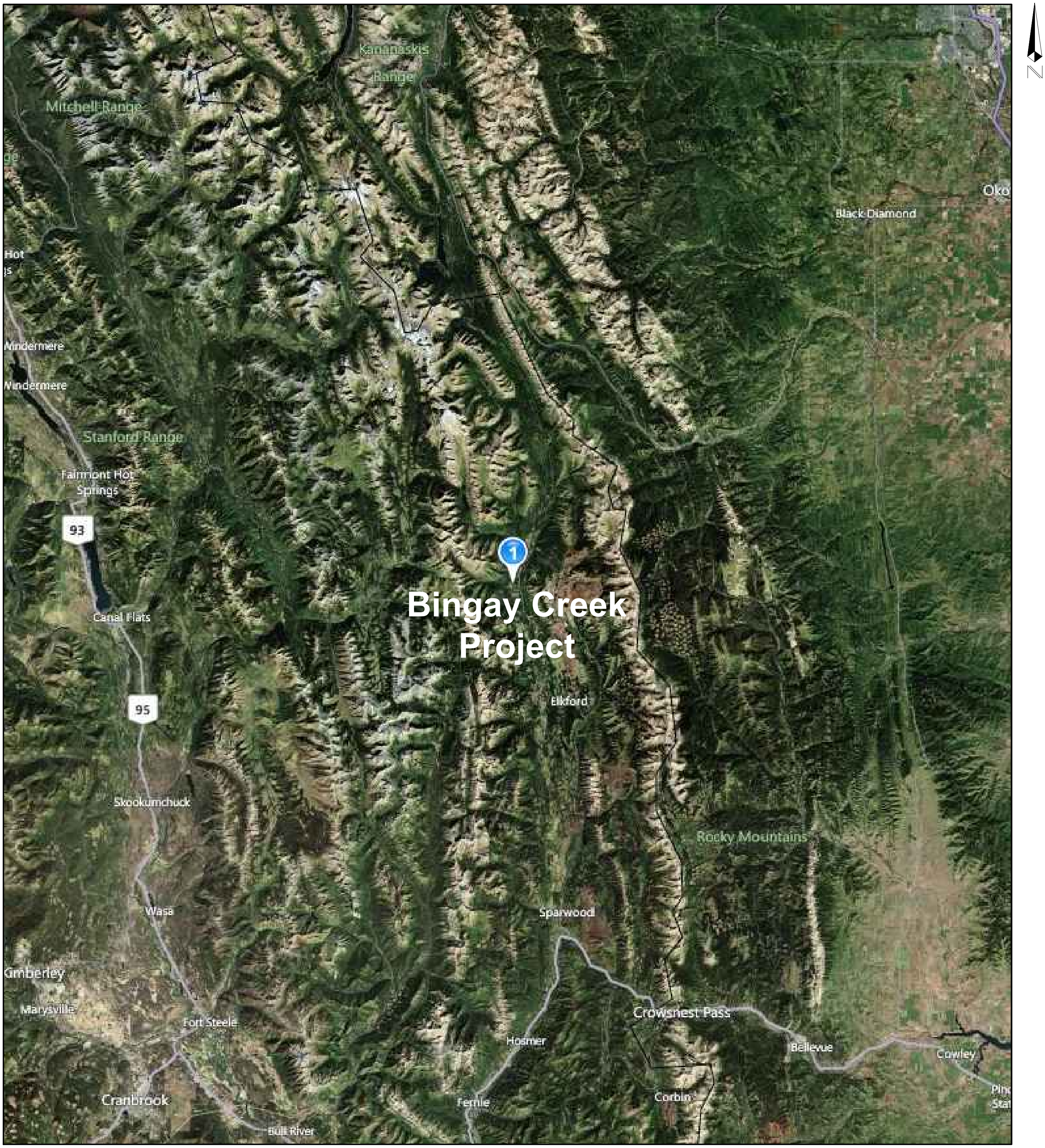
Figures



LEGEND

CLIENT

CENTERMOUNT COAL

PROJECT

BINGAY CREEK

TITLE

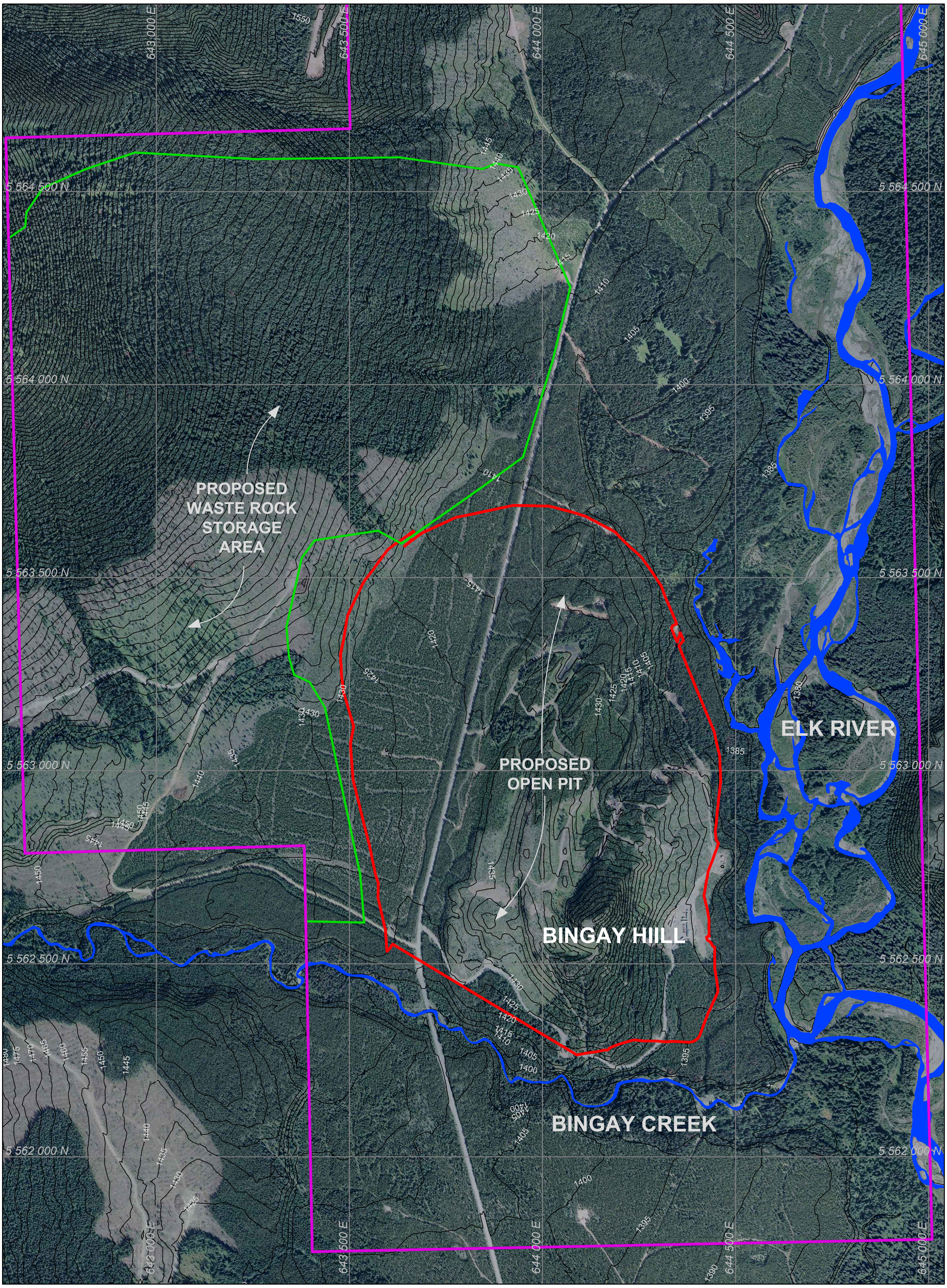
FIGURE 1

PROJECT LOCATION

SCALE

-5km 0km 10km 20km 30km 40km

W A T T E R S O N   G E O S C I E N C E   I N C



LEGEND

- PROPOSED PIT LIMIT
- PROPOSED WASTE STOCKPILE AREA
- BINGAY PROPERTY BOUNDARY

CLIENT
CENTERMOUNT COAL

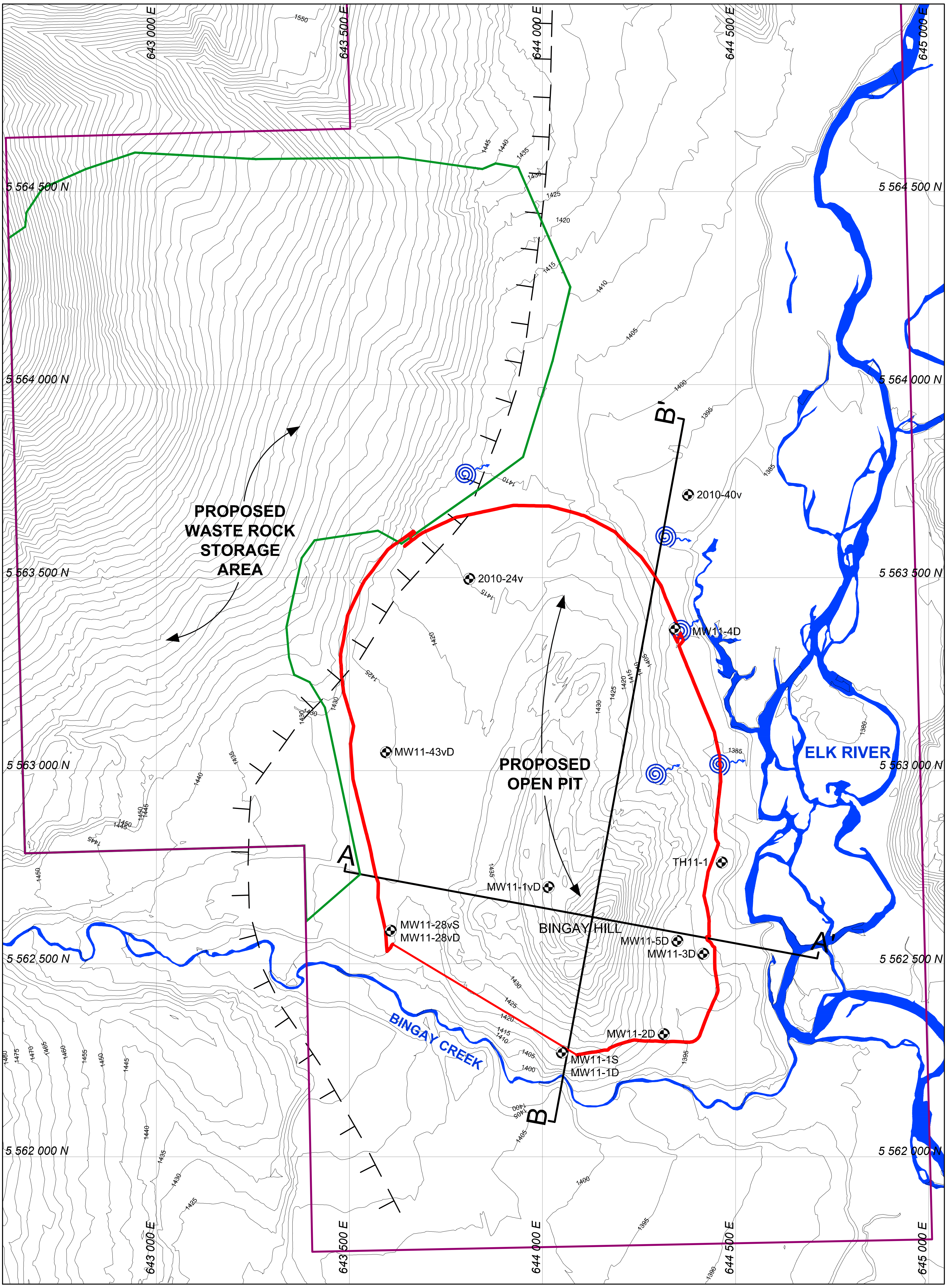
PROJECT
BINGAY CREEK

TITLE
FIGURE 2

PROJECT AREA

SCALE
SCALE 1 : 10,000 AT ANSI B SIZE
-100m 0m 200m 400m 600m

WATTERSON GEOSCIENCE INC



LEGEND

- PROPOSED PIT LIMIT
- PROPOSED WASTE STOCKPILE AREA
- BINGAY PROPERTY BOUNDARY
- BOURGEAU FAULT (APROXIMATE TRACE)
- 2011 MONITORING WELL
- ARTESIAN SPRING / BEDROCK GROUNDWATER SEEPAGE

CLIENT: **CENTERMOUNT COAL**

PROJECT: ***BINGAY CREEK***

TITLE: **FIGURE 3**

MONITORING WELL AND GEOLOGICAL CROSS-SECTION LOCATIONS

SCALE: SCALE 1 : 10,000 AT ANSI B SIZE

-100m 0m 200m 400m 600m

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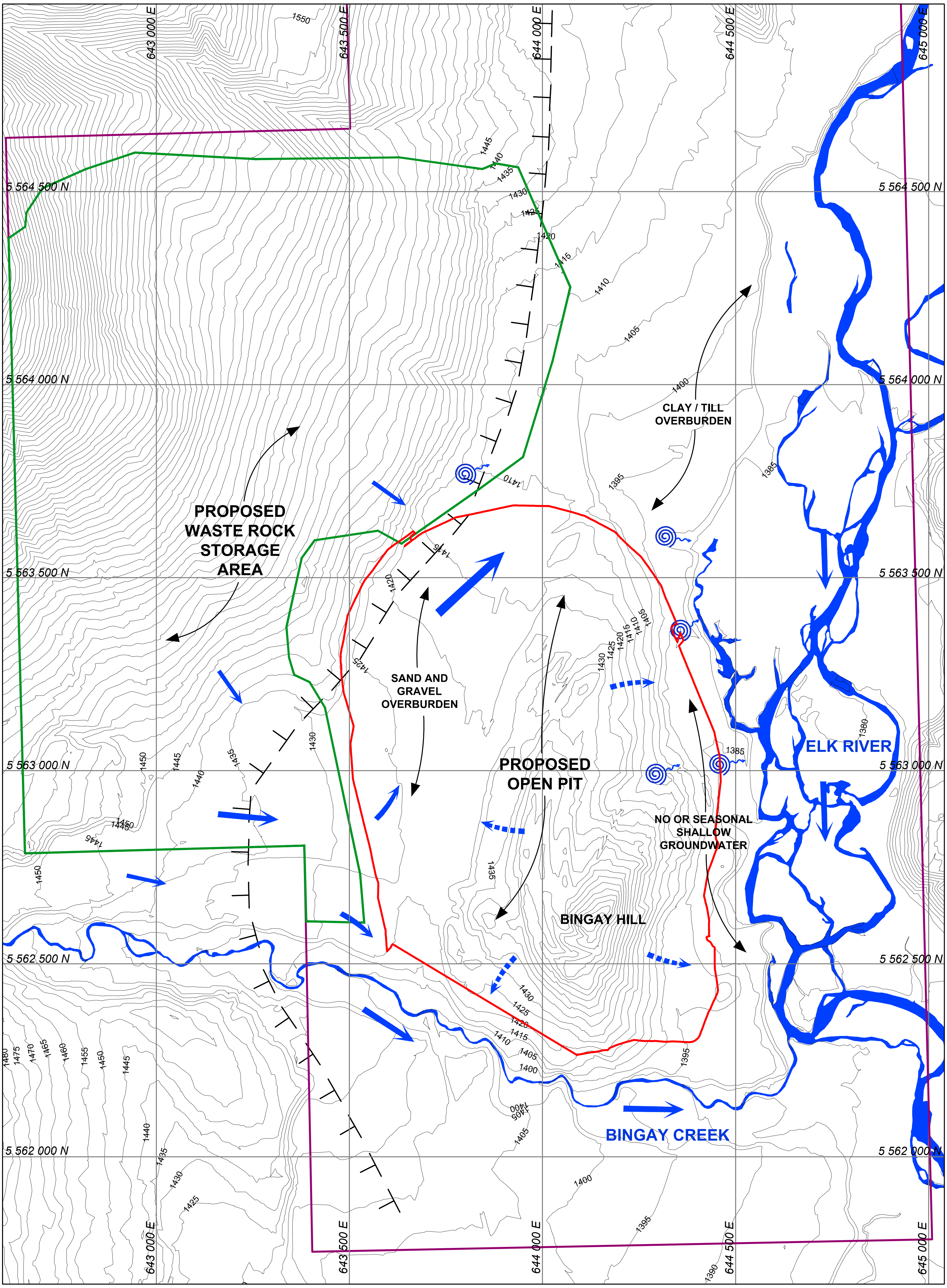


LEGEND

- PROPOSED PIT LIMIT
- PROPOSED WASTE STOCKPILE AREA
- BINGAY PROPERTY BOUNDARY
- BOURGEAU FAULT (APROXIMATE TRACE)
- GROUNDWATER FLOW
- SEASONAL GROUNDWATER FLOW
- ARTESIAN SPRING / BEDROCK GROUNDWATER SEEPAGE

CLIENT
CENTERMOUNT COAL

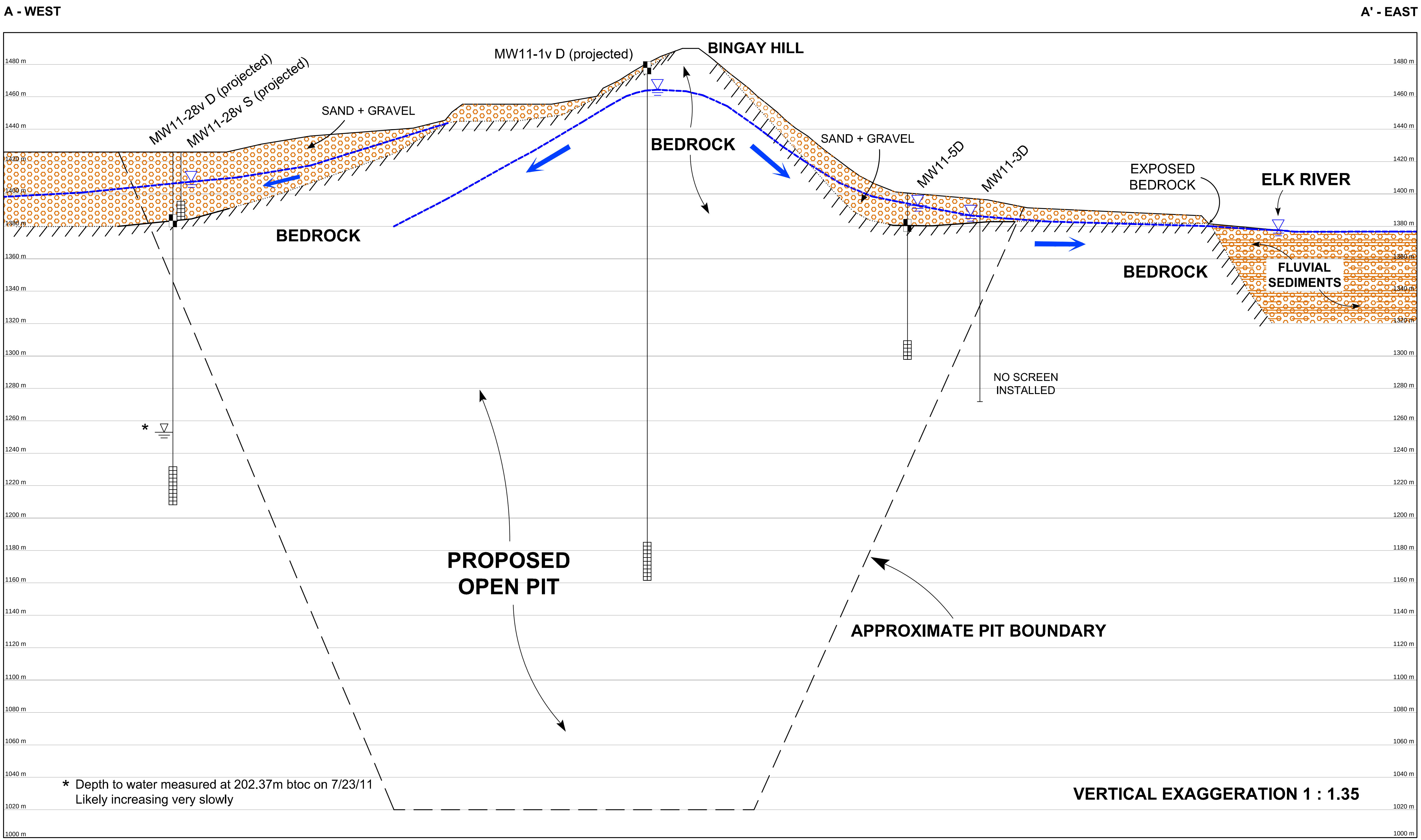
PROJECT
BINGAY CREEK

TITLE
FIGURE 4

CONCEPTUAL GROUNDWATER FLOW DIRECTIONS

SCALE
SCALE 1 : 10,000 AT ANSI B SIZE
-100m 0m 200m 400m 600m

WATTERSON GEOSCIENCE INC



LEGEND

Geological Contact, solid where known, dotted where inferred	Sand + Gravel, with Silt	MW11-3D	Groundwater Monitoring Well
Groundwater Flow Direction	Clay / Till		Well Screen
Groundwater Elevation measured 7/23/2011	Bedrock		Bentonite Seal

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CLIENT: CENTERMOUNT COAL

PROJECT: *BINGAY CREEK*

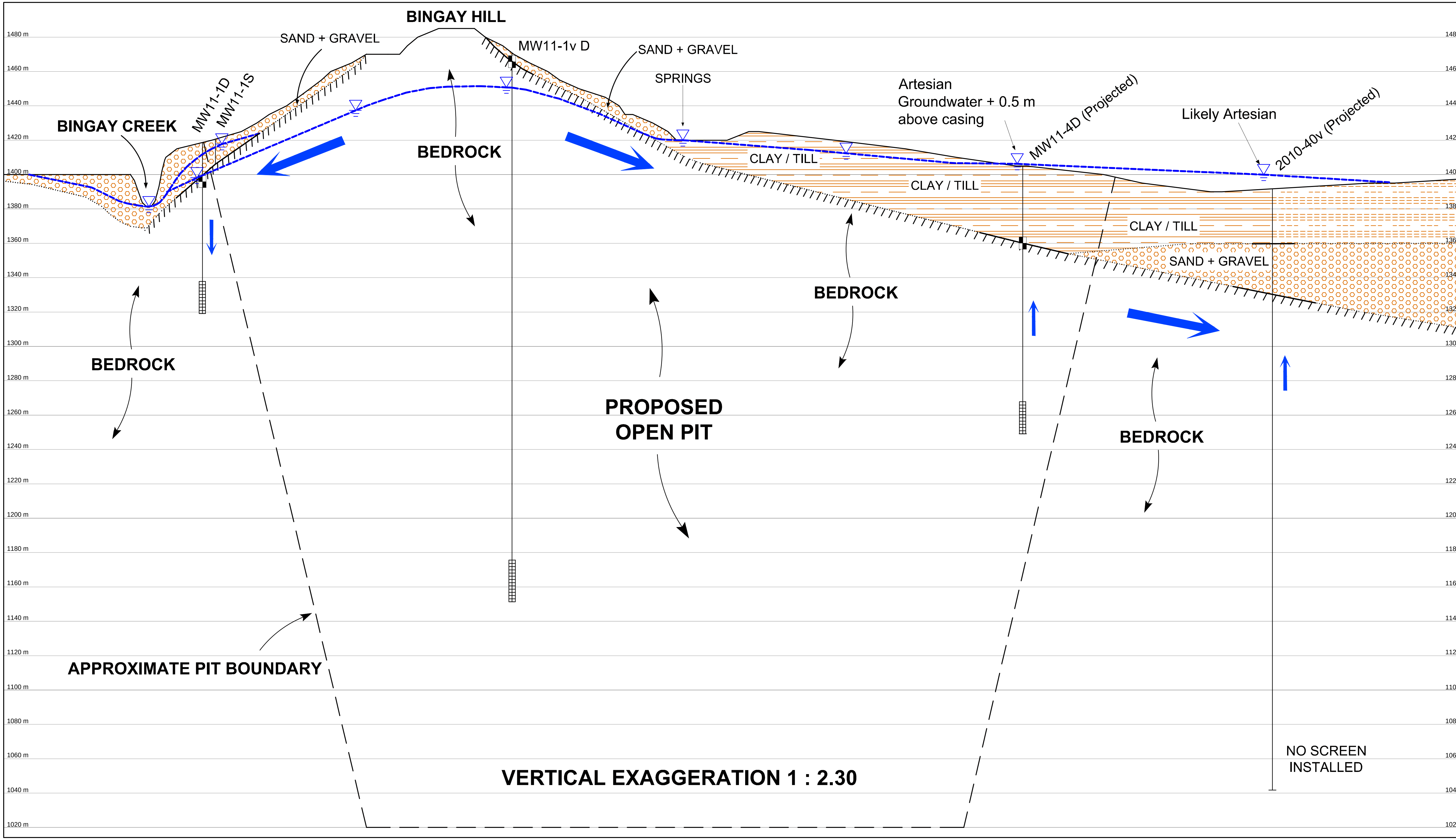
SCALE: 1 : 1.35 VERTICAL EXAGGERATION — HORIZONTAL SCALE 1 : 3000 - ANSI B (-30m, 0m, 30m, 60m, 90m)

TITLE: **FIGURE 5**

SCHEMATIC WEST-EAST HYDROGEOLOGICAL CROSS-SECTION A - A`

B - SOUTH

B' - NORTH



LEGEND

	Geological Contact, solid where known, dotted where inferred		Sand + Gravel, with Silt	MW11-1D	Groundwater Monitoring Well
	Groundwater Flow Direction		Clay / Till		Well Screen
	Groundwater Elevation measured 7/23/2011		Bedrock		Bentonite Seal

W A T T E R S O N   G E O S C I E N C E   I N C

CLIENT: CENTERMOUNT COAL

PROJECT: BINGAY CREEK

SCALE: 1 : 2.30 VERTICAL EXAGGERATION — HORIZONTAL SCALE 1 : 5000 - ANSI B (-50m, 0m, 50m, 100m, 150m)

TITLE: FIGURE 6

SCHEMATIC SOUTH-NORTH HYDROGEOLOGICAL CROSS-SECTION B - B`

Tables

Table 1: BINGAY WELL CONSTRUCTION AND TEST SUMMARY DATA							
Well	MW11-1D	MW11-4D	MW11-5D	MW11-43vS	MW11-28vS	MW11-v28D	MW11-1vD
Test Type	24-hour	24-hour	24-hour	8-hour[b]	24-hour	Falling Head[a]	3-hr test
Lithology	BR	BR	BR	BR/OB	OB	BR	BR
Well Depth	101.8	151.2	102.4	70.1	38.71	217	270
Casing Stickup	0.32	0.46	0.36	0.3	0.46	0.1	0.05
Ground Elevation	1419	1390	1398	1424.47	1420.21	1420.21	1452.3
Casing Length (m)	18.3	18.3	12.2	12.2	12.2	24.4	24.4
Transducer Depth (m btoc)	97	144	70	63	34.4	217	NA
Beginning Static Water Level (m btoc)	12.09	2.5	8.06	26.18	20.7	202.37	9.14
Step Test	7/7/2011	7/12/2011	7/14/2011	7/17/2011	7/19/2011	NA	NA
Step-Test Flow Rates (US gpm)	2.8, 5.6, 7.4	1.1, 2.0, 3.0, 3.9	1.2, 0.9, 1.7, 2.3	1.5, 3.0, 1.15	2.75, 7.5, 14.14	NA	NA
Test Start	7/8/2011	7/12/2011	7/15/2011	7/18/2011	7/20/2011	7/22/2011	7/14/2011
Test Flow Rates US gpm	5.0, 2.0, 2.5	2.5, 1.0	1.7, 2.0	1.5, 1.0, 0.76	32.2	NA	30
Test Finish	7/9/2011	7/13/2011	7/16/2011	7/18/2011[b]	7/21/2011	7/23/2011	7/15/2011
Max Drawdown (m)	42.31	130.33	80.84	36.95	0.785	NA	50.86

Notes

a - Falling head test performed on this well - approximately 32 US gpm pumped for 3 minutes

b- Test ended after 8 hours due to well plugging

All well diameters 6-inch

Casing lengths as noted on geological logs

NA - Not Applicable

Table 2: Groundwater Elevations

		Ground Elevation (Est) (m amsl[1])	Casing Height (m)	Date	Depth to Water (m btoc[2])	Groundwater Elevation (m amsl)	Comments
Monitoring Wells	**Well Type**						
MW11-1S	OB[3]	1419	0.34	7/23/2011	5.30	1413.36	
MW11-1D	BR[4]	1419	0.32	7/23/2011	13.23	1405.46	
MW11-28vS	OB	1420.21	0.46	7/23/2011	20.87	1398.88	
MW11-43vS	OB/BR	1424.47	0.3	7/23/2011	24.45	1399.72	Possible combined overburden and bedrock elevations
MW11-2D	BR	1400	0.81	7/23/2011	24.14	1375.05	
MW11-3D	BR	1390	1.28	7/23/2011	2.39	1386.33	
MW11-4D	BR	1388.1	0.47	7/23/2011	+0.4	1388.03	Artesian
MW11-5D	BR	1398	0.35	7/23/2011	6.79	1390.86	
MW11-1vD	BR	1452.3	0.05	7/23/2011	10.20	1442.05	
MW11-28vD	BR	1420.21	0.1	7/23/2011	176.43	1243.68	Likely not stabilized - actual elevation higher
2010-24v	BR/OB	1414.32	0.05	6/29/2011	10.57	1403.70	Possible combined overburden and bedrock elevations
Groundwater Seeps/Springs							
NE Spring		1417	NA	7/8/2011		1417	Artesian
NW Spring		1395	NA	7/8/2011		1395	Artesian
2005-7v		1402.5	0.15	7/23/2011		1402.5	Artesian
2005-15a		1388.95		7/23/2011		1388.95	Artesian

Notes

1 - meters above mean sea level

2- below top of casing

3 - Overburden

4 - Bedrock

Table 3: Bingay Hydraulic Testing Results Summary

Well ID	Well Type	Transmissivity (m^2/day)		Aquifer Thickness (m)	Est. Hydraulic Cond[1] (m/day)	
		Cooper Jacob Drawdown	Theis Recovery		Based on Cooper Jacob	Based on Theis Recovery
MW11-1D	Bedrock	0.49	0.36	87.38	5.61E-03	4.12E-03
MW11-4D	Bedrock	0.0069	0.05	148.68	4.64E-05	3.36E-04
MW11-5D	Bedrock	0.0048	0.03	91.6	5.24E-05	3.28E-04
MW11-1vD	Bedrock	1.15	1.2	260.86	4.41E-03	4.60E-03
MW11-43vS[2]	BR/OB	0.029	0.013	41.74	6.95E-04	3.11E-04
MW11-28vS	Overburden	230	495	17.95	1.28E+01	2.76E+01
MW11-v28D[3]	Bedrock	No Water Infiltration				
MW11-2D[4]	Bedrock				Approximately 7.5 E-03	
Published[5]	Bedrock				1 E-08 (shale) to 1 E+01 (sandstone)	
Published[5]	Overburden				15 E-01 (silty sand) to 1E+02 (sand)	

1 – Based on K = T/b, where K is conductivity, T is aquifer transmissivity, and b is aquifer thickness

2 – Initial 8 hours of test data used to estimate Transmissivity, values possibly invalid due to aquifer/screen plugging

3 – Attempted falling head instantaneous response (slug) test in this well - No test data due to no water level decline

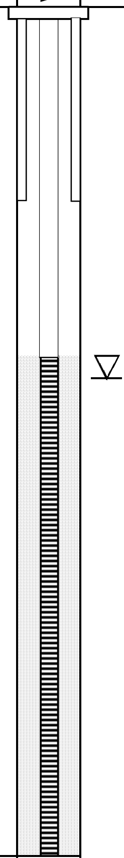
4 – Estimated from water inflow into well after drilling

5 – Fetter,C.W. Applied Hydrogeology, 3rd Ed. Prentice Hall 1994.

Appendix A – Geologic Logs and Well Construction Diagrams

Project: Bingay Coal	Location: Refer to site plan	Borehole Number: MW11-1S
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: +/- 1419 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Well Design	Comments
					Well Monument 6-in Steel Casing Stickup 0.5 m
0	0	SM	Gravelly sandy silt, damp, loose		Well Cap
					Native Cuttings Backfill
			Alternating silt / sand / gravel layers		4.5in ID Sch 20 PVC Casing
					6-inch surface casing set at 2.5 m
10	3.0				Hydrated Bentonite Chips
					Groundwater at 4.54 m (7-1-11) GW @ 5.22 m 7-15-11
					Airlift approximately 2 USGPM
20	6.1				10-20 Silica Sand Filter Pack
			Increasing gravel with depth		6.1m 4.5in ID Sch 20 PVC Screen 0.010-in Slot
30	9.1		Weathered Bedrock 9.75 m		PVC End Cap
			Hole Total Depth 10.36 m		
40	12.2				



Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 30.6 m
	Reviewed by: DW	Completed: July 1, 2011
	Figure A1	Page: 1 of 1

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-1D**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: +/- 1419 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Well Design	Comments Well Monument 6-in Steel Casing Stickup 0.3 m
0	0				Well Cap
			Silty sandy gravel, dense, damp (TILL)		
		GM			No Groundwater observ ed
20	6.1				Native cuttings backfill
	7.62		Sand and Gravel		
		GP			6-inch surface casing to 16.46 m
	11.6				
40	12.2	BR	Mudstone and siltstone, dark brown, soft		
			Thin coal layers		
					Hydrated Bentonite Chips 17.37 to 14.02 m
					Packer set at 17.37 m
60	18.3				GW at 17.7 m below ground surface (6-30-11)
			As above		
80	24.4		As above		
					Native cuttings backfill
100	30.5		As above		
120	36.6				
		BR	Siltstone / shale, dark gray to black		
140	42.7		As above		
					Native cuttings backfill
					Groundwater Inflow @ 45.72 m + / - 2 US gpm
160	48.8		As above		
174	53.04				Harder Drilling
		BR	Sandstone, gray, hard		GW flow increased to approximately 4 US gpm
					18.28 m 4.5in ID Sch 20 PVC Screen
					set from 101.80 to 83.52 m bgs
334	101.8	BR	Hole Total Depth		0.010-in Slot
					PVC End Cap

Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 101.80m
	Reviewed by: DW	Completed: June 27, 2011
	Figure A2	Page: 1 of 1

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-1vD**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: NA	Elevation: 1452.3 m amsl

Depth (m)	Description		Well Design	Comments
				Well Monument 6-in Steel Casing Stickup 0.05 m
0	0 to 1.8 TILL, 1.8 to 3.4 Mudstone, 3.4 to 4.0 Coal, 4.0 to 5.6 Mudstone			Well Cap
	5.6			Hydrated Bentonite Chips 0 to 6.2 m
10		Siltstone		Packer set at 6.2 m
				6-inch steel casing set at 3 m
20				
30				GW at 10.16 m below ground surface (7-15-11)
40				
50				
60				
				Fracture at 68.5 m
70	68.4	Sandstone		
				Native Cuttings Backfill
80				
90	90.8	Coal		4.5 in ID Sch 20 PVC Casing
100				
110				
120				
130	128.7	Interbedded coal, shale and sandstone		
140				
	144.7	Sandstone, hard		
150				
				Possible fracture zone
160				
170				
180				
190				
200				Native Cuttings Backfill
	203	Sandstone with thin coal, shale,		
210		siltstone layers		
220				24.38m 4.5in ID Sch 20 PVC Screen
				set from 258 m to 270 m bgs
230				0.010-in Slot
				PVC End Cap
240	241	Coal,, No. 10 Seam		
250				Note: Hole originally drilled in 2004 to 320 m, reentered
	253	Coal and shale		and reconstructed as piezometer in 2011
260				
	262	Shale and siltstone		
270		Hole Total Depth 270 m		

Watterson Geoscience Inc.	Logged by: Hillsborough	Completion Depth: 270.1 m
	Reviewed by: DW	Completed: July 14, 2011
	Figure A8	Page: 1 of 1

Project: Bingay Coal | Location: Refer to site plan | **Borehole Number: MW11-2D**

Client: Centermount Ltd. | Driller: JR Drilling Ltd. | Project No. 11-007

Project Engineer: DW | Drill Method: Air Rotary | Elevation: +/- 1400 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Comments
				Well Monument 6-in Steel Casing Stickup 0.81 m
0	0			Well Cap
			Silty sandy gravel, dense, v sli damp	
		GM		No Groundwater observed
5	1.5			
			Increased sand and gravel	
10	3.0			
			Decreasing moisture with depth	6-inch surface casing to 7.92 m
15	4.6		Increased silt, gravel with depth	
20	6.1			
25	7.6			
				Hard drilling
		BR	Sandstone, gray, hard, dry	No water produced during drilling
				No Well Installed
30	9.1			Native cuttings backfill
				GW at 25.72 m below ground surface (7-7-11)
360	109.7		Hole Total Depth	

Watterson Geoscience Inc.

Logged by: WGI | Completion Depth: 109.70 m

Reviewed by: DW | Completed: June 27, 2011

Figure A3 | Page: 1 of 1

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-3D**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: +/- 1390 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Well Design	Comments
					Well Monument 6-in Steel Casing Stickup 1.28 m
0	0				Well Cap
			Sand and Gravel, loose		No Groundwater
		SW			
					6-in Steel Surface Casing set to 10.97m
20	6.1		Gray mudstone		
	6.7		Coal 6.1m - 6.7m		GW at 6.7 m below ground surface (7-7-11)
		BR	Gray mudstone		
40	12.2				Soft drilling
60	18.3		As above		
80	24.4				
100	30.5				
			Possible coal seam 31.1m to 32.92m		Slough / cavings recovered to 28.04 m on July 7, 2011
			Possible coal seam 35.05		
120	36.6				
128	39.01				
			Coal		
140	42.7				
150 - 153	45.72 - 46.33		Mudstone, brown, soft		
			Coal and shaly coal layers		

Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 30.6 m
	Reviewed by: DW	Completed: July 6, 2011
	Figure A4	Page: 1 of 3

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-3D**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: +/- 1390 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Well Design	Comments Well Monument 6-in Steel Casing Stickup 1.28 m
160	48.8				
			Coaly shale and mudstone		Harder Drilling
180	54.9				V. Slight GW Inflow < 0.5 US gpm
			Decreasing coal content		damp cuttings
					No water produced when adding drill rods
195	59.44	BR	Gray sandstone, mod hard		
200	61.0				
					GW @ 62.48 m 0 to 10 US gpm
			As above with thin coal seams		
220	67.1				Very poor sample - abundant slough
			Increased coal content		
			As above		Possible slight increase in GW flow
240	73.2				
					Very poor sample - abundant coal slough
260	79.2		As above		GW flow 5 to 10 US gpm
			Increased coal content		Very poor sample - abundant slough
280	85.3				
					Very poor sample - abundant coal slough
			Mostly coal with gray sandstone		
300	91.4				
305	93.0				
			As above - mostly coal		
320	97.5				

Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 30.6 m
	Reviewed by: DW	Completed: July 6, 2011
	Figure A4	Page: 2 of 3

Project: Bingay Coal	Location: Refer to site plan	Borehole Number: MW11-3D
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: +/- 1390 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Well Design	Comments Well Monument 6-in Steel Casing Stickup 1.28 m
340	103.6		Sandstone with possible mudstone		Softer Drilling
360	109.7		Larger coal fragments - 1 to 2"		Increased coal sloughing
			As above		No Well Installed
380	115.8				Hole abandoned due to excessive coal slough
385	117.3		Hole Total Depth		100' Drill Pipe left in hole

Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 30.6 m
	Reviewed by: DW	Completed: July 6, 2011
	Figure A4	Page: 3 of 3

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-4D**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: +/- 1390 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Well Design	Comments
					Well Monument 6-in Steel Casing Stickup 0.46 m
0	0		Silty gravelly sand, damp, loose		Well Cap
					GW at 1.67 m below ground surface (7-17-11)
			Increasing silt, fine gravel		No Groundwater during drilling
20	6.1				
			Gravelly sandy silt, damp, hard		
			Possibly glacial till		Native cuttings backfill
					4.5in ID Sch 20 PVC Casing
40	12.2				
			Increasing silt with depth		
					Dry during drilling
57	17.37				
60	18.3		Sandy clay, soft to firm, damp		
70	21.33				
			Coal		
80	24.4				
		BR	Sandstone and mudstone, gray and brown		6-in Steel Surface Casing set to 24.69 m
			Common coal and mudstone layers		
100	30.5				
			Increased coal with depth		
			Grading to coaly shale / shaly coal		Fast drilling
118	35.97				
120	36.6		Coal with coaly mudstone layers		Dry
140	42.7				
			Shaly coal grading to mudstone		
					Native cuttings backfill
160	48.8				
173	52.73				
			Shale / mudstone, brown and gray		Dry
180	54.9				Slower drilling
195	59.44				
		BR	Shale, dark gray, harder		
200	61.0				

Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 151.2 m
	Reviewed by: DW	Completed: July 7, 2011
	Figure A5	Page: 1 of 3

Project: **Bingay Coal**	Location: Refer to site plan	**Borehole Number: MW11-4D**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: +/- 1390 m amsl

220	67.1		As above	Dry
240	73.2		As above	Inject water to help clean out cuttings +/- 2 US gpm
248	75.6			
			Coal	
258	78.6			
260	79.2	BR	Mudstone, brown	Native cuttings backfill
275	83.8			
280	85.3		Coal	
290	88.4			
		BR	Sandstone, gray, hard	Slow drilling
300	91.4			No water
320	97.5		As above	No water
340	103.6		As above	No water
				Native cuttings backfill
360	109.7		As above	No water
380	115.8		As above	No water
400	121.9		As above	No water
420	128.0			
				Native cuttings backfill
436	132.9			
			Possible coal	Fast drilling
440	134.1			
			Shale / mudstone, black, soft	

Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 151.2 m
	Reviewed by: DW	Completed: July 7, 2011
	Figure A5	Page: 2 of 3

Project: **Bingay Coal**	Location: Refer to site plan	**Borehole Number: MW11-4D**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: +/- 1390 m amsl

460	140.2		As above		No water produced
					18.3 m 4.5in ID Sch 20 PVC Screen
					.
480	146.3		As above		Native cuttings backfill
496	151.2				PVC End Cap
500	152.4		Hole Depth		

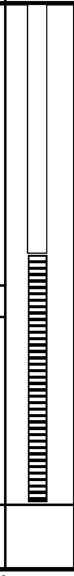
Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 151.2 m
	Reviewed by: DW	Completed: July 7, 2011
	Figure A5	Page: 3 of 3

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-5D**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: NA	Elevation: +/- 1398 m amsl

Depth (m)	Description	Well Design	Comments Well Monument 6-in Steel Casing Stickup 0.36 m
0	Sand and Gravel		Well Cap
			GW at 8.06 m below ground surface (7-13-11)
10			
13.1	Till / Clay		
17.98	Bedrock		6-inch steel casing set at 23.16 m
20			Hydrated Bentonite Chips 26 to 21 m
24.38	Coal		Packer set at 26 m
30	Bedrock 30.4 to 32.0 m Coal 32.0 to 35.05 m		Native Cuttings Backfill
35.05	Bedrock		4.5 in ID Sch 20 PVC Casing
40			
42.6	Coal		
45.7	Bedrock - Shale		
50			
51.8	Coal		
53.34	Bedrock		Water at 56.34 m
57.92	Coal 57.92 to 58.52 m		
60	Bedrock		Native Cuttings Backfill
70			

Watterson Geoscience Inc.	Logged by: JR	Completion Depth: 102.4 m
	Reviewed by: DW	Completed: July 10, 2011
	Figure A6	Page: 1 of 1

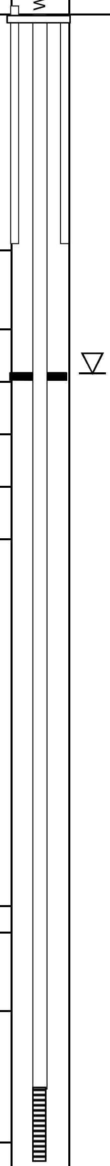
Project: Bingay Coal	Location: Refer to site plan	Borehole Number: MW11-5D
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: NA	Elevation: +/- 1398 m amsl



Depth	Description	Notes
80		
90		
90.83	Coal	
93.27	Bedrock	12.2 m 4.5in ID Sch 20 PVC Screen set from 102.4 m to 90.2 m bgs 0.010-in Slot
100		
102.41		2 gpm at 102.4 m
	Hole Total Depth	PVC End Cap

Watterson Geoscience Inc.	Logged by: JR	Completion Depth: 102.4 m
	Reviewed by: DW	Completed: July 10, 2011
	Figure A6	Page: 1 of 1

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-1vD**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: NA	Elevation: 1452.3 m amsl



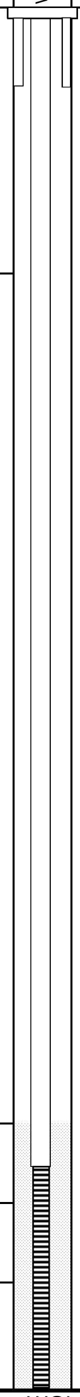
Depth (m)	Description		Well Design	Comments: Well Monument 6-in Steel Casing, Stickup 0.1 m
0		Sand and Gravel		Well Cap
10				Native Cuttings Backfill
20				
30				GW at 17.7 m below ground surface (6-30-11)
40				6-inch steel casing set to 43 m
	46	Mudstone		
50				
60	58	Siltstone		Hydrated Bentonite Chips 67 to 55 m Packer set at 67 m
70	67	Mudstone		
				Native Cuttings Backfill
80	79	Siltstone and mudstone		
90	88	Mudstone		4.5 in ID Sch 20 PVC Casing
100	98	Siltstone		
110				
120				Native Cuttings Backfill
130				
140				
150				
160				
170	168-174	Mudstone		
		Siltstone		Note: Hole originally drilled in 2004 to 401 m, caved to 217 m, and reconstructed as piezometer in 2011
180				
190	189	Mudstone		
200				24.4 m 4.5 in ID Sch 20 PVC Screen set from 217 m to 205 m bgs 0.010-in Slot
210				PVC End Cap
	216	Siltstone		
220		Hole Total Depth 217 m		

Watterson Geoscience Inc.	Logged by: Hillsborough	Completion Depth: 217 m
	Reviewed by: DW	Completed: July 14, 2011
	Figure A7	Page: 1 of 1

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-28vS**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: 1420.21 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Comments: Well Monument 6-in Steel Casing Stickup 0.46 m
0	0		Silty gravelly sand, loose dry to slightly damp	Well Cap
		SM		6-inch Steel casing set at 1.2m Native Cuttings Backfill
10	3.048			
		GM	Silty gravel with large cobbles, dry	
20	6.096			4.5 in ID Sch 20 PVC Casing
		SM	Silty gravelly sand, dry to very slightly damp, loose	
30	9.144		As above	
40	12.19		As above	
50	15.24	SM	Increasing cobbles	
				Native Cuttings Backfill
60	18.29		As above	
				▽ Groundwater at 20.70 m (7-19-11)
70	21.34	SM	As above	
				Groundwater encountered during drilling at 22.55 m (7-8-11)
80	24.38			
				Hydrated Bentonite Chips
85	25.91			
		SP	Sand, medium, loose	
90	27.43			10-20 Silica Sand Filter Pack
		SM	Sandy silt with gravel	
95	28.96			
		CL	Clay and clayey gravel	12.2m 4.5in ID Sch 20 PVC Screen
100	30.48			0.010-in Slot

Well Design



Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 38.71 m
	Reviewed by: DW	Completed: July 8, 2011
	Figure A7	Page: 1 of 1

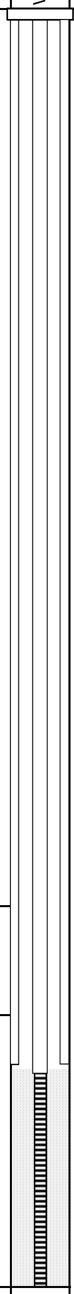
Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-28vS**
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: 1420.21 m amsl

Project: Bingay Coal	Location: Refer to site plan	Borehole Number: MW11-28vS
Client: Centermount Ltd.	Driller: JR Drilling Ltd.	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: 1420.21 m amsl

110	33.53			
116	35.36			
		SM	Sand, medium, loose	
120	36.58			
		GM	Gravelly sandy silt, dense (glacial till)	
127	38.71			
		BR	Bedrock	PVC End Cap
130	39.62		Hole Total Depth	

Watterson Geoscience Inc.	Logged by: WGI	Completion Depth: 38.71 m
	Reviewed by: DW	Completed: July 8, 2011
	Figure A7	Page: 1 of 1

Project: Bingay Coal	Location: Refer to site plan	**Borehole Number: MW11-43vS**
Client: Centermount Ltd.	Driller: NA	Project No. 11-007
Project Engineer: DW	Drill Method: Air Rotary	Elevation: 1424.47 m amsl

Depth (ft)	Depth (m)	USC Symbol	Soil Description	Well Design	Comments Well Monument 6-in Steel Casing Stickup 0.3 m
0	0	GP	Gravel, mix of sandstone, siltstone mudstone fragments		Well Cap Native Cuttings Backfill ▽ Groundwater at 23.4 m (7-1-11)
20	6.096				
40	12.19		As above		
60	18.29				
80	24.38				
100	30.48		As above		4.5in ID Sch 20 PVC Casing
120	36.58				Native Cuttings Backfill
140	42.67		As above		
160	48.77				
		BR	Sandstone, dark gray		PVC End Cap
180	54.86				
		BR	Siltstone, dark gray		6-inch steel casing set at 57.91 m Hydrated bentonite chips
200	60.96				10-20 Silica Sand Filter Pack
					12.2m 4.5in ID Sch 20 PVC Screen 0.010-in Slot
220	67.06				Note: Hole originally drilled in 2004 to 150 m, reentered and reconstructed as piezometer in 2011
230	70.1				
			Hole Total Depth		
240	73.15				

Watterson Geoscience Inc.	Logged by: Hillsborough	Completion Depth: 70.1 m
	Reviewed by: DW	Completed: July 14, 2011
	Figure A9	Page: 1 of 1

Appendix B – Aquifer Testing and Analysis Data

Watterson Geoscience Inc.	Bingay Mine Project	24-Hour Test	Project 11-007

Well ID:	**MW11-1D**
Well Depth:	101.8 m
Casing Stickup:	0.32 m
Ground Elevation:	1419 m above sea level
Lithology:	Bedrock
First Water-Bearing Fracture:	45.7 m below ground surface (+/- 2 Usgpm)
Maximum Safe Water Level:	36 m
Static Water Level Before 24-Hour Test:	14.95 m-toc
Transducer Depth:	97 m-toc
Tested By:	Watterson Geoscience Inc. & Thompson Drilling Ltd.
Start Date 7/8/2017	End Date 7/9/2011

Date and Time	Elapsed Time Since Pumping Started	Elapsed Time Since Pumping Stopped	t/t'	MW11-1D (Pumping Well)		MW11-1S (Observation Well)		Pumping Rate		Totalizing Flow Meter	Remarks
				Depth to Water	Drawdown	Depth to Water	Drawdown				
	(minutes)	(minutes)		(m-btoc)	(m)	(m-btoc)	(m)	(US gpm)	(L/sec)	(US gal)	
08-Jul-11 10:00 AM	0			14.402	0.000	4.814	0.000	5.40	0.34		Start pumping.
08-Jul-11 10:01 AM	1			16.404	2.002			5.38	0.34		
08-Jul-11 10:02 AM	2			17.629	3.227	4.813	-0.001				
08-Jul-11 10:03 AM	3			18.661	4.259			5.32	0.34		
08-Jul-11 10:04 AM	4			19.507	5.105					22.76	
08-Jul-11 10:05 AM	5			20.294	5.892	4.811	-0.003				
08-Jul-11 10:06 AM	6			20.949	6.547			5.13	0.32		
08-Jul-11 10:07 AM	7			21.548	7.146					38.51	
08-Jul-11 10:08 AM	8			22.089	7.687						
08-Jul-11 10:09 AM	9			22.617	8.215	4.809	-0.005				
08-Jul-11 10:10 AM	10			23.115	8.713	5.100	0.286				
08-Jul-11 10:12 AM	12			23.998	9.596			5.08	0.32		
08-Jul-11 10:14 AM	14			24.776	10.374	4.800	-0.014				
08-Jul-11 10:16 AM	16			25.437	11.035			5.07	0.32		
08-Jul-11 10:18 AM	18			26.506	12.104			5.06	0.32		
08-Jul-11 10:20 AM	20			26.601	12.199	4.793	-0.021	5.05	0.32	105.38	
08-Jul-11 10:25 AM	25			27.787	13.385	4.789	-0.025	5.04	0.32	130.70	
08-Jul-11 10:30 AM	30			28.745	14.343	4.785	-0.029	5.03	0.32	155.70	
08-Jul-11 10:35 AM	35			29.624	15.222	4.781	-0.033	5.00	0.32	181.00	
08-Jul-11 10:42 AM	42			30.693	16.291	4.774	-0.040	5.00	0.32	216.01	
08-Jul-11 10:45 AM	45			31.087	16.685	4.774	-0.040	5.00	0.32	231.36	
08-Jul-11 10:50 AM	50			31.712	17.310	4.769	-0.045	4.99	0.31	256.38	
08-Jul-11 10:55 AM	55			32.288	17.886	4.769	-0.045	4.99	0.31	281.28	
08-Jul-11 11:10 AM	70			33.676	19.274	4.755	-0.059	4.98	0.31	356.85	
08-Jul-11 11:25 AM	85			34.784	20.382	4.747	-0.067	4.97	0.31	433.52	
08-Jul-11 11:30 AM	90			35.097	20.695	4.740	-0.074	4.96	0.31	455.64	
08-Jul-11 12:00 PM	120			36.535	22.133	4.730	-0.084	4.94	0.31	604.69	
08-Jul-11 12:20 PM	140			37.443	23.041	4.721	-0.093	4.93	0.31	702.64	
08-Jul-11 12:40 PM	160			38.213	23.811	4.713	-0.101	4.92	0.31	802.16	
08-Jul-11 01:00 PM	180			38.853	24.451	4.705	-0.109	4.91	0.31	901.22	
08-Jul-11 01:30 PM	210			39.689	25.287	4.697	-0.117	4.91	0.31	1049.11	
08-Jul-11 02:06 PM	246			40.550	26.148	4.684	-0.130	4.89	0.31	1223.52	
08-Jul-11 02:35 PM	275			41.108	26.706	4.680	-0.134	4.89	0.31	1366.32	
08-Jul-11 03:00 PM	300			41.541	27.139	4.677	-0.137	4.88	0.31	1488.31	
08-Jul-11 03:30 PM	330			42.016	27.614	4.674	-0.140	4.88	0.31	1636.00	
08-Jul-11 04:08 PM	368			42.611	28.209	4.677	-0.137	4.87	0.31	1825.66	
08-Jul-11 04:30 PM	390			43.548	29.146	4.672	-0.142	5.13	0.32	1933.41	
08-Jul-11 05:00 PM	420			44.294	29.892	4.672	-0.142	5.12	0.32	2086.89	
08-Jul-11 05:30 PM	450			44.830	30.428	4.671	-0.143	5.11	0.32	2241.83	
08-Jul-11 06:00 PM	480			45.395	30.993	4.675	-0.139	5.10	0.32	2405.79	
08-Jul-11 07:00 PM	540			45.915	31.513	4.680	-0.134	5.08	0.32	2700.22	
08-Jul-11 08:02 PM	602			51.315	36.913	4.685	-0.129	5.03	0.32	3014.13	
08-Jul-11 08:15 PM	615			52.675	38.273						
08-Jul-11 08:20 PM	620			53.217	38.815			5.02	0.32	3103.60	
08-Jul-11 08:25 PM	625			53.807	39.405						

Watterson Geoscience Inc. **Bingay Mine Project** **24-Hour Test** **Project 11-007**

Well ID: **MW11-1D**
Well Depth: 101.8 m
Casing Stickup: 0.32 m
Ground Elevation: 1419 m above sea level
Lithology: Bedrock
First Water-Bearing Fracture: 45.7 m below ground surface (+/- 2 Usgpm)
Maximum Safe Water Level: 36 m
Static Water Level Before 24-Hour Test: 14.95 m-toc
Transducer Depth: 97 m-toc
Tested By: Watterson Geoscience Inc. & Thompson Drilling Ltd.

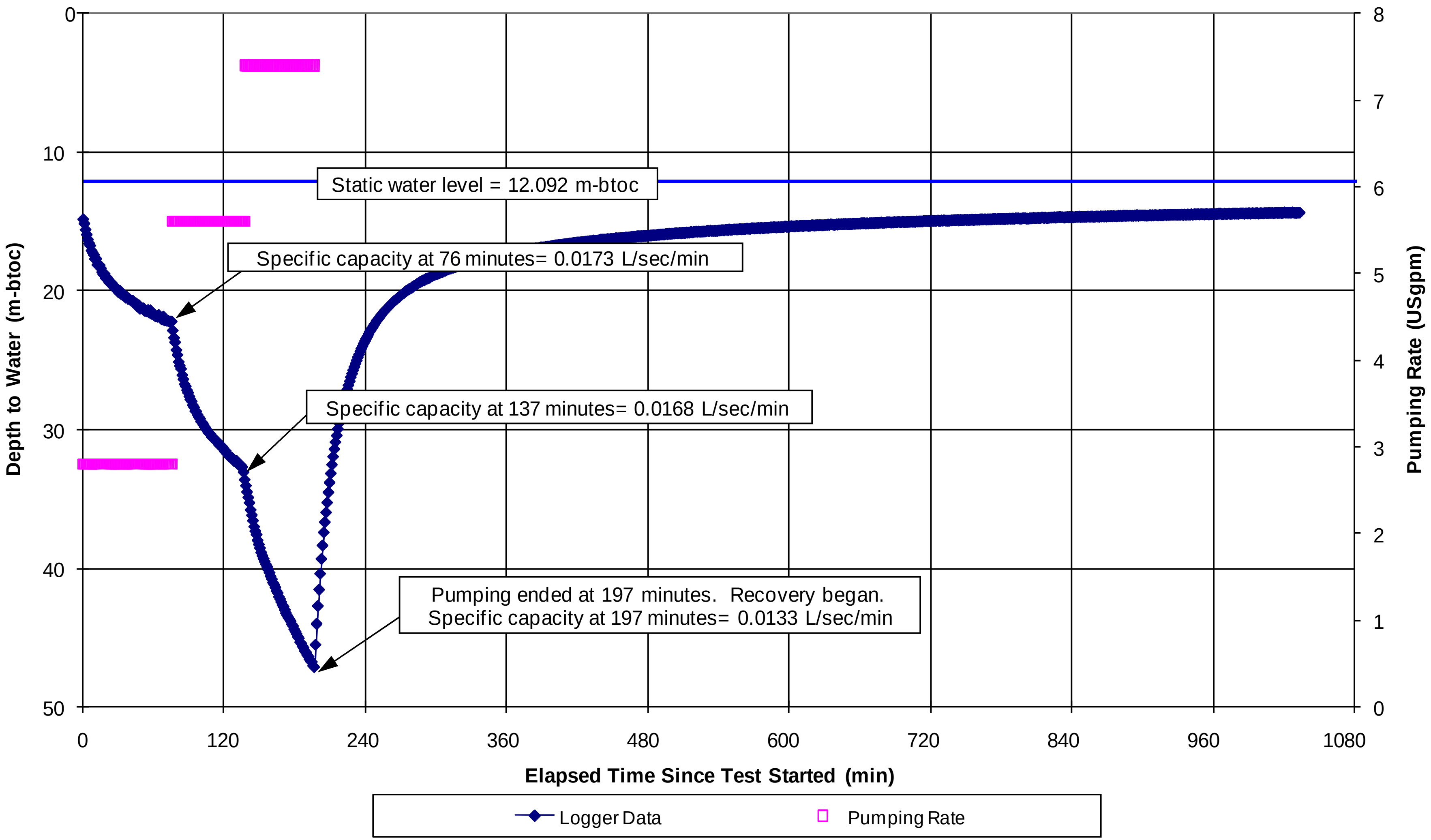
08-Jul-11 08:30 PM	630			54.396	39.994			5.00	0.32	3153.85	
08-Jul-11 08:33 PM	633							2.03	0.13		
08-Jul-11 08:34 PM	634			54.079	39.677	4.690	-0.124	2.02	0.13	3170.38	
08-Jul-11 08:36 PM	636			52.623	38.221			2.02	0.13		
08-Jul-11 08:38 PM	638			51.262	36.860			2.02	0.13		
08-Jul-11 08:40 PM	640			49.021	34.619						
08-Jul-11 08:42 PM	642			48.621	34.219			2.03	0.13	3186.28	
08-Jul-11 08:44 PM	644			47.374	32.972						
08-Jul-11 08:46 PM	646			46.157	31.755						
08-Jul-11 08:48 PM	648			45.010	30.608						
08-Jul-11 08:50 PM	650			43.974	29.572						
08-Jul-11 08:55 PM	655			41.878	27.476	4.696	-0.118	2.04	0.13	3213.36	
08-Jul-11 09:00 PM	660			40.355	25.953			2.05	0.13		
08-Jul-11 09:05 PM	665			39.255	24.853						
08-Jul-11 09:10 PM	670			38.363	23.961						
08-Jul-11 09:20 PM	680			37.133	22.731	4.710	-0.104	2.04	0.13	3263.80	
08-Jul-11 09:30 PM	690			36.315	21.913	4.716	-0.098	2.04	0.13	3284.35	
08-Jul-11 09:40 PM	700			35.690	21.288	4.718	-0.096	2.04	0.13	3304.83	
08-Jul-11 09:45 PM	705			35.440	21.038	4.714	-0.100	2.51	0.16	3318.42	
08-Jul-11 10:00 PM	720			35.718	21.316	4.725	-0.089	2.50	0.16	3354.47	
08-Jul-11 10:30 PM	750			35.655	21.253	4.750	-0.064	2.49	0.16	3429.12	
08-Jul-11 11:00 PM	780			35.120	20.718	4.750	-0.064	2.48	0.16	3508.04	
09-Jul-11 12:00 PM	840			34.067	19.665	4.770	-0.044	2.49	0.16	3653.40	
09-Jul-11 01:00 AM	900			34.044	19.642	4.790	-0.024	2.49	0.16	3801.53	
09-Jul-11 02:00 AM	960			35.024	20.622	4.800	-0.014	2.48	0.16	3953.54	
09-Jul-11 03:00 AM	1020			35.115	20.713	4.810	-0.004	2.48	0.16	4103.86	
09-Jul-11 04:00 AM	1080			34.024	19.622	4.820	0.006	2.47	0.16	4249.90	
09-Jul-11 05:00 AM	1140			33.970	19.568	4.838	0.024	2.46	0.16	4398.18	
09-Jul-11 06:00 AM	1200			33.951	19.549	4.851	0.037	2.46	0.16	4545.34	
09-Jul-11 07:00 AM	1260			33.955	19.553	4.857	0.043	2.46	0.16	4693.69	
09-Jul-11 08:00 AM	1320			33.974	19.572	4.882	0.068	2.46	0.16	4841.36	
09-Jul-11 09:00 AM	1380			33.990	19.588	4.898	0.084	2.46	0.16	4999.89	
09-Jul-11 10:00 AM	1440	0		36.220	21.818			2.45	0.15	5136.06	Sample port open for water sample collection. Stop pump. Start recovery.
09-Jul-11 10:01 AM	1441	1	1441.0	35.493	21.091						
09-Jul-11 10:02 AM	1442	2	721.0	34.700	20.298						
09-Jul-11 10:03 AM	1443	3	481.0	34.128	19.726						
09-Jul-11 10:04 AM	1444	4	361.0	33.552	19.150						
09-Jul-11 10:05 AM	1445	5	289.0	32.997	18.595						
09-Jul-11 10:06 AM	1446	6	241.0	32.524	18.122	4.910	0.096				
09-Jul-11 10:07 AM	1447	7	206.7	32.100	17.698	4.915	0.101				
09-Jul-11 10:08 AM	1448	8	181.0	31.690	17.288	4.915	0.101				
09-Jul-11 10:09 AM	1449	9	161.0	31.305	16.903						
09-Jul-11 10:10 AM	1450	10	145.0	30.999	16.597	4.916	0.102				
09-Jul-11 10:12 AM	1452	12	121.0	30.420	16.018						
09-Jul-11 10:14 AM	1454	14	103.9	29.901	15.499						
09-Jul-11 10:16 AM	1456	16	91.0	29.483	15.081	4.914	0.100				
09-Jul-11 10:18 AM	1458	18	81.0	29.064	14.662	4.916	0.102				
09-Jul-11 10:20 AM	1460	20	73.0	28.773	14.371	4.918	0.104				
09-Jul-11 10:25 AM	1465	25	58.6	28.129	13.727	4.921	0.107				
09-Jul-11 10:30 AM	1470	30	49.0	27.624	13.222	4.922	0.108				
09-Jul-11 10:35 AM	1475	35	42.1	27.180	12.778	4.927	0.113				

Watterson Geoscience Inc. **Bingay Mine Project** **24-Hour Test** **Project 11-007**

Well ID: **MW11-1D**
Well Depth: 101.8 m
Casing Stickup: 0.32 m
Ground Elevation: 1419 m above sea level
Lithology: Bedrock
First Water-Bearing Fracture: 45.7 m below ground surface (+/- 2 Usgpm)
Maximum Safe Water Level: 36 m
Static Water Level Before 24-Hour Test: 14.95 m-toc
Transducer Depth: 97 m-toc
Tested By: Watterson Geoscience Inc. & Thompson Drilling Ltd.

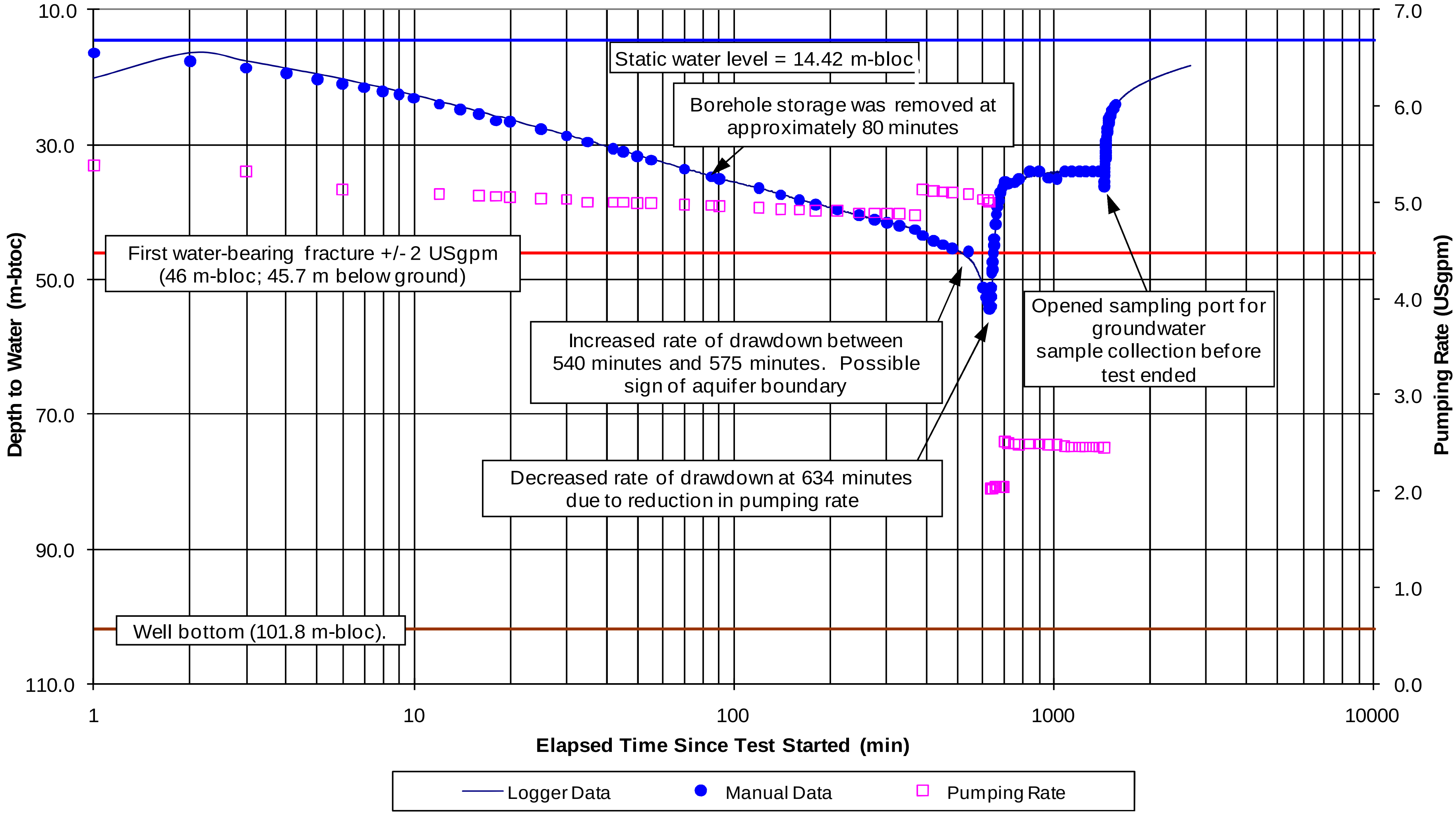
09-Jul-11 10:40 AM	1480	40	37.0	26.827	12.425	4.927	0.113				
09-Jul-11 10:45 AM	1485	45	33.0	26.499	12.097	4.931	0.117				
09-Jul-11 10:50 AM	1490	50	29.8	26.191	11.789						
09-Jul-11 10:55 AM	1495	55	27.2	25.922	11.520	4.932	0.118				
09-Jul-11 11:00 AM	1500	60	25.0	25.697	11.295	4.936	0.122				
09-Jul-11 11:10 AM	1510	70	21.6	25.299	10.897	4.941	0.127				
09-Jul-11 11:21 AM	1521	81	18.8	24.956	10.554	4.944	0.130				
09-Jul-11 11:30 AM	1530	90	17.0	24.716	10.314	4.949	0.135				
09-Jul-11 11:45 AM	1545	105	14.7	24.354	9.952	4.953	0.139				
09-Jul-11 12:00 PM	1560	120	13.0	24.052	9.650	4.961	0.147				

Figure B1: 197-Minute Step-Drawdown Test - MW11-1D
Depth to Water versus Time (Linear Scale)
July 7, 2011



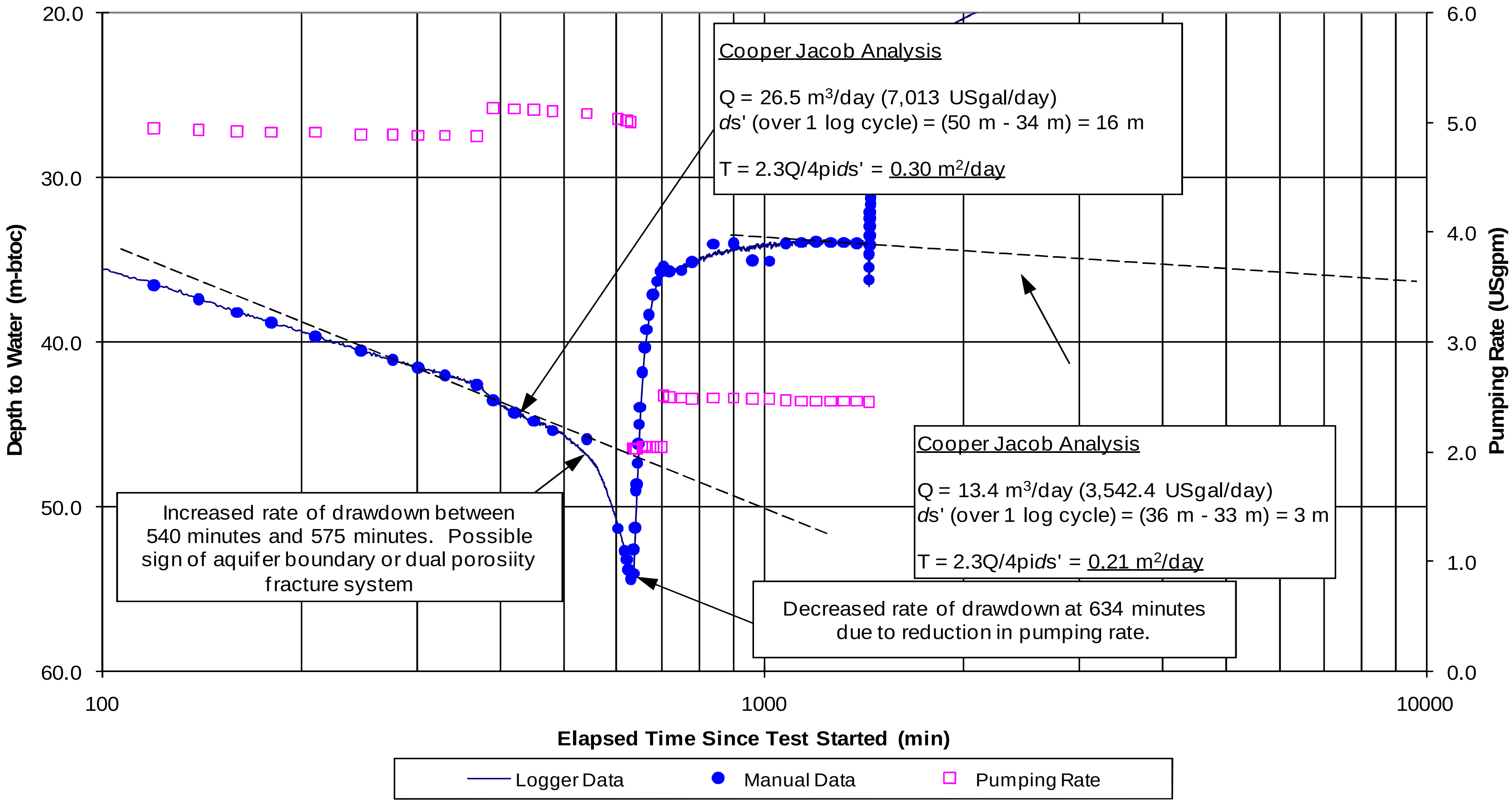
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine		Project No: 11:007
Client:	Centermount Coal Ltd.	Figure No: B1

Figure B2: 24-Hour Test - MW11-1D
Depth to Water versus Time (Log Scale)
July 8 to July 9, 2011



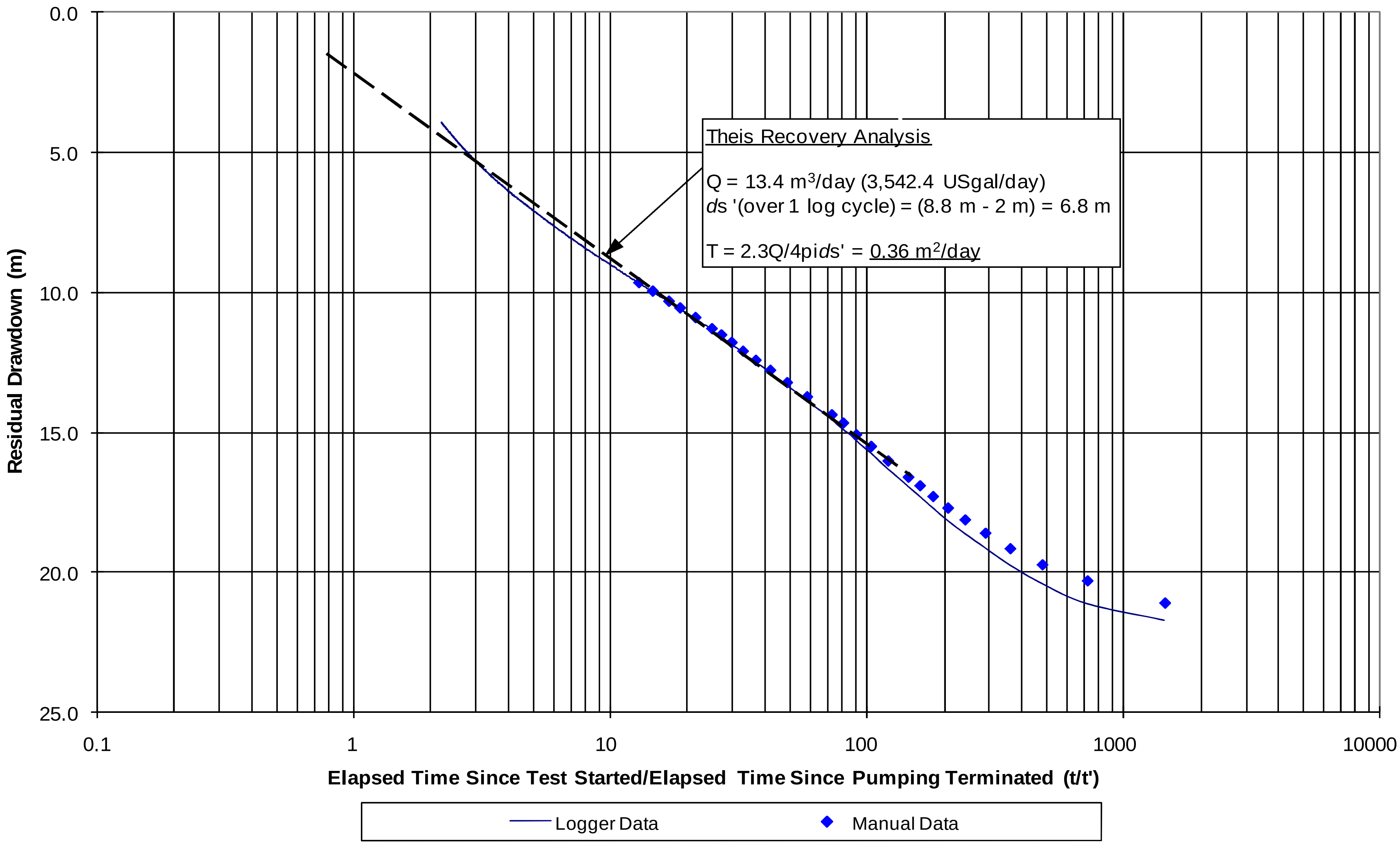
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B2

Figure B3: 24-Hour Test - MW11-1D
Depth to Water versus Time (Log Scale)
Between 100 and 2000 Minutes
July 8 to July 9, 2011



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B3

Figure B4: 24-Hour Pumping Test - MW11-1D
Residual Drawdown versus t/t' (Log Scale)



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B4

Watterson Geoscience Inc.	Bingay Mine	24-Hour Test	Project 11-007
Well ID:	**MW11-4D**		
Well Depth:	151.2 m below ground surface		
Casing Stickup:	0.46 m		
Ground Elevation:	1390 m above sea level		
Lithology:	Bedrock		
First Water-Bearing Fracture:	56.3 m below ground surface		
Static Water Level Before 24-Hour Test:	2.523 m-toc		
Transducer Depth:	144 m-toc		
Tested By:	Watterson Geoscience Inc. & Thompson Drilling Ltd.		
Start Date 7/12/2011	End Date 7/13/2011		

Date and Time	Elapsed Time Since Pumping Started	Elapsed Time Since Pumping Stopped	t/t'	MW11-4D Depth to Water	MW11-4D Drawdown	Pumping Rate		Totalizing Flow Meter	Remarks
	(minutes)	(minutes)		(m-btoc)	(m)	(USgpm)	(L/sec)	(USgal)	
12-Jul-11 01:00 PM	0			2.523	0.000				Start pumping.
12-Jul-11 01:01 PM	1			3.320	0.797				
12-Jul-11 01:02 PM	2			3.917	1.394				
12-Jul-11 01:02 PM	2.5					2.54	0.16		
12-Jul-11 01:03 PM	3			4.487	1.964				
12-Jul-11 01:04 PM	4			5.049	2.526			5.58	
12-Jul-11 01:05 PM	5			5.584	3.061	2.54	0.16		
12-Jul-11 01:06 PM	6			6.110	3.587	2.53	0.16		
12-Jul-11 01:07 PM	7			6.640	4.117				
12-Jul-11 01:08 PM	8			7.132	4.609				
12-Jul-11 01:09 PM	9			7.629	5.106				
12-Jul-11 01:10 PM	10			8.133	5.610	2.52	0.16		
12-Jul-11 01:11 PM	11								
12-Jul-11 01:12 PM	12.5			9.304	6.781				
12-Jul-11 01:14 PM	14			9.969	7.446			27.08	
12-Jul-11 01:16 PM	16			10.859	8.336	2.50	0.16		
12-Jul-11 01:18 PM	18			11.711	9.188	2.49	0.16		
12-Jul-11 01:20 PM	20			12.518	9.995	2.48	0.16		
12-Jul-11 01:25 PM	25.1			14.481	11.958	2.48	0.16		
12-Jul-11 01:26 PM	26					2.47	0.16		
12-Jul-11 01:26 PM	27					2.45	0.15		
12-Jul-11 01:28 PM	28							64.34	
12-Jul-11 01:30 PM	30			16.340	13.817	2.65	0.17		
12-Jul-11 01:35 PM	35			18.156	15.633			69.48	
12-Jul-11 01:40 PM	40			19.848	17.325	2.59	0.16		
12-Jul-11 01:45 PM	45			21.406	18.883	2.56	0.16		
12-Jul-11 01:50 PM	50			22.897	20.374	2.55	0.16		
12-Jul-11 01:55 PM	55			24.234	21.711	2.54	0.16		
12-Jul-11 01:58 PM	58								
12-Jul-11 02:00 PM	60			25.573	23.050	2.47	0.16		
12-Jul-11 02:10 PM	70.3			27.654	25.131			145.82	
12-Jul-11 02:21 PM	81			29.659	27.136				
12-Jul-11 02:31 PM	91			31.590	29.067	2.46	0.16		
12-Jul-11 02:40 PM	100			33.227	30.704	2.44	0.15		
12-Jul-11 02:50 PM	110			34.888	32.365				
12-Jul-11 03:00 PM	120			36.920	34.397	2.45	0.15		
12-Jul-11 03:10 PM	130				-2.523	2.44	0.15		
12-Jul-11 03:11 PM	131				-2.523	2.42	0.15		
12-Jul-11 03:16 PM	136			38.440	35.917	2.41	0.15	321.99	
12-Jul-11 03:30 PM	150			40.770	38.247	2.64	0.17		
12-Jul-11 03:32 PM	152				-2.523	2.53	0.16		
12-Jul-11 03:45 PM	165			42.980	40.457	2.52	0.16		

Watterson Geoscience Inc. | **Bingay Mine** | **24-Hour Test** | **Project 11-007**

Well ID: **MW11-4D**
Well Depth: 151.2 m below ground surface
Casing Stickup: 0.46 m
Ground Elevation: 1390 m above sea level
Lithology: Bedrock
First Water-Bearing Fracture: 56.3 m below ground surface
Static Water Level Before 24-Hour Test: 2.523 m-toc
Transducer Depth: 144 m-toc
Tested By: Watterson Geoscience Inc. & Thompson Drilling Ltd.

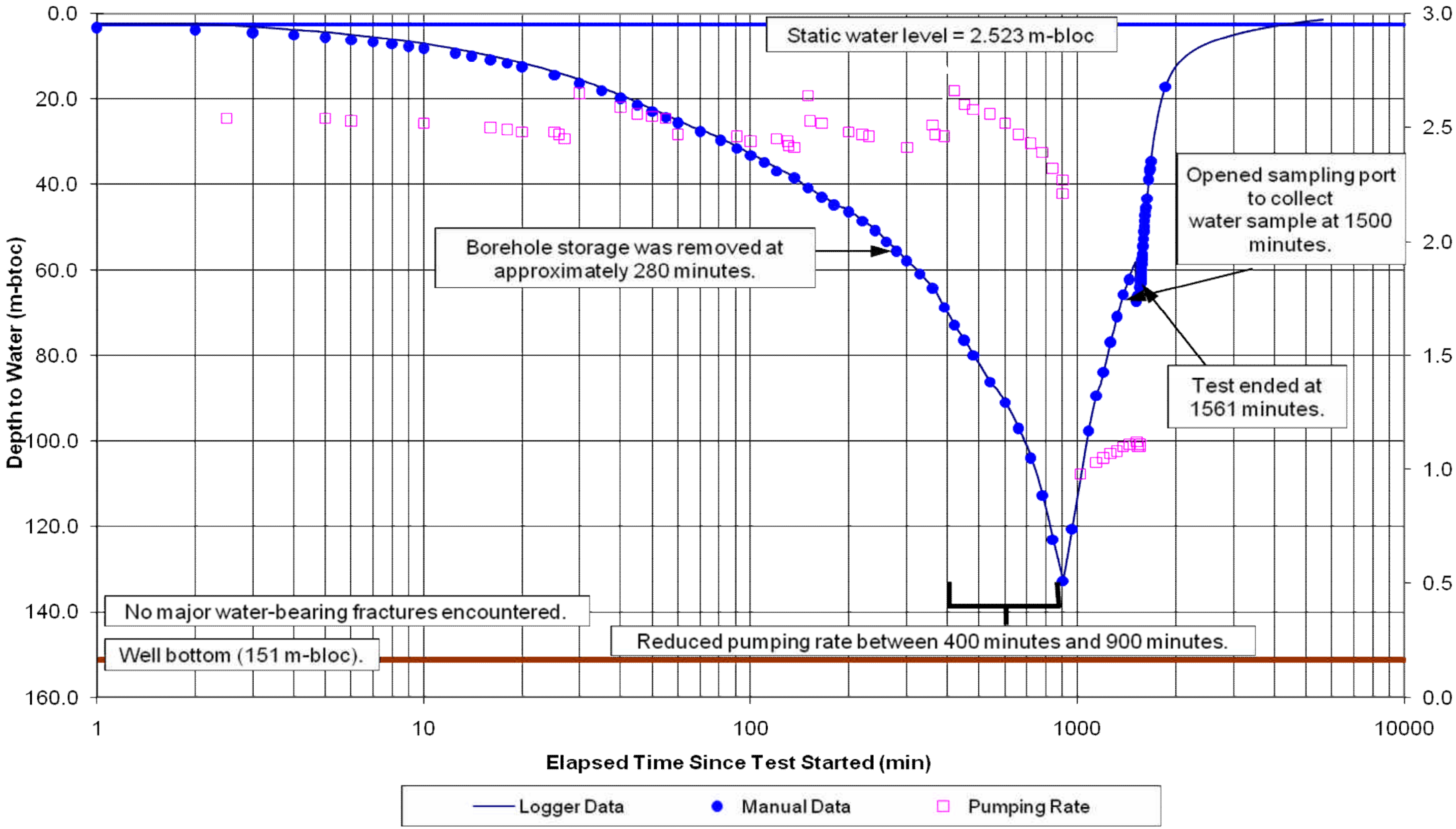
12-Jul-11 04:00 PM	180			44.800	42.277			370.66	
12-Jul-11 04:20 PM	200			46.430	43.907	2.48	0.16		
12-Jul-11 04:40 PM	220			48.630	46.107	2.47	0.16		
12-Jul-11 04:50 PM	230				-2.523	2.46	0.16		
12-Jul-11 05:00 PM	240			50.766	48.243				
12-Jul-11 05:20 PM	260			53.460	50.937			0.00	
12-Jul-11 05:40 PM	280			55.630	53.107				
12-Jul-11 06:00 PM	300			57.920	55.397				
12-Jul-11 06:01 PM	301				-2.523	2.41	0.15		
12-Jul-11 06:02 PM	302				-2.523				
12-Jul-11 06:30 PM	330			60.970	58.447	3.12	0.20	750.36	
12-Jul-11 07:00 PM	360			64.280	61.757	2.51	0.16		
12-Jul-11 07:06 PM	366				-2.523				
12-Jul-11 07:07 PM	367				-2.523	2.47	0.16		
12-Jul-11 07:31 PM	391			68.802	66.279	2.46	0.16		
12-Jul-11 07:33 PM	393.5				-2.523			913.53	
12-Jul-11 08:01 PM	421			72.920	70.397	2.66	0.17		
12-Jul-11 08:30 PM	450			76.482	73.959			986.96	
12-Jul-11 08:31 PM	451				-2.523	2.60	0.16	1050.49	
12-Jul-11 09:00 PM	480			80.043	77.520	2.58	0.16		
12-Jul-11 09:01 PM	481				-2.523			1134.28	
12-Jul-11 10:00 PM	540			86.264	83.741	2.56	0.16		
12-Jul-11 10:01 PM	541							1211.54	
12-Jul-11 11:02 PM	602			91.049	88.526	2.52	0.16		
12-Jul-11 11:03 PM	603							1364.37	
13-Jul-11 12:00 AM	660			97.073	94.550	2.47	0.16		
13-Jul-11 12:01 AM	661							1519.90	
13-Jul-11 01:00 AM	720			104.030	101.507	2.43	0.15		
13-Jul-11 01:02 AM	722							1662.12	
13-Jul-11 02:00 AM	780			112.756	110.233	2.39	0.15		
13-Jul-11 02:02 AM	782							1809.38	
13-Jul-11 03:00 AM	840			123.204	120.681	2.32	0.15		
13-Jul-11 03:01 AM	841							1950.76	
13-Jul-11 04:00 AM	900			132.832	130.309	2.27	0.14		
13-Jul-11 04:01 AM	901							2086.39	
13-Jul-11 04:02 AM	902					2.21	0.14		
13-Jul-11 05:02 AM	962			120.551	118.028			2221.22	
13-Jul-11 06:00 AM	1020					0.98	0.06		
13-Jul-11 07:00 AM	1080			97.633	95.110			2284.85	
13-Jul-11 07:04 AM	1084								
13-Jul-11 08:00 AM	1140			89.437	86.914	1.03	0.06		
13-Jul-11 08:01 AM	1141							2405.10	
13-Jul-11 09:00 AM	1200			83.858	81.335	1.05	0.07		
13-Jul-11 09:01 AM	1201							2465.04	
13-Jul-11 10:00 AM	1260			76.883	74.360	1.07	0.07		
13-Jul-11 10:01 AM	1261							2529.05	
13-Jul-11 11:00 AM	1320			70.920	68.397	1.08	0.07		
13-Jul-11 12:00 PM	1380			65.785	63.262			2593.97	
13-Jul-11 12:02 PM	1382					1.10	0.07		

Watterson Geoscience Inc. **Bingay Mine** **24-Hour Test** **Project 11-007**

Well ID: **MW11-4D**
Well Depth: 151.2 m below ground surface
Casing Stickup: 0.46 m
Ground Elevation: 1390 m above sea level
Lithology: Bedrock
First Water-Bearing Fracture: 56.3 m below ground surface
Static Water Level Before 24-Hour Test: 2.523 m-toc
Transducer Depth: 144 m-toc
Tested By: Watterson Geoscience Inc. & Thompson Drilling Ltd.

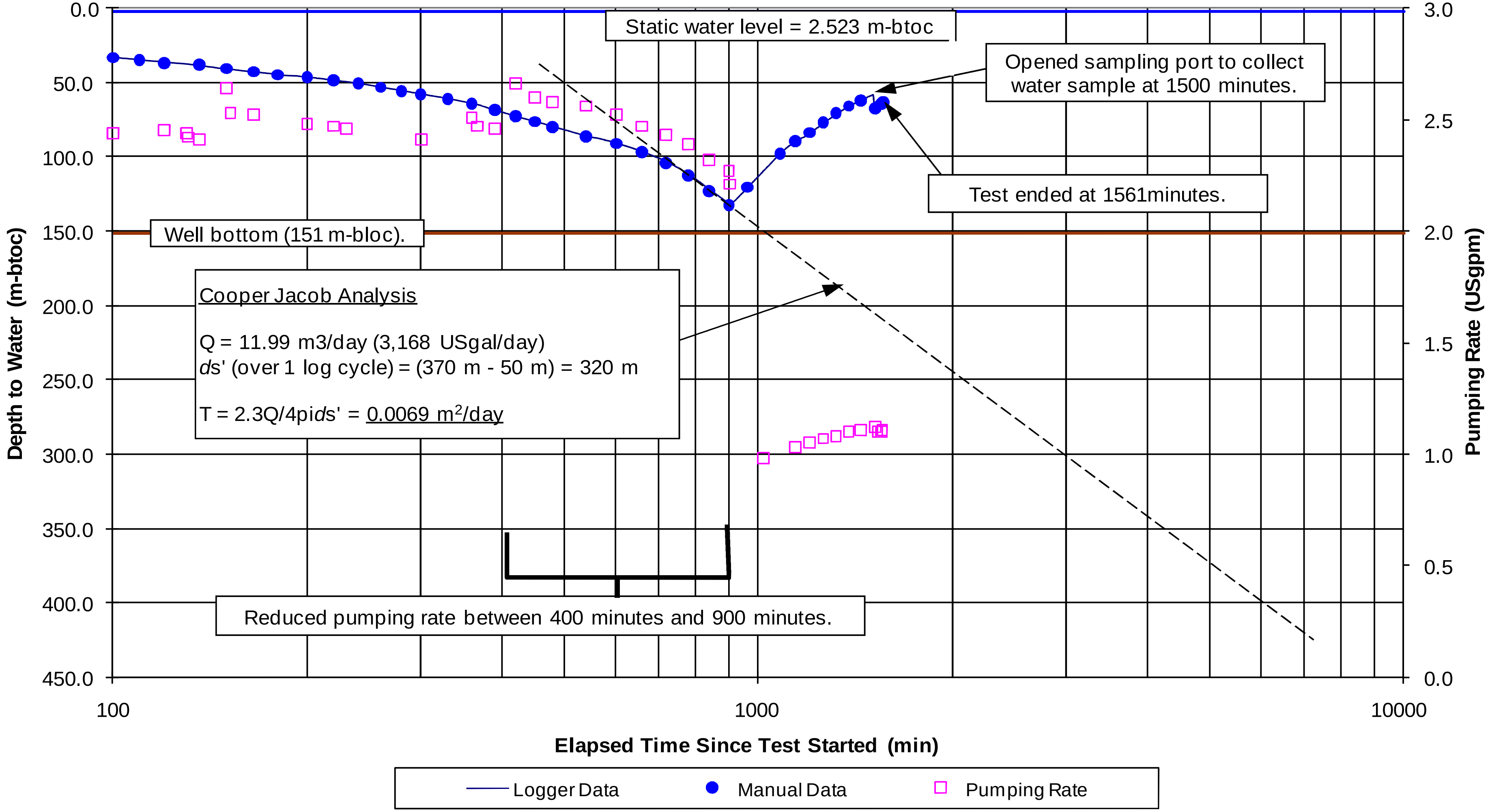
13-Jul-11 01:03 PM	1443			62.230	59.707	1.11	0.07		
13-Jul-11 02:00 PM	1500								Opened sampling port to collect water sample.
13-Jul-11 02:16 PM	1516			67.433	64.910		0.00	2727.55	
13-Jul-11 02:18 PM	1518					1.12	0.07		
13-Jul-11 02:31 PM	1531			66.090	63.567	1.10	0.07		
13-Jul-11 02:32 PM	1532							2879.39	
13-Jul-11 02:54 PM	1554			64.120	61.597	1.10	0.07		
13-Jul-11 02:57 PM	1557							2894.90	
13-Jul-11 02:58 PM	1558			63.976	61.453	1.11	0.07		
13-Jul-11 02:59 PM	1559			63.900	61.377			2922.71	
13-Jul-11 04:59 PM	1559.75			63.856	61.333				
13-Jul-11 03:00 PM	1560								
13-Jul-11 03:00 PM	1560.5			63.620	61.097				
13-Jul-11 03:01 PM	1561	0		63.437	60.914			2926.10	Stop pump. Start recovery.
13-Jul-11 03:02 PM	1562	1	1562.0	63.042	60.519				
13-Jul-11 03:03 PM	1563	2	781.5	62.628	60.105				
13-Jul-11 03:04 PM	1564	3	521.3	62.270	59.747				
13-Jul-11 03:05 PM	1565	4	391.3	61.881	59.358				
13-Jul-11 03:06 PM	1566	5	313.2	61.490	58.967				
13-Jul-11 03:07 PM	1567	6	261.2	61.096	58.573				
13-Jul-11 03:08 PM	1568	7	224.0	60.709	58.186				
13-Jul-11 03:09 PM	1569	8	196.1	60.319	57.796				
13-Jul-11 03:10 PM	1570	9	174.4	59.958	57.435				
13-Jul-11 03:12 PM	1572	11	142.9	59.254	56.731				
13-Jul-11 03:14 PM	1574	13	121.1	58.535	56.012				
13-Jul-11 03:16 PM	1576	15	105.1	57.574	55.051				
13-Jul-11 03:18 PM	1578	17	92.8	57.026	54.503				
13-Jul-11 03:20 PM	1580	19	83.2	56.306	53.783				
13-Jul-11 03:25 PM	1585	24	66.0	54.486	51.963				
13-Jul-11 03:30 PM	1590	29	54.8	52.765	50.242				
13-Jul-11 03:30 PM	1595.5	34.5	46.2	51.020	48.497				
13-Jul-11 03:40 PM	1600	39	41.0	49.815	47.292				
13-Jul-11 03:45 PM	1605	44	36.5	48.587	46.064				
13-Jul-11 03:50 PM	1610	49	32.9	47.288	44.765				
13-Jul-11 03:56 PM	1616.2	55.2	29.3	46.096	43.573				
13-Jul-11 04:00 PM	1620	59	27.5	45.351	42.828				
13-Jul-11 04:10 PM	1630	69	23.6	43.262	40.739				
13-Jul-11 04:30 PM	1650	89	18.5	38.900	36.377				
13-Jul-11 04:40 PM	1660	99	16.8	36.780	34.257				
13-Jul-11 04:50 PM	1670	109	15.3	36.360	33.837				
13-Jul-11 05:00 PM	1680	119	14.1	34.630	32.107				
13-Jul-11 07:56 PM	1856	295	6.3	17.231	14.708				

Figure B5: 26-Hour Test - MW11-4D
Depth to Water versus Time (Log Scale)
July 12 to July 13, 2011



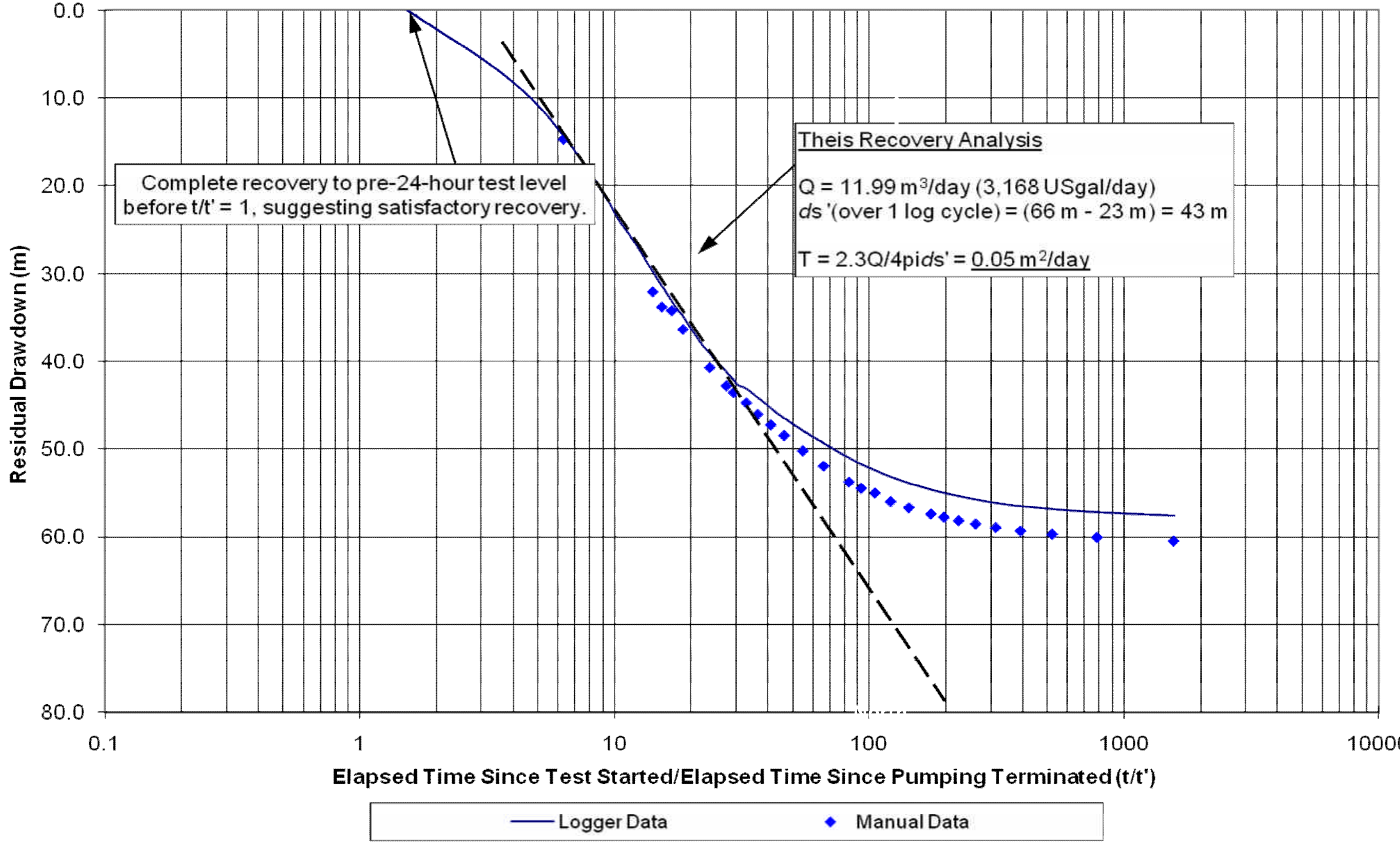
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B5

Figure B6: 26-Hour Test - MW11-4D
Depth to Water versus Time (Log Scale)
Between 100 and 2000 Minutes
July 12 to July 13, 2011



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B6

Figure B7: 26-Hour Pumping Test - MW11-4D
Residual Drawdown versus t/t' (Log Scale)



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B7

Watterson Geoscience Inc.	**Bingay Mine**	**Project 11-007**	**24-Hour Test**
Well ID:	**MW11-5D**		
Well Depth:	102.4 m		
Casing Stickup:	0.36 m		
Ground Elevation:	1398 m above sea level		
Lithology:	Bedrock		
First Water-Bearing Fracture:	56.3 m below ground surface		
Static Water Level Before 24-Hour Test:	10.80 m-toc		
Transducer Depth:	70 m-toc		
Tested By:	Watterson Geoscience Inc. & Thompson Drilling Ltd.		
Start Date 7/15/2011	End Date 7/16/2011		

Date and Time	Elapsed Time Since Pumping Started	Elapsed Time Since Pumping Stopped	t/t'	MW11-5D Depth to Water	Drawdown	Pumping Rate		Totalizing Flow Meter	Remarks
	(minutes)	(minutes)		(m-btoc)	(m)	(USgpm)	(L/sec)	(USgal)	
15-Jul-11 12:10 PM	0			10.800	0.000				Start pumping.
15-Jul-11 12:11 PM	1			10.203	-0.597				
15-Jul-11 12:11 PM	1.5							3.42	
15-Jul-11 12:12 PM	2			11.045	0.245	1.87	0.12		
15-Jul-11 12:13 PM	3			11.809	1.009	1.86	0.12		
15-Jul-11 12:14 PM	4			12.484	1.684	1.83	0.12		
15-Jul-11 12:14 PM	4.5							8.98	
15-Jul-11 12:15 PM	5			13.154	2.354				
15-Jul-11 12:16 PM	6			13.724	2.924				
15-Jul-11 12:17 PM	7			14.281	3.481	1.82	0.11		
15-Jul-11 12:18 PM	8			14.787	3.987	1.79	0.11		
15-Jul-11 12:19 PM	9.1			15.298	4.498	1.78	0.11		
15-Jul-11 12:20 PM	10			15.682	4.882	1.77	0.11		
15-Jul-11 12:22 PM	12			16.466	5.666				
15-Jul-11 12:24 PM	14			17.196	6.396				
15-Jul-11 12:26 PM	16			17.834	7.034	1.74	0.11		
15-Jul-11 12:28 PM	18			18.362	7.562	1.64	0.10		
15-Jul-11 12:30 PM	20			18.925	8.125	2.00	0.13		
15-Jul-11 12:31 PM	21							38.50	
15-Jul-11 12:25 PM	25			20.667	9.867	1.99	0.13		
15-Jul-11 12:40 PM	30			22.054	11.254				
15-Jul-11 12:45 PM	35			23.211	12.411	1.98	0.12		
15-Jul-11 12:50 PM	40			24.181	13.381				
15-Jul-11 12:51 PM	41							58.40	
15-Jul-11 12:57 PM	47			25.211	14.411	1.91	0.12		
15-Jul-11 01:00 PM	50			25.589	14.789				
15-Jul-11 01:05 PM	55.2			26.207	15.407	1.89	0.12		
15-Jul-11 01:10 PM	60.2			26.708	15.908	1.88	0.12		

Watterson Geoscience Inc.			Bingay Mine			Project 11-007	24-Hour Test			
Well ID:			**MW11-5D**							
Well Depth:			102.4 m							
Casing Stickup:			0.36 m							
Ground Elevation:			1398 m above sea level							
Lithology:			Bedrock							
First Water-Bearing Fracture:			56.3 m below ground surface							
Static Water Level Before 24-Hour Test:			10.80 m-toc							
Transducer Depth:			70 m-toc							
Tested By:			Watterson Geoscience Inc. & Thompson Drilling Ltd.							
15-Jul-11 01:11 PM	61							116.42	
15-Jul-11 01:20 PM	70			27.596	16.796				
15-Jul-11 01:30 PM	80			28.389	17.589	1.87	0.12		
15-Jul-11 01:40 PM	90			29.103	18.303				
15-Jul-11 01:50 PM	100			29.768	18.968	1.86	0.12		
15-Jul-11 02:00 PM	110			30.355	19.555				
15-Jul-11 02:11 PM	121			30.951	20.151				
15-Jul-11 02:12 PM	122							230.64	
15-Jul-11 12:25 PM	135			31.653	20.853				
15-Jul-11 02:40 PM	150			32.372	21.572				
15-Jul-11 02:41 PM	151							284.69	
15-Jul-11 02:55 PM	165			33.200	22.400				
15-Jul-11 02:56 PM	166							312.34	
15-Jul-11 03:11 PM	181			33.610	22.810	1.85	0.12		
15-Jul-11 03:12 PM	182							341.80	
15-Jul-11 03:40 PM	210			34.700	23.900				
15-Jul-11 03:41 PM	211							395.60	
15-Jul-11 04:10 PM	240			35.670	24.870	1.84	0.12		
15-Jul-11 04:11 PM	241							450.80	
15-Jul-11 04:40 PM	270			36.540	25.740				
15-Jul-11 04:41 PM	271							500.60	
15-Jul-11 05:10 PM	300			37.245	26.445				
15-Jul-11 05:11 PM	301							562.00	
15-Jul-11 05:40 PM	330			38.285	27.485				Datalogger lowered to approximately 90 m-btoc.
15-Jul-11 05:41 PM	331							617.65	
15-Jul-11 06:10 PM	360			39.900	29.100	1.83	0.12		
15-Jul-11 06:11 PM	361							673.93	
15-Jul-11 07:11 PM	421			40.763	29.963	1.86	0.12		
15-Jul-11 07:12 PM	422							783.15	
15-Jul-11 08:11 PM	481			44.460	33.660	1.85	0.12		
15-Jul-11 08:12 PM	482							896.94	
15-Jul-11 09:10 PM	540			44.750	33.950	1.77	0.11		
15-Jul-11 09:12 PM	542							1002.79	
15-Jul-11 10:10 PM	600			44.865	34.065	1.74	0.11		

Watterson Geoscience Inc. **Bingay Mine** **Project 11-007** **24-Hour Test**

Well ID: **MW11-5D**
Well Depth: 102.4 m
Casing Stickup: 0.36 m
Ground Elevation: 1398 m above sea level
Lithology: Bedrock
First Water-Bearing Fracture: 56.3 m below ground surface
Static Water Level Before 24-Hour Test: 10.80 m-toc
Transducer Depth: 70 m-toc
Tested By: Watterson Geoscience Inc. & Thompson Drilling Ltd.

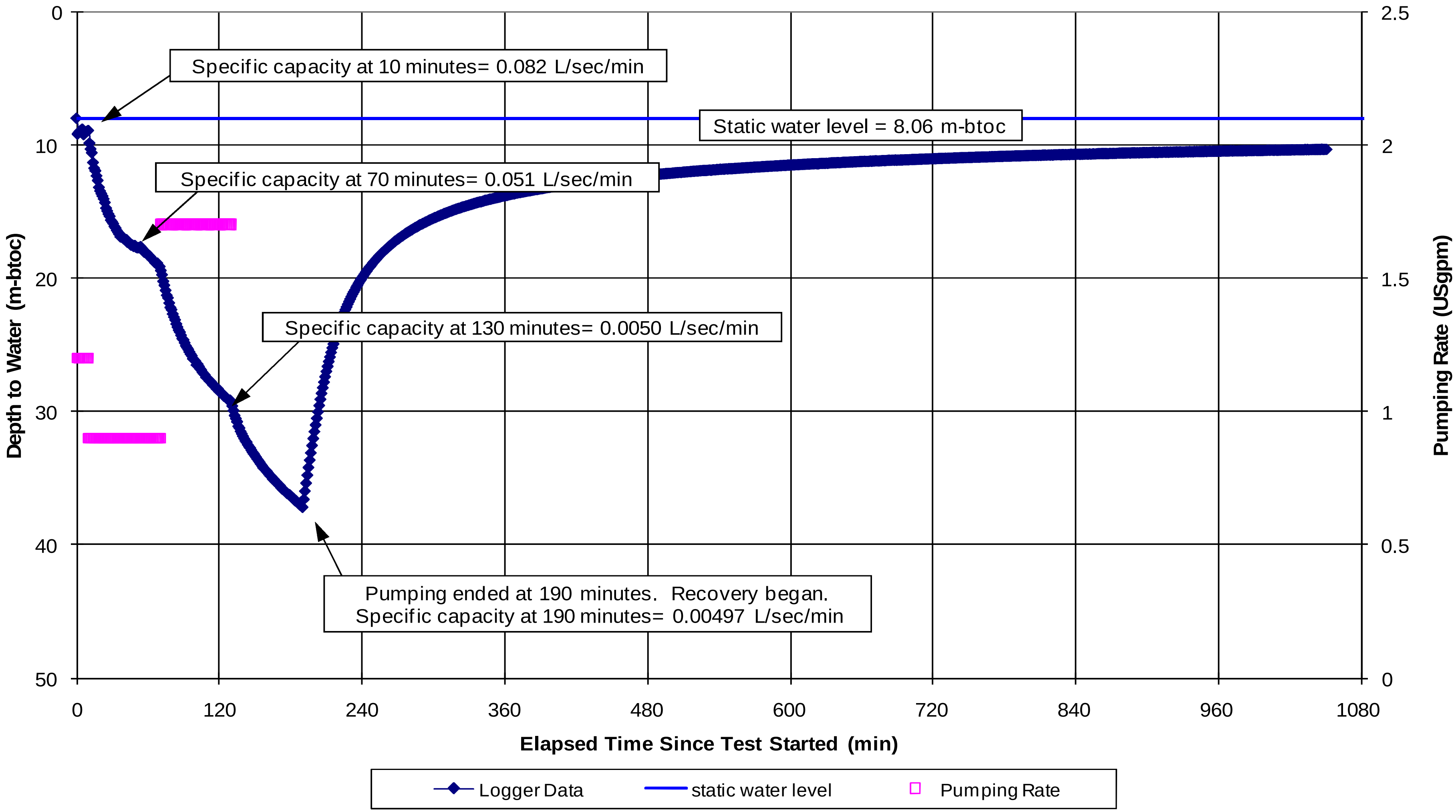
15-Jul-11 10:11 PM	601							1091.36	
15-Jul-11 11:12 PM	662			47.855	37.055	1.72	0.11		
15-Jul-11 11:13 PM	663							1217.78	
16-Jul-11 12:10 AM	720			49.450	38.650	1.77	0.11		
16-Jul-11 12:11 AM	721							1317.90	
16-Jul-11 01:10 AM	780			51.410	40.610	1.75	0.11		
16-Jul-11 01:11 AM	781							1423.56	
16-Jul-11 02:10 AM	840			53.790	42.990	1.74	0.11		
16-Jul-11 02:11 AM	841							1530.00	
16-Jul-11 03:10 AM	900			57.150	46.350	1.69	0.11		
16-Jul-11 03:11 AM	901							1631.47	
16-Jul-11 04:10 AM	960			60.490	49.690	1.66	0.10		
16-Jul-11 04:11 AM	961							1732.67	
16-Jul-11 05:10 AM	1020			65.550	54.750	1.69	0.11		
16-Jul-11 05:11 AM	1021							1834.22	
16-Jul-11 06:10 AM	1080			71.934	61.134	1.73	0.11		
16-Jul-11 06:11 AM	1081							1937.10	
16-Jul-11 07:10 AM	1140			79.402	68.602	1.70	0.11		
16-Jul-11 07:11 AM	1141							2040.91	
16-Jul-11 08:10 AM	1200			88.880	78.080	1.72	0.11		
16-Jul-11 08:11 AM	1201							2144.14	Adjust pumping rate.
16-Jul-11 08:15 AM	1215							2150.11	
16-Jul-11 08:16 AM	1216			88.906	78.106	0.76	0.05		
16-Jul-11 09:10 AM	1260								
16-Jul-11 09:17 AM	1267			79.708	68.908	0.84	0.05		
16-Jul-11 09:18 AM	1268							2200.44	
16-Jul-11 10:10 AM	1320			75.151	64.351	0.91	0.06		
16-Jul-11 10:11 AM	1321							2247.42	
16-Jul-11 11:10 AM	1380			71.470	60.670				
16-Jul-11 11:11 AM	1381							2300.91	
16-Jul-11 12:14 PM	1444			68.850	58.050	0.96	0.06		
16-Jul-11 12:15 PM	1445							2359.04	
16-Jul-11 12:17 PM	1447								
16-Jul-11 12:28 PM	1458			68.677	57.877				

Watterson Geoscience Inc. **Bingay Mine** **Project 11-007** **24-Hour Test**

Well ID: **MW11-5D**
Well Depth: 102.4 m
Casing Stickup: 0.36 m
Ground Elevation: 1398 m above sea level
Lithology: Bedrock
First Water-Bearing Fracture: 56.3 m below ground surface
Static Water Level Before 24-Hour Test: 10.80 m-toc
Transducer Depth: 70 m-toc
Tested By: Watterson Geoscience Inc. & Thompson Drilling Ltd.

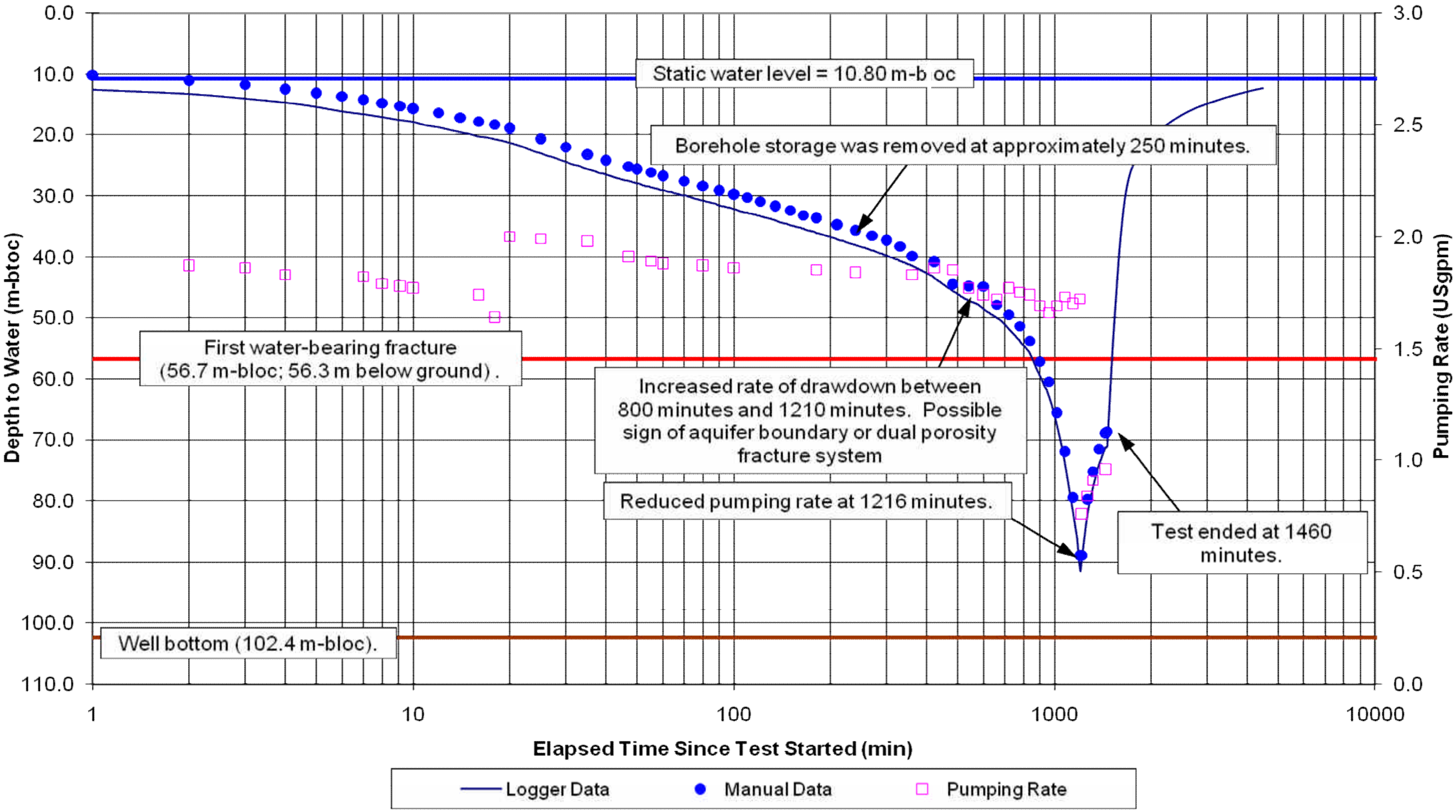
16-Jul-11 12:29 PM	1459			68.644	57.844				
16-Jul-11 12:29 PM	1459.7			68.639	57.839				
16-Jul-11 12:30 PM	1460	0						2373.45	Stop pump. Start recovery.
16-Jul-11 12:31 PM	1461	1	1461.0	68.291	57.491				
16-Jul-11 12:32 PM	1462	2	731.0	67.976	57.176				
16-Jul-11 12:33 PM	1463	3	487.7	67.660	56.860				
16-Jul-11 12:34 PM	1464	4	366.0	67.360	56.560				
16-Jul-11 12:35 PM	1465	5	293.0	67.059	56.259				
16-Jul-11 12:36 PM	1466	6	244.3	66.744	55.944				
16-Jul-11 12:37 PM	1467	7	209.6	66.426	55.626				
16-Jul-11 12:38 PM	1468	8	183.5	66.118	55.318				
16-Jul-11 12:39 PM	1469	9	163.2	65.810	55.010				
16-Jul-11 12:40 PM	1470	10	147.0	65.498	54.698				
16-Jul-11 12:42 PM	1472	12	122.7	64.895	54.095				
16-Jul-11 12:44 PM	1474	14	105.3	64.287	53.487				
16-Jul-11 12:46 PM	1476	16	92.3	63.683	52.883				
16-Jul-11 12:48 PM	1478	18	82.1	63.140	52.340				
16-Jul-11 12:50 PM	1480	20	74.0	62.559	51.759				
16-Jul-11 12:55 PM	1485	25	59.4	61.120	50.320				
16-Jul-11 01:00 PM	1490.2	30.2	49.3	59.623	48.823				
16-Jul-11 01:05 PM	1495.2	35.2	42.5	58.204	47.404				
16-Jul-11 01:10 PM	1500	40	37.5	56.882	46.082				
16-Jul-11 01:15 PM	1505	45	33.4	55.554	44.754				
16-Jul-11 01:20 PM	1510	50	30.2	54.229	43.429				
16-Jul-11 01:25 PM	1515.5	55.5	27.3	52.806	42.006				
16-Jul-11 01:30 PM	1520.1	60.1	25.3	51.622	40.822				
16-Jul-11 01:40 PM	1530.2	70.2	21.8	49.304	38.504				
16-Jul-11 01:50 PM	1540	80	19.3	47.134	36.334				
16-Jul-11 02:00 PM	1550	90	17.2	45.006	34.206				
16-Jul-11 02:10 PM	1560	100	15.6	42.864	32.064				
16-Jul-11 02:20 PM	1570	110	14.3	40.768	29.968				
16-Jul-11 02:30 PM	1580	120	13.2	38.766	27.966				

Figure B8: 190-Minute Step-Drawdown Test - MW11-5D
Depth to Water versus Time (Linear Scale)
July 14, 2011



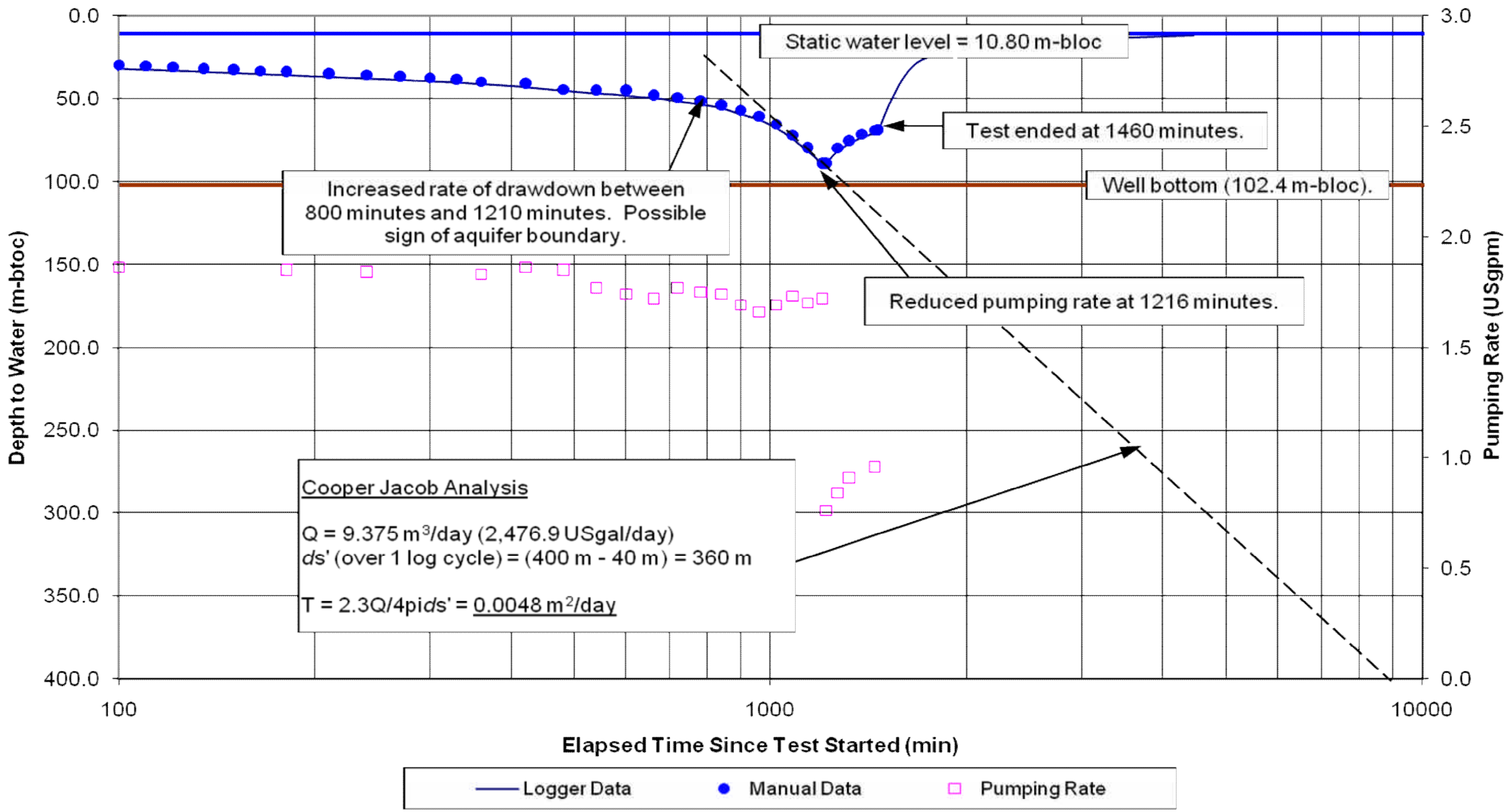
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B8

Figure B9: 24.3-Hour Test - MW11-5D
Depth to Water versus Time (Log Scale)
July 15 to July 16, 2011



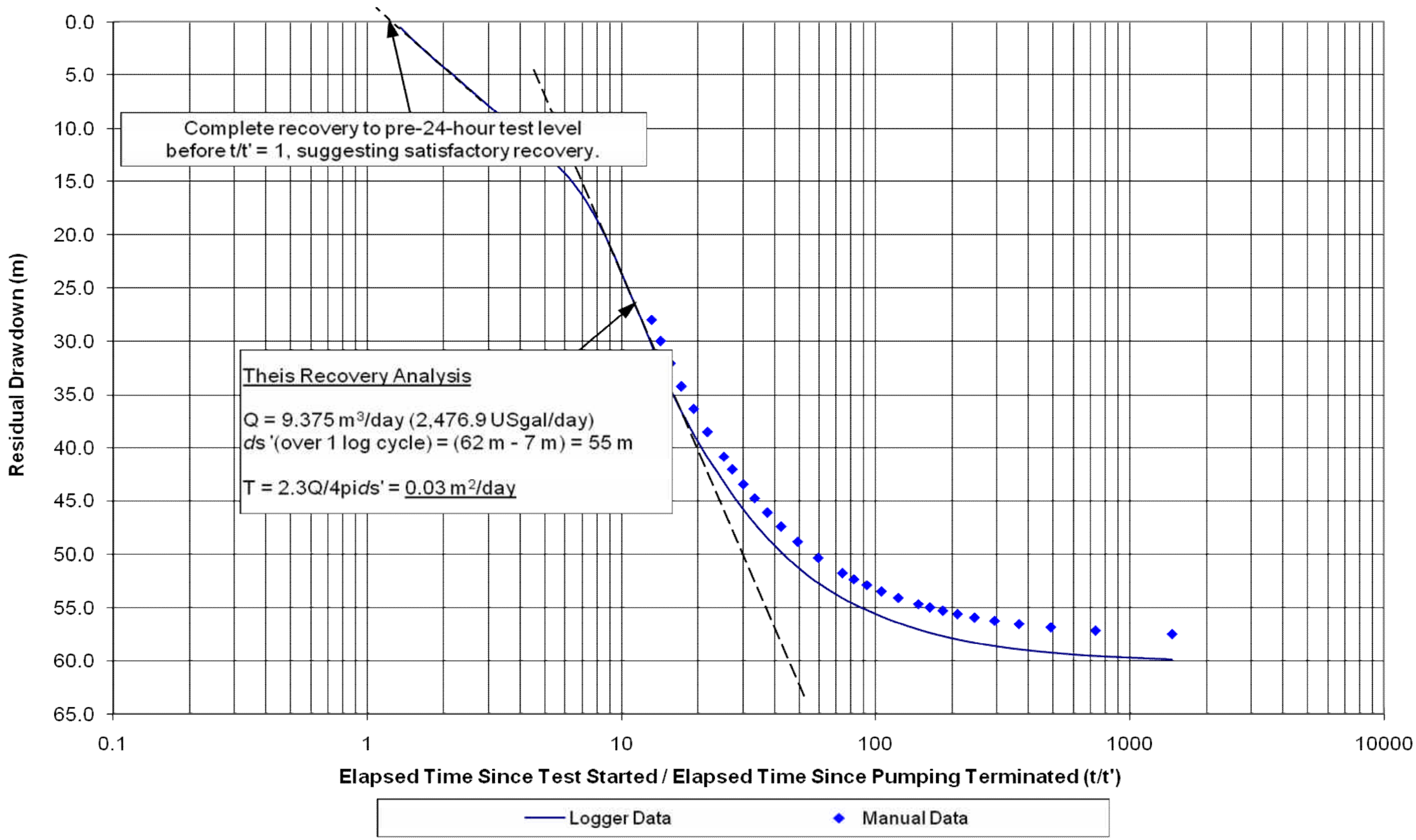
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B9

Figure B10: 24.3-Hour Test - MW11-5D
Depth to Water versus Time (Log Scale)
Between 100 and 2000 Minutes
July 15 to July 16, 2011



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine		Project No: 11:007
Client:	Centermount Coal Ltd.	Figure No: B10

Figure B11: 24.3-Hour Pumping Test - MW11-5D
Residual Drawdown versus t/t' (Log Scale)



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B11

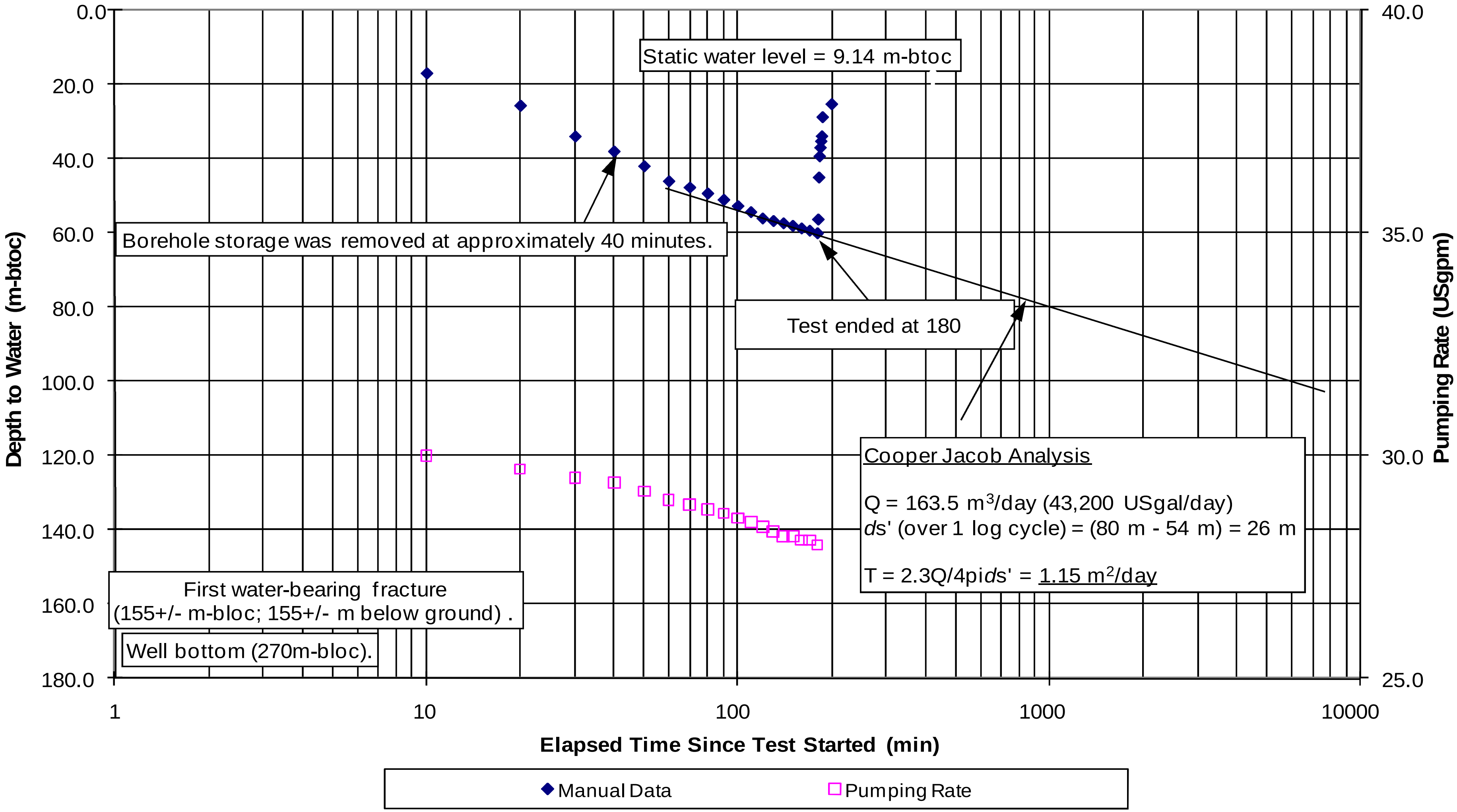
Watterson Geoscience Inc.	Bingay Mine	3-Hour Test	Project 11-007

Well ID: **MW11-1vD**
Well Depth: 270 m
Casing Stickup: 0.05 m
Ground Elevation: 1452.3 m above sea level
Lithology: Bedrock
First Water-Bearing Fracture: 115+/- m below ground surface
Static Water Level Before 24-Hour Test: 9.14 m-toc
Transducer Depth: N/A
Tested By: Watterson Geoscience Inc. & Thompson Drilling Ltd.
Start Date 7/14/2011 End Date 7/15/2011

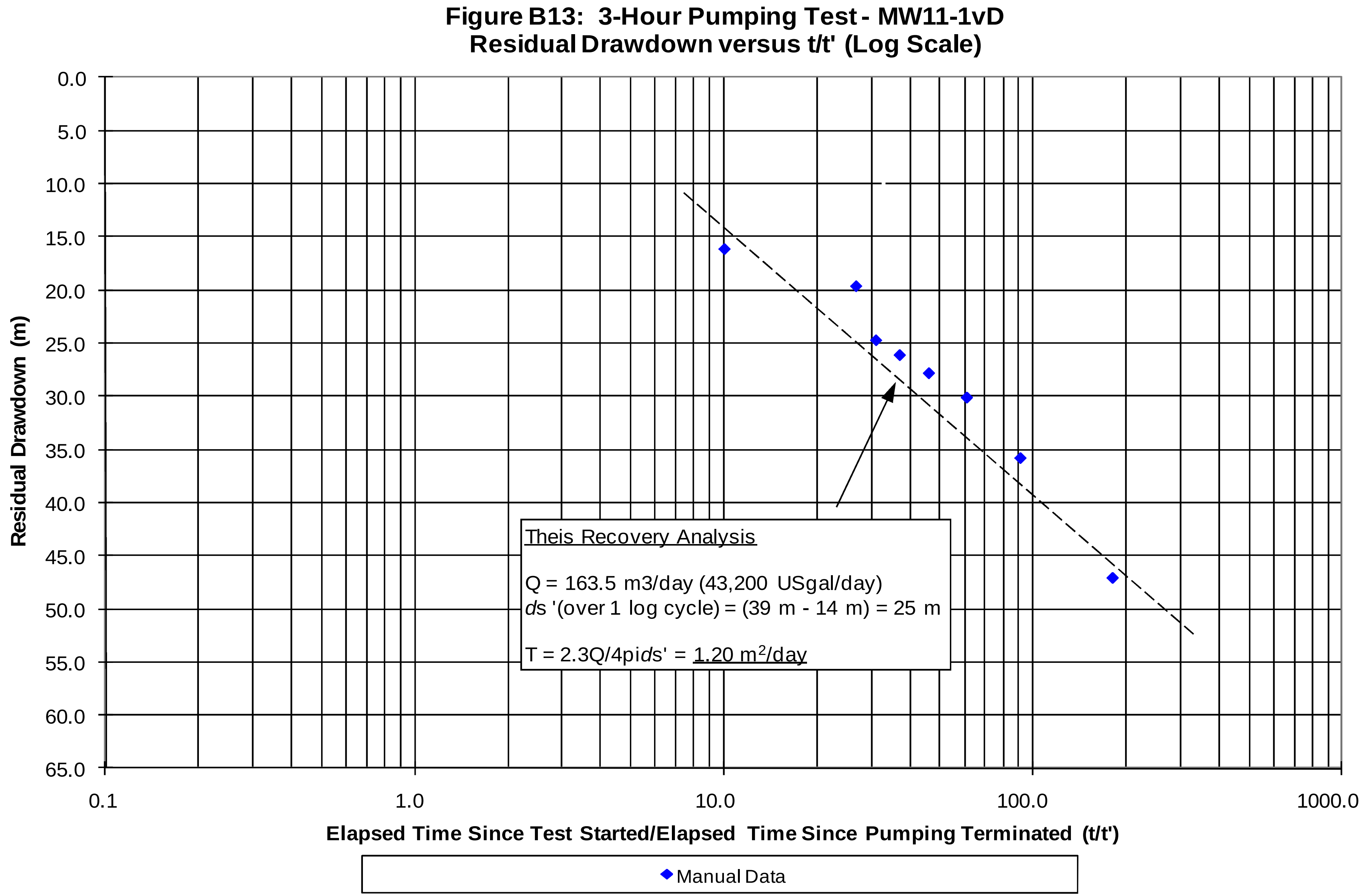
Date and Time	Elapsed Time Since Pumping Started	Elapsed Time Since Pumping Stopped	t/t'	MW11-1vD (Pumping Well)		Pumping Rate		Remarks
				Depth to Water	Drawdown			
	(minutes)	(minutes)		(m-btoc)	(m)	(USgpm)	(L/sec)	
14-Jul-11 12:00 PM	0			9.14	0.00			Start pumping.
14-Jul-11 12:10 PM	10			17.00	7.86	30.0	1.89	
14-Jul-11 12:20 PM	20			25.70	16.56	29.7		
14-Jul-11 12:30 PM	30			34.00	24.86	29.5	1.86	
14-Jul-11 12:40 PM	40			38.00	28.86	29.4		
14-Jul-11 12:50 PM	50			42.00	32.86	29.2		
14-Jul-11 01:00 PM	60			46.00	36.86	29.0	1.83	
14-Jul-11 01:10 PM	70			47.70	38.56	28.9		
14-Jul-11 01:20 PM	80			49.30	40.16	28.8		
14-Jul-11 01:30 PM	90			51.00	41.86	28.7		
14-Jul-11 01:40 PM	100			52.70	43.56	28.6		
14-Jul-11 01:50 PM	110			54.30	45.16	28.5	1.80	
14-Jul-11 02:00 PM	120			56.00	46.86	28.4		
14-Jul-11 02:10 PM	130			56.70	47.56	28.3	1.79	
14-Jul-11 02:20 PM	140			57.30	48.16	28.2	1.78	
14-Jul-11 02:30 PM	150			58.00	48.86	28.2	1.78	
14-Jul-11 02:40 PM	160			58.70	49.56	28.1	1.77	
14-Jul-11 02:50 PM	170			59.30	50.16	28.1	1.77	

Watterson Geoscience Inc.			Bingay Mine	3-Hour Test		Project 11-007		
Well ID:			**MW11-1vD**					
Well Depth:			270 m					
Casing Stickup:			0.05 m					
Ground Elevation:			1452.3 m above sea level					
Lithology:			Bedrock					
First Water-Bearing Fracture:			115+/- m below ground surface					
Static Water Level Before 24-Hour Test:			9.14 m-toc					
Transducer Depth:			N/A					
Tested By:			Watterson Geoscience Inc. & Thompson Drilling Ltd.					
14-Jul-11 03:00 PM	180	0		60.00	50.86	28.0	1.77	Stop pump.
14-Jul-11 03:01 PM	181	1	181.0	56.30	47.16			
14-Jul-11 03:02 PM	182	2	91.0	45.00	35.86			
14-Jul-11 03:03 PM	183	3	61.0	39.30	30.16			
14-Jul-11 03:04 PM	184	4	46.0	37.00	27.86			
14-Jul-11 03:05 PM	185	5	37.0	35.30	26.16			
14-Jul-11 03:06 PM	186	6	31.0	33.90	24.76			
14-Jul-11 03:07 PM	187	7	26.7	28.80	19.66			
14-Jul-11 03:20 PM	200	20	10.0	25.30	16.16			

Figure B12: 3-Hour Test - MW11-1vD
Depth to Water versus Time (Log Scale)
July 14, 2011



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B12



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B13

Watterson Geoscience Inc.	Bingay Mine	Project 11-007	24-Hour Test

Well ID:	**MW11-28vS**
Well Depth:	38.7 m below ground surface
Casing Stickup:	0.46 m
Ground Elevation:	1420.21 m above sea level
Lithology:	Overburden
First Water-Bearing Fracture:	56.3 m below ground surface
Static Water Level Before 24-Hour Test:	20.757 m-toc
Transducer Depth:	34.4 m-toc
Tested By:	D.Watterson, P.Geo., Watterson Geoscience Inc. & Dennis Thompson
Start Date 7/20/2011	End Date 7/21/2011

Date and Time	Elapsed Time Since Pumping Started	Elapsed Time Since Pumping Stopped	t/t'	MW11-28vS Depth to Water	Drawdown	Pumping Rate		Totalizing Flow Meter	Remarks
	(minutes)	(minutes)		(m-btoc)	(m)	(USgpm)	(L/sec)	(USgal)	
20-Jul-11 08:30 PM	0			20.757	0.000				Start pumping.
20-Jul-11 08:31 PM	1			21.321	0.564				
20-Jul-11 08:32 PM	2			21.342	0.585				
20-Jul-11 08:33 PM	3			21.359	0.602	32.04	2.02		
20-Jul-11 08:34 PM	4			21.366	0.609	32.12	2.03		
20-Jul-11 08:35 PM	5			21.373	0.616				
20-Jul-11 08:36 PM	6			21.377	0.620				
20-Jul-11 08:37 PM	7			21.374	0.617				
20-Jul-11 08:38 PM	8			21.377	0.620	32.18	2.03		
20-Jul-11 08:39 PM	9			21.386	0.629		0.00		
20-Jul-11 08:40 PM	10			21.384	0.627	32.21	2.03		
20-Jul-11 08:42 PM	12			21.388	0.631			346.83	
20-Jul-11 08:44 PM	14			21.392	0.635	32.21	2.03		
20-Jul-11 08:46 PM	16			21.391	0.634	32.19	2.03		
20-Jul-11 08:48 PM	18			21.393	0.636				
20-Jul-11 08:50 PM	20			21.389	0.632	32.15	2.03		
20-Jul-11 08:55 PM	25			21.394	0.637	32.18	2.03		
20-Jul-11 09:00 PM	30			21.395	0.638	32.20	2.03		
20-Jul-11 09:04 PM	34					32.25	2.03		
20-Jul-11 09:30 PM	60			21.397	0.640			1087.61	
20-Jul-11 09:31 PM	61					32.24	2.03		
20-Jul-11 09:38 PM	68				-20.757			1958.41	
20-Jul-11 10:30 PM	120			21.408	0.651				
21-Jul-11 12:31 AM	241			21.417	0.660				
21-Jul-11 02:33 AM	363			21.425	0.668				
21-Jul-11 04:34 AM	484			21.431	0.674				

Watterson Geoscience Inc. **Bingay Mine** **Project 11-007** **24-Hour Test**

Well ID: **MW11-28vS**
Well Depth: 38.7 m below ground surface
Casing Stickup: 0.46 m
Ground Elevation: 1420.21 m above sea level
Lithology: Overburden
First Water-Bearing Fracture: 56.3 m below ground surface
Static Water Level Before 24-Hour Test: 20.757 m-toc
Transducer Depth: 34.4 m-toc
Tested By: D.Watterson, P.Geo., Watterson Geoscience Inc. & Dennis Thompson

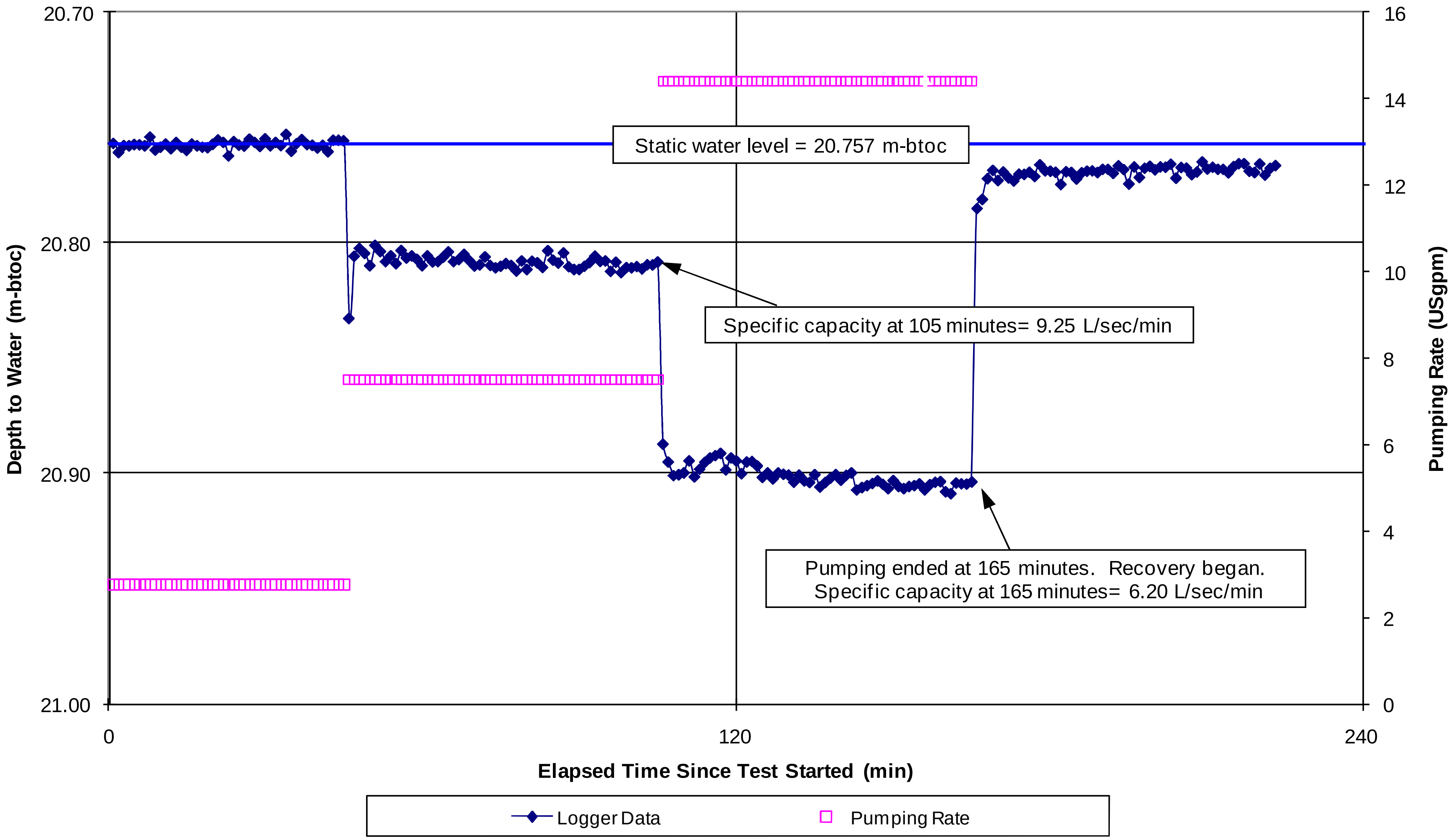
21-Jul-11 07:07 AM	637			21.447	0.690				
21-Jul-11 08:30 AM	720			21.446	0.689			21717.77	
21-Jul-11 10:30 AM	960			21.450	0.693				
21-Jul-11 10:56 AM	986								
21-Jul-11 11:02 AM	992				-20.757	32.22	2.03	27950.29	
21-Jul-11 11:30 AM	1020			21.450	0.693				
21-Jul-11 11:31 AM	1021					32.24	2.03		
21-Jul-11 12:36 PM	1086			21.450	0.693			29077.16	
21-Jul-11 12:37 PM	1087					32.25	2.03		
21-Jul-11 01:30 PM	1140			21.460	0.703			31210.28	
21-Jul-11 01:31 PM	1141					32.23	2.03		
21-Jul-11 02:30 PM	1200			21.455	0.698			32932.45	
21-Jul-11 02:31 PM	1201					32.26	2.04		
21-Jul-11 03:30 PM	1260			21.460	0.703			34864.92	
21-Jul-11 03:31 PM	1261					32.28	2.04		
21-Jul-11 04:30 PM	1320			21.450	0.693			36825.69	
21-Jul-11 04:31 PM	1321					32.25	2.03		
21-Jul-11 05:30 PM	1380			21.460	0.703			38749.15	
21-Jul-11 05:31 PM	1381					32.31	2.04		
21-Jul-11 06:30 PM	1440			21.475	0.718			40662.37	
21-Jul-11 06:31 PM	1441					32.21	2.03		
21-Jul-11 07:30 PM	1500			21.482	0.725			42598.61	
21-Jul-11 07:31 PM	1501					32.22	2.03		
21-Jul-11 08:20 PM	1550							44569.45	Opened sampling port to collect water sample.
21-Jul-11 08:37 PM	1567			21.485	0.728				
21-Jul-11 08:39 PM	1569			21.482	0.725	32.25	2.03		
21-Jul-11 08:40 PM	1570	0		21.482	0.725	32.22	2.03	46777.38	Stop pump. Start recovery.
21-Jul-11 08:41 PM	1571	1	1571.0	20.911	0.154				
21-Jul-11 08:42 PM	1572	2	786.0	20.885	0.128				
21-Jul-11 08:43 PM	1573.2	3.2	491.6	20.860	0.103				
21-Jul-11 08:44 PM	1574	4	393.5	20.861	0.104				
21-Jul-11 08:45 PM	1575	5	315.0	20.858	0.101				
21-Jul-11 08:46 PM	1576	6	262.7	20.855	0.098				

Watterson Geoscience Inc. **Bingay Mine** **Project 11-007** **24-Hour Test**

Well ID: **MW11-28vS**
Well Depth: 38.7 m below ground surface
Casing Stickup: 0.46 m
Ground Elevation: 1420.21 m above sea level
Lithology: Overburden
First Water-Bearing Fracture: 56.3 m below ground surface
Static Water Level Before 24-Hour Test: 20.757 m-toc
Transducer Depth: 34.4 m-toc
Tested By: D.Watterson, P.Geo., Watterson Geoscience Inc. & Dennis Thompson

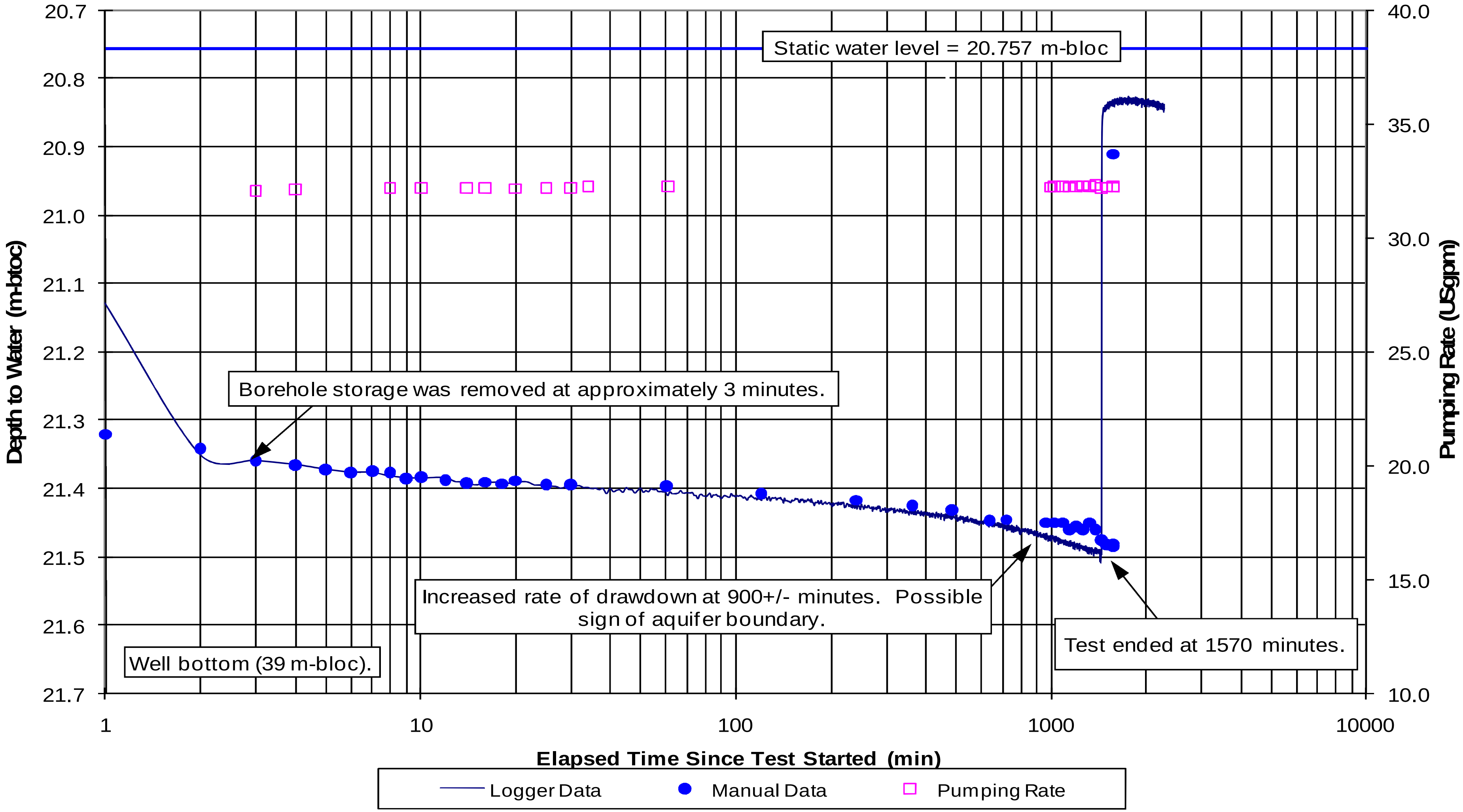
21-Jul-11 08:47 PM	1577	7	225.3	20.849	0.092					
21-Jul-11 08:48 PM	1578	8	197.3	20.848	0.091					
21-Jul-11 08:49 PM	1579	9	175.4	20.846	0.089					
21-Jul-11 08:50 PM	1580	10	158.0	20.843	0.086					
21-Jul-11 08:52 PM	1582	12	131.8	20.845	0.088					
21-Jul-11 08:55 PM	1585	15	105.7	20.840	0.083					
21-Jul-11 09:00 PM	1590	20	79.5	20.837	0.080					
21-Jul-11 09:10 PM	1600	30	53.3	20.839	0.082					
21-Jul-11 09:30 PM	1620	50	32.4	20.834	0.077					
21-Jul-11 10:00 PM	1650	80	20.6	20.831	0.074					
21-Jul-11 10:40 PM	1680	110	15.3	20.823	0.066					
22-Jul-11 08:40 AM	2280	710	3.2	20.829	0.072					

Figure B14: 165-Minute Step-Drawdown Test - MW11-28vS
Depth to Water versus Time (Linear Scale)
July 19, 2011



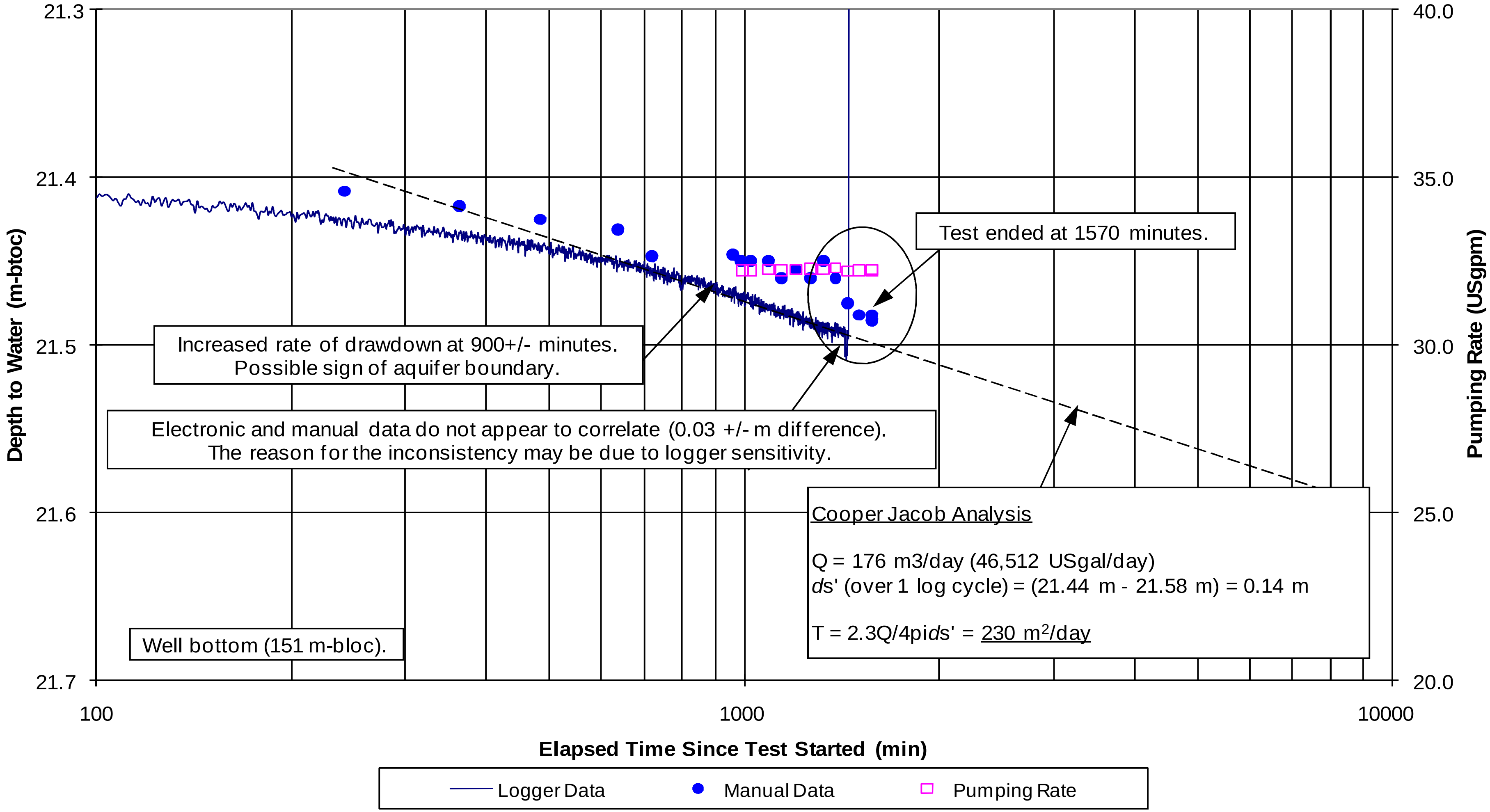
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B14

Figure B15: 26-Hour Test - MW11-28vS
Depth to Water versus Time (Log Scale)
July 20 to July 21, 2011



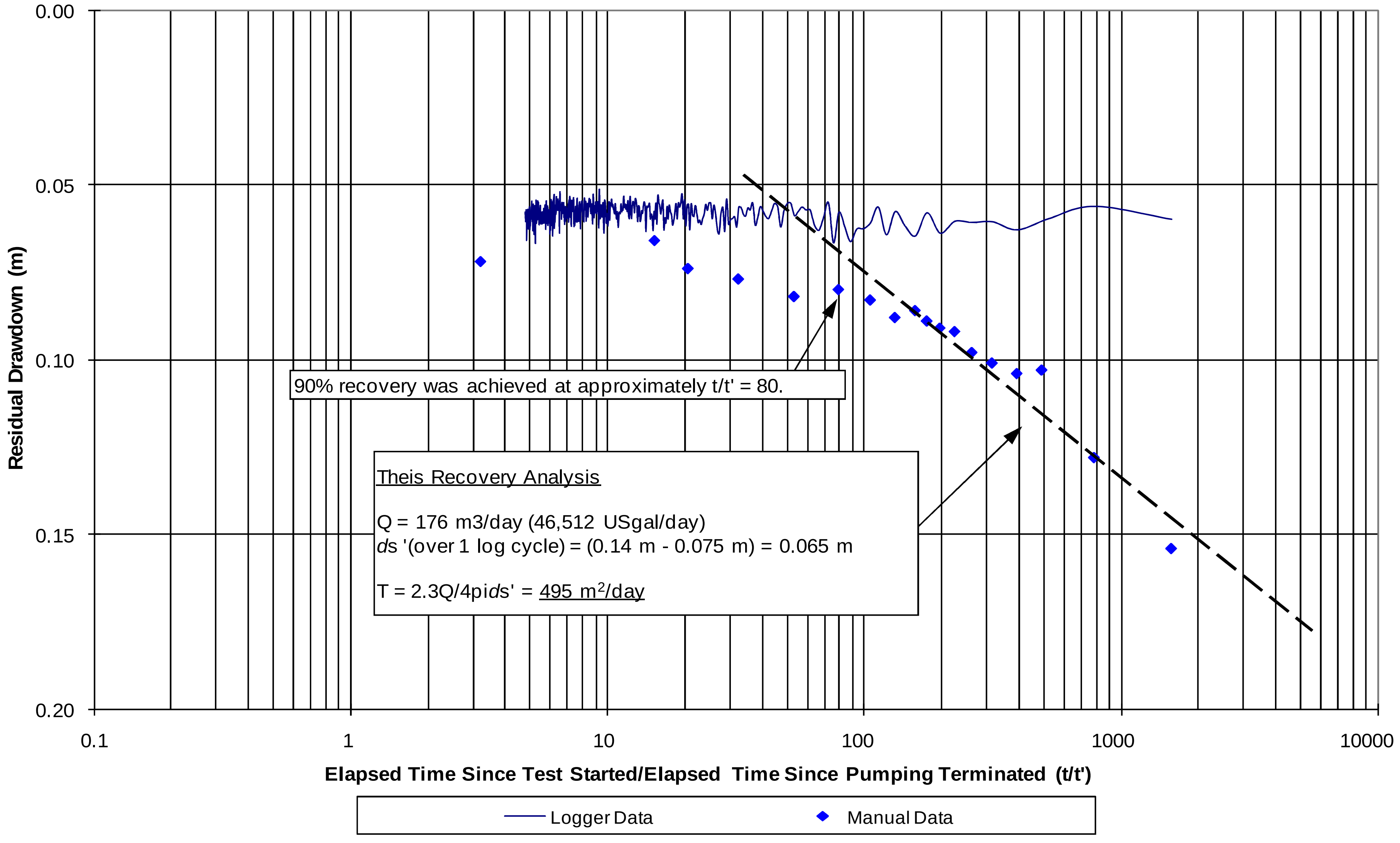
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B15

Figure B16: 26-Hour Test - MW11-28vS
Depth to Water versus Time (Log Scale)
Between 100 and 2000 Minutes
July 20 to July 21, 2011



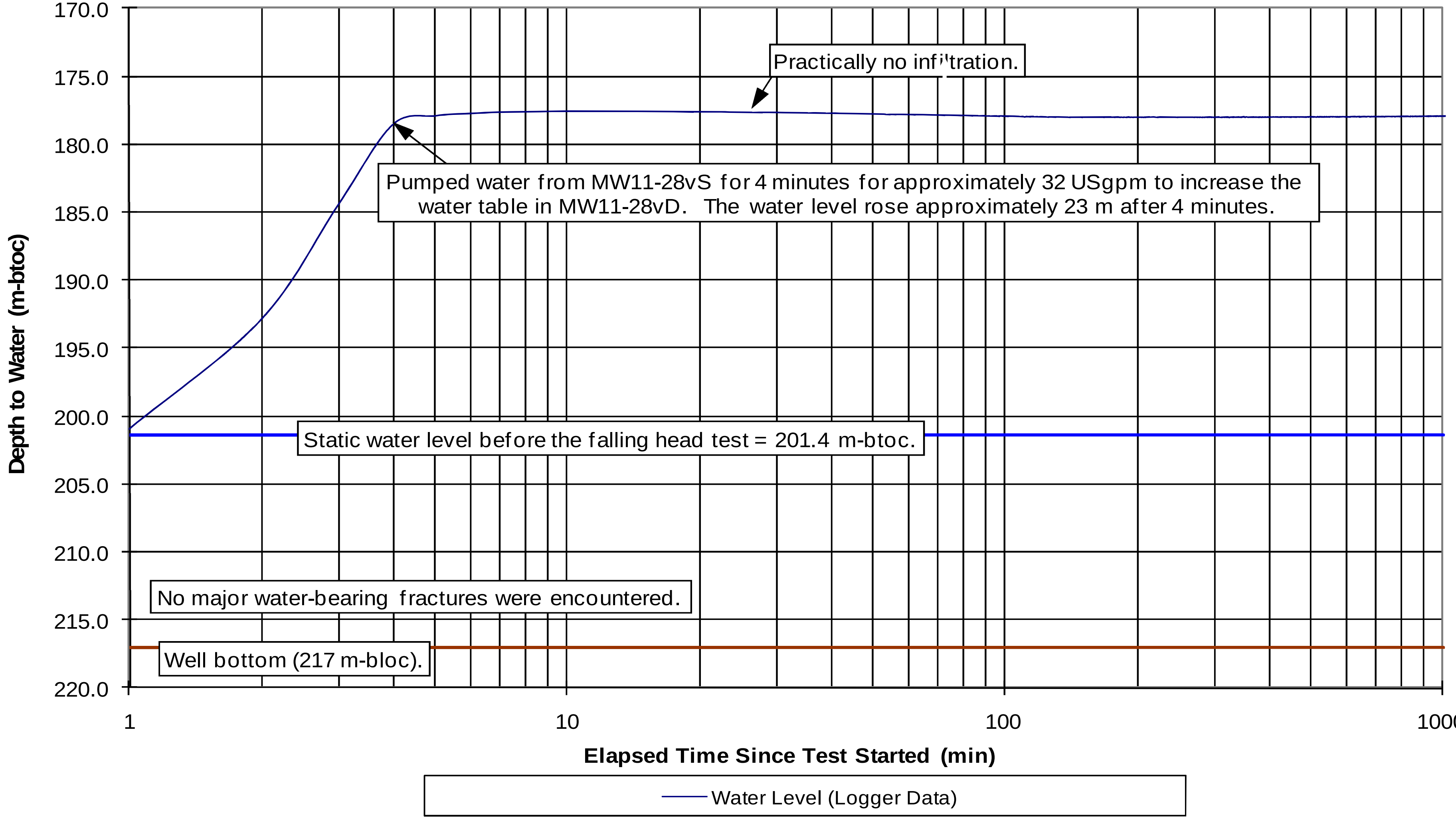
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B16

Figure B17: 26-Hour Pumping Test - MW11-28vS
Residual Drawdown versus t/t' (Log Scale)



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B17

Figure B18: Falling Head Test - MW11-28vD
Depth to Water versus Time (Log Scale)
July 22, 2011



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B18

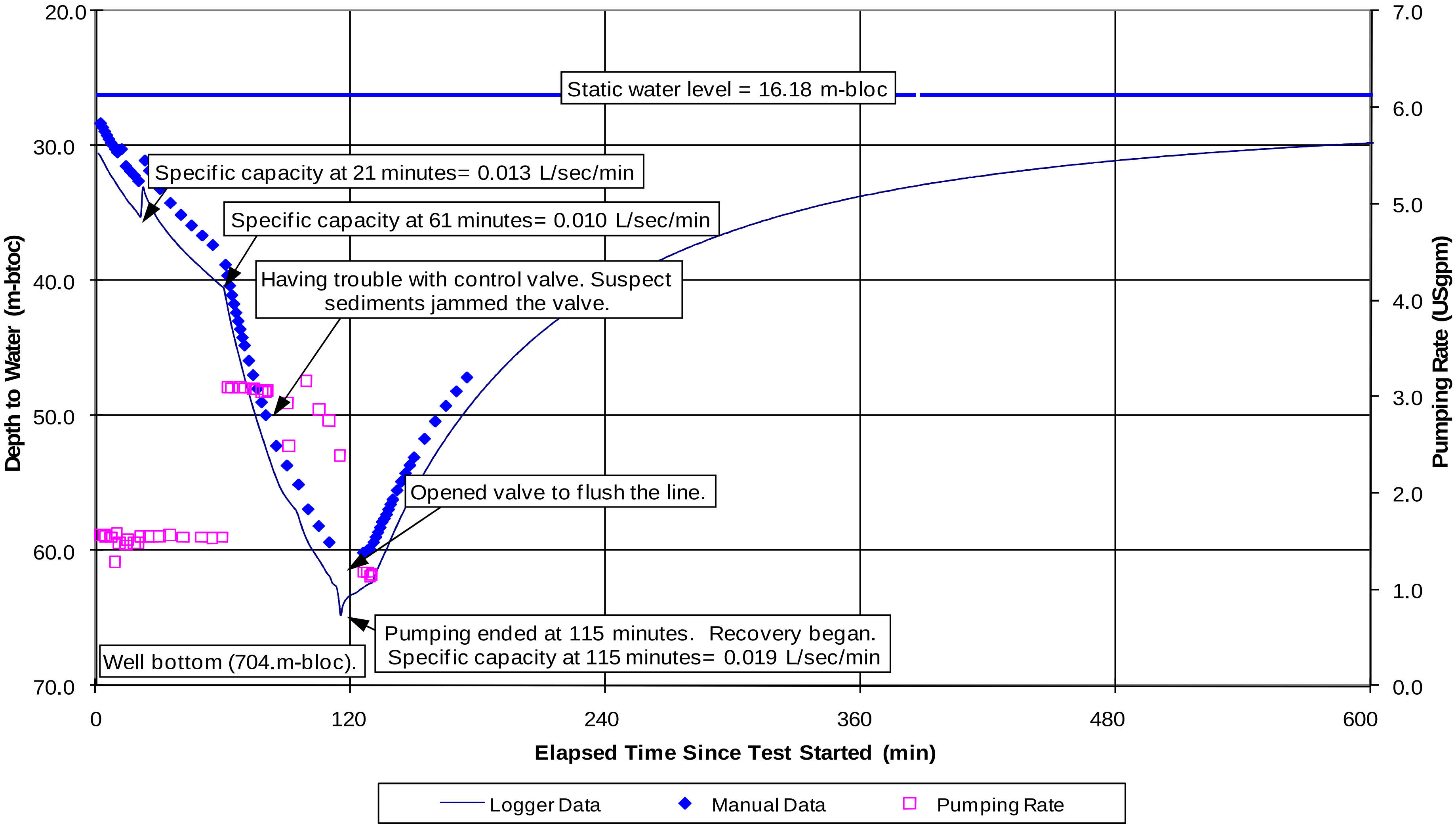
Watterson Geoscience Inc.	Bingay Mine			Step-Drawdown Test	
Well ID:	**MW11-43vS**			**Project 11-007**	
Well Depth:				102.4 m	
Casing Stickup:				0.36 m	
Ground Elevation:				1398 m above sea level	
Lithology:				Bedrock	
First Water-Bearing Fracture:				56.3 m below ground surface	
Static Water Level Before 24-Hour Test:				10.80 m-toc	
Transducer Depth:				70 m-toc	
Tested By:				Watterson Geoscience Inc. & Thompson Drilling Ltd.	
Start Date	7/18/2011		End Date	7/18/2011	

Time	Elapsed Time (min)	Depth to Water (m)	Pumping Rate	Totalizing Flow Meter	Remarks
	minutes	meters	US gpm	US gal	
5:57					
6:30					
6:37					
6:39					
6:40	0				
	1				
	2	28.281	1.57		
	2.5			5.16	
	3	28.581	1.56		
	4	28.887	1.55		
	5	29.177			
	6	29.46	1.54		
	7	29.734	1.54		
	7.5			12.9	
	8	29.954	1.29		Valve Adujstment was constant
	9	30.194	1.58		
6:50	10	30.45	1.48		
	11			18.07	
	12	30.193	1.46		
	14	31.464	1.52		
	15			24.21	
	16	31.841	1.48		
	18	32.166	1.48		
7:00	20	32.574	1.55		
	21			33.24	
7:03	23	31.046	1.55		Water breaking in?
	25	31.8	1.55		
7:10	30	33.155	1.56		
	35	34.199			
7:20	40	35.083	1.54		
	41			64.36	
	45	35.869	1.54		
7:30	50	36.612	1.53		
	55	37.324	1.54		
	59.5			92.9	
7:40	60				
	61	38.785	3.1		
	62	39.59			
	62.5			101.11	
	63	40.339	3.09		
	64	41.046			
	65	41.701			

Watterson Geoscience Inc.	**Bingay Mine**	**Step-Drawdown Test**
Well ID: **MW11-43vS**		**Project 11-007**
Well Depth:		102.4 m
Casing Stickup:		0.36 m
Ground Elevation:		1398 m above sea level
Lithology:		Bedrock
First Water-Bearing Fracture:		56.3 m below ground surface
Static Water Level Before 24-Hour Test:		10.80 m-toc
Transducer Depth:		70 m-toc
Tested By:		Watterson Geoscience Inc. & Thompson Drilling Ltd.
Start Date 7/18/2011	End Date	7/18/2011

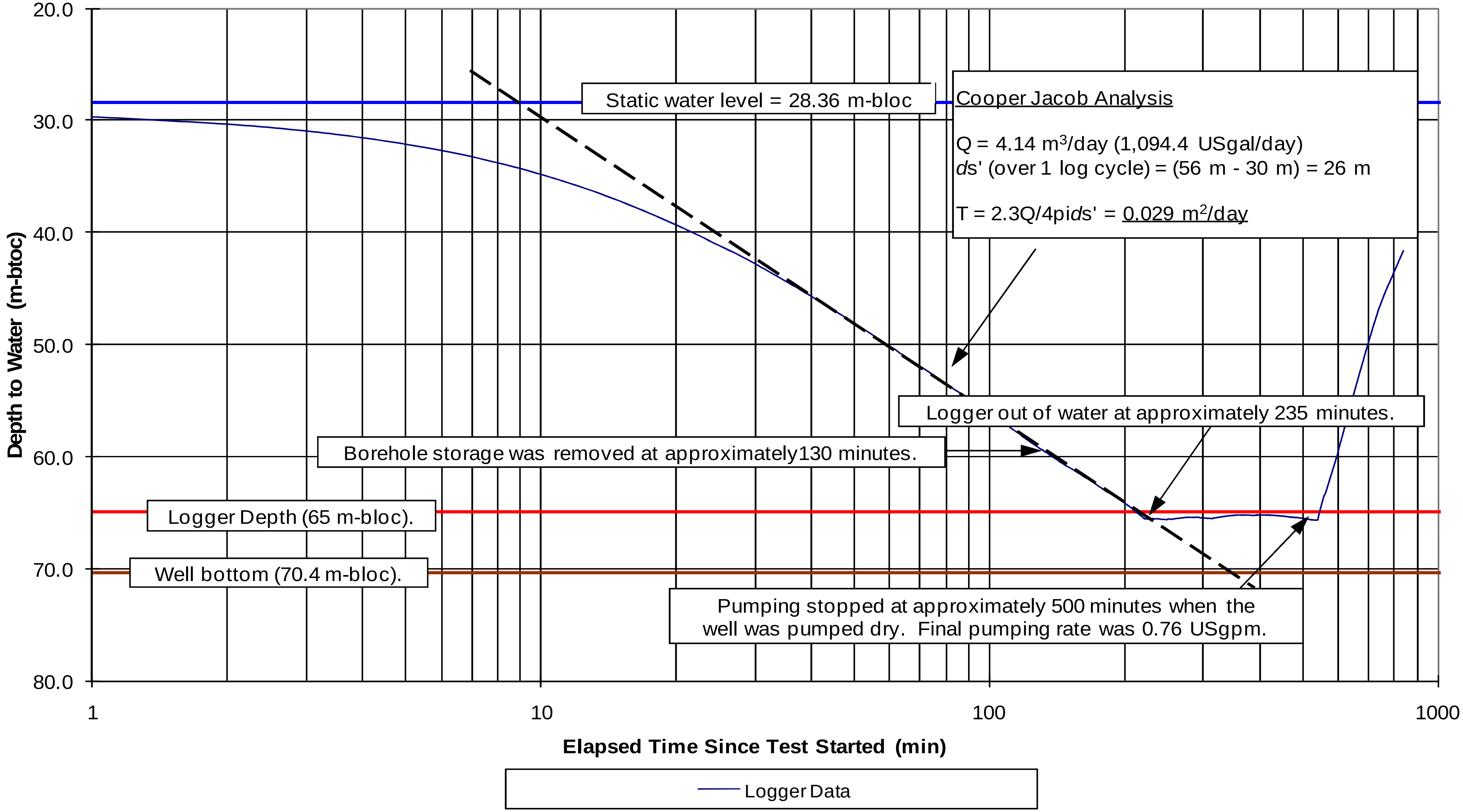
	66	42.343			
	67	42.974	3.1		
	68	43.575			
	69	44.196	3.09		
7:50	70	44.776			
	71			127.45	
	72	45.913	3.08		
	74	46.986	3.07		
	76	47.998	3.05		
	78	49	3.05		
8:00	80	49.961	3.06		Started having trouble controlling line
	81			158.17	Sediment jamming valve?
	85	52.238	2.93		
8:10	90	53.696	2.49		
	91			186.49	
	95.5	55.11	3.16		
	99			209.16	
8:20	100	56.941	2.87		
	105	58.193	2.75		
8:30	110	59.398	2.39		
	115				Opened valve to flush
8:38	118		1.18		
8:46	126	60.165	1.18		
8:48	128	59.985	1.14		
8:49	129	59.895	1.15		
8:50	130				Shut off pump
	131	59.394			
	132	59.014			
	133	58.663			
	134	58.303			
	135	57.882			
	136	57.639			
	137	57.33			
	138	56.957			
	139	56.581			
9:00	140	56.222			
	142	55.543			
	144	54.889			
	146	54.271			
	148	53.677			
9:10	150	53.094			
	155	51.711			
9:20	160	50.42			
	165	49.26			
9:30	170	48.182			
9:35	175	47.155			

Figure B19: 115-Minute Step Test - MW11-43vS
Depth to Water versus Time (Linear Scale)
July 17, 2011



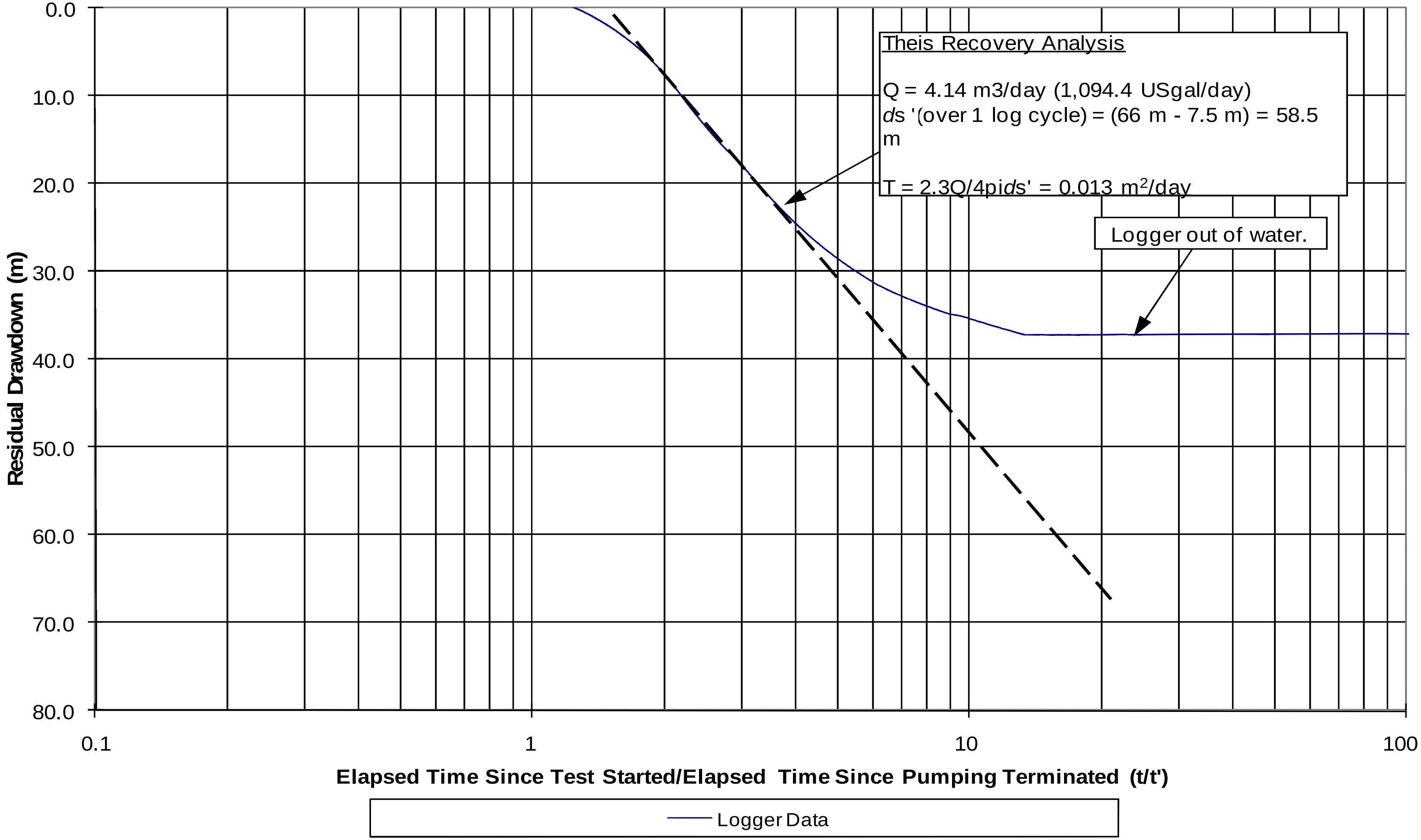
Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B19

Figure B20: 8-Hour Test - MW11-43vS
Depth to Water versus Time (Log Scale)
July 18, 2011



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B20

Figure B21: 8-Hour Pumping Test - MW11-43vS
Residual Drawdown versus t/t' (Log Scale)



Preliminary Hydrogeological Investigation Proposed Bingay Coal Mine	Project No: 11:007
Client: Centermount Coal Ltd.	Figure No: B21

Appendix D – Groundwater Chemistry

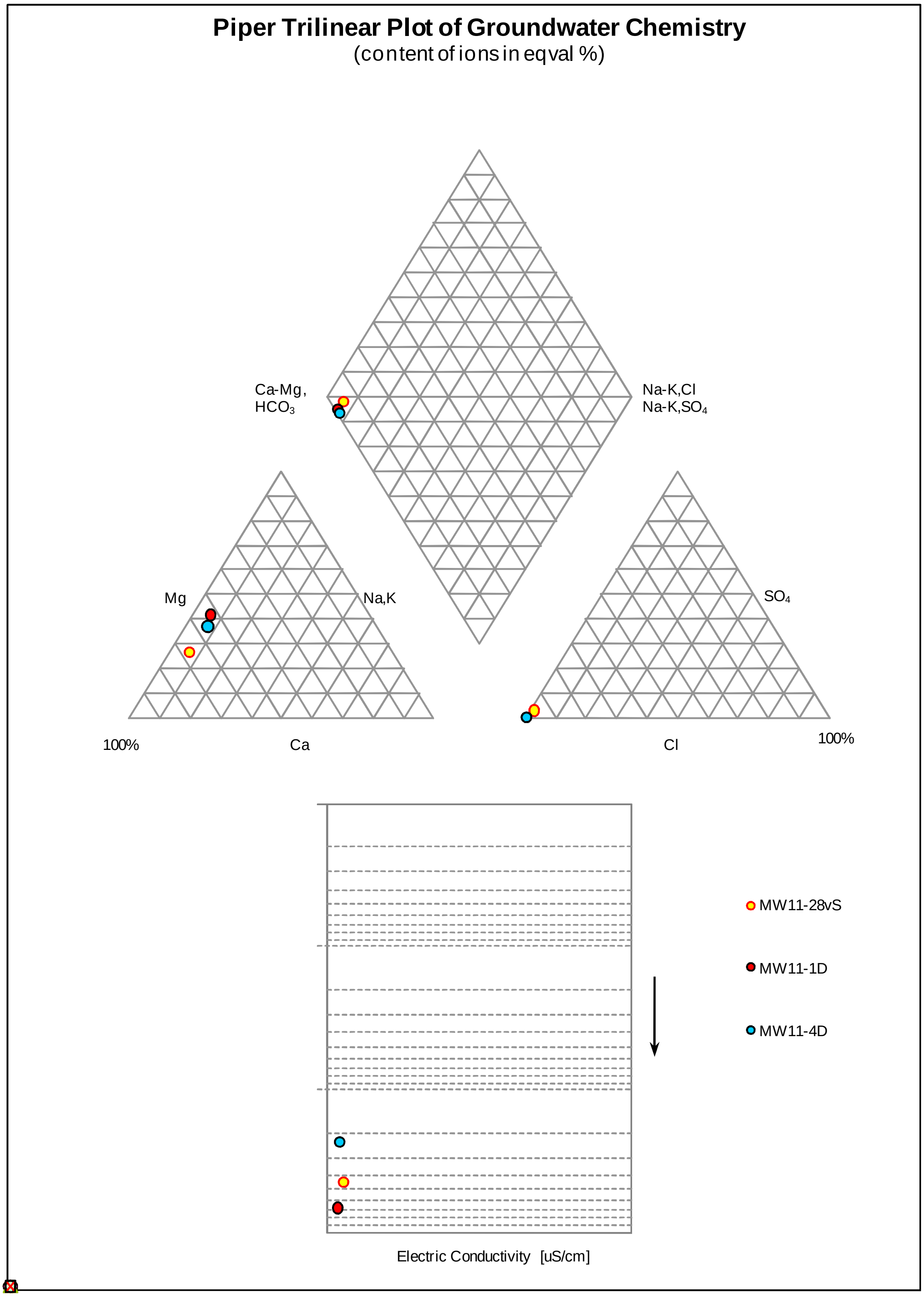

Piper Trilinear Plot of Groundwater Chemistry
(content of ions in eqval %)
Ca-Mg,
HCO_3
Na-K,Cl
Na-K,SO_4
Mg
Na,K
SO_4
100%
Ca
Cl
100%
MW11-28vS
MW11-1D
MW11-4D
Electric Conductivity [uS/cm]

Table D1: Bingay Groundwater Quality Analyses Summary

	Maxxam Report Date	26-Jul-11	26-Jul-11	04-Aug-11	Canadian Water Quality Guidelines for Aquatic Life	
	Sampling Date	13-Jul-11	13-Jul-11	21-Jul-11		
	Sampled by:	D. Thompson	D. Thompson	D. Thompson	Approved	Working
		Well				
	Units	MW11-28vS	MW11-1D	MW11-4D		
		Overburden	Bedrock	Bedrock		
Anions						
Alkalinity (PP as CaCO3)	mg/L	<0.5	<0.5	<0.5		
Alkalinity (Total as CaCO3)	mg/L	220	330	390		
Bicarbonate (HCO3)	mg/L	270	400	480		
Carbonate (CO3)	mg/L	<0.5	<0.5	<0.5		
Dissolved Fluoride (F)	mg/L	0.35	0.32	0.66	0.3[a]	
Hydroxide (OH)	mg/L	<0.5	<0.5	<0.5		
Hardness (CaCO3)	mg/L	230	290	330		
Dissolved Sulphate (SO4)	mg/L	7	<1	<1	100	
Dissolved Chloride (Cl)	mg/L	2	1	1	150	
Nutrients						
Total Ammonia (N)	mg/L	0.09	1.0	4.7 (1)		
Dissolved Phosphorus (P)	mg/L	0.003	<0.003	<0.003		
Total Phosphorus (P)	mg/L	0.007	0.018	0.013		
Total Total Kjeldahl Nitrogen	mg/L	0.14	1.3	4.5 (2)		
Dissolved Nitrite (N)	mg/L	<0.003	<0.003	<0.003	0.02	
Dissolved Nitrate (N)	mg/L	<0.003	<0.003	<0.003	3	
Physical Properties						
Turbidity	NTU	1.6	36	50		
Conductivity	uS/cm	410	560	690		
pH	N/A	8.00	7.99	7.90		
Total Dissolved Solids	mg/L	250	300	360		
Total Suspended Solids	mg/L	<1	12	9		
Total Metals						
Total Aluminum (Al)	mg/L	0.004	1.1	0.11	0.1	
Total Antimony (Sb)	mg/L	0.0016	<0.0006	0.0008		0.02
Total Arsenic (As)	mg/L	0.0008	0.0017	0.0022	0.005	
Total Barium (Ba)	mg/L	0.81	8.6	2.9		1
Total Beryllium (Be)	mg/L	<0.001	<0.001	<0.001		0.0053
Total Boron (B)	mg/L	<0.02	<0.02	0.05	1.2	
Total Calcium (Ca)	mg/L	70	66	84		
Total Chromium (Cr)	mg/L	<0.001	0.003	0.004		0.0089
Total Cobalt (Co)	mg/L	<0.0003	0.0003	0.0006	0.004	
Total Copper (Cu)	ug/L	0.3	2.9	2.5	0.04[a]	
Total Iron (Fe)	mg/L	0.20	2.8	6.5	1	
Total Lead (Pb)	mg/L	<0.0002	0.0006	0.0008	0.01	
Total Lithium (Li)	mg/L	<0.02	0.07	0.15		
Total Magnesium (Mg)	mg/L	17	32	34		0.87
Total Manganese (Mn)	mg/L	0.025	0.036	0.037	1.9[a]	
Total Molybdenum (Mo)	mg/L	0.0033	0.0014	0.0009	1	
Total Nickel (Ni)	mg/L	<0.0005	0.0016	0.0042		150[a]
Total Phosphorus (P)	mg/L	<0.1	0.1	0.1		
Total Potassium (K)	mg/L	0.9	6.3	17		
Total Selenium (Se)	mg/L	0.0002	<0.0002	<0.0002	0.002	

Table D1 (Cont.): Bingay Groundwater Quality Analyses Summary

	Maxxam Report Date	26-Jul-11	26-Jul-11	04-Aug-11	Canadian Water Quality Guidelines for Aquatic Life	
	Sampling Date	13-Jul-11	13-Jul-11	21-Jul-11		
	Sampled by:	D. Thompson	D. Thompson	D. Thompson	Approved	Working
		Well				
	Units	MW11-28vS	MW11-1D	MW11-4D		
		Overburden	Bedrock	Bedrock		
Total Silicon (Si)	mg/L	4.2	5.7	2.9		
Total Silver (Ag)	mg/L	<0.0001	<0.0001	<0.0001	0.003[a]	
Total Sodium (Na)	mg/L	7.2	4.5	2.4		200
Total Strontium (Sr)	mg/L	0.28	1.1	0.23		
Total Sulphur (S)	mg/L	2.2	0.2	0.3		
Total Thallium (Tl)	mg/L	<0.0002	<0.0002	<0.0002		0.0017
Total Tin (Sn)	mg/L	<0.001	<0.001	<0.001		
Total Titanium (Ti)	mg/L	<0.001	0.030	0.002		2
Total Uranium (U)	mg/L	0.0007	0.0002	0.0005	0.02	
Total Vanadium (V)	mg/L	0.002	0.005	0.002		0.006
Total Zinc (Zn)	mg/L	0.007	0.016	0.026	0.265 [a]	
Dissolved Metals						
Dissolved Aluminum (Al)	mg/L	0.001	0.004	0.002		
Dissolved Antimony (Sb)	mg/L	0.0013	<0.0006	<0.0006		
Dissolved Arsenic (As)	mg/L	0.0002	<0.0002	<0.0002		
Dissolved Barium (Ba)	mg/L	0.76	8.5	2.8		
Dissolved Beryllium (Be)	mg/L	<0.001	<0.001	<0.001		
Dissolved Boron (B)	mg/L	<0.02	<0.02	0.05		
Dissolved Calcium (Ca)	mg/L	66	64	81		
Dissolved Chromium (Cr)	mg/L	<0.001	<0.001	<0.001		
Dissolved Cobalt (Co)	mg/L	<0.0003	<0.0003	0.0004		
Dissolved Copper (Cu)	mg/L	0.0002	0.0014	0.0005		
Dissolved Iron (Fe)	mg/L	0.15	0.06	0.08		
Dissolved Lead (Pb)	mg/L	<0.0002	<0.0002	<0.0002		
Dissolved Lithium (Li)	mg/L	<0.02	0.07	0.15		
Dissolved Magnesium (Mg)	mg/L	16	31	32		
Dissolved Manganese (Mn)	mg/L	0.024	0.030	0.029		
Dissolved Molybdenum (Mo)	mg/L	0.0028	0.0005	0.0010 (1)		
Dissolved Nickel (Ni)	mg/L	<0.0005	0.0006	0.0030		
Dissolved Phosphorus (P)	mg/L	<0.1	<0.1	<0.1		
Dissolved Potassium (K)	mg/L	0.8	5.8	17		
Dissolved Selenium (Se)	mg/L	<0.0002	<0.0002	<0.0002		
Dissolved Silicon (Si)	mg/L	3.9	2.6	2.5		
Dissolved Silver (Ag)	mg/L	<0.0001	<0.0001	<0.0001		
Dissolved Sodium (Na)	mg/L	6.7	4.4	2.3		
Dissolved Strontium (Sr)	mg/L	0.27	1.1	0.22		
Dissolved Sulphur (S)	mg/L	2.2	<0.2	0.3 (2)		
Dissolved Thallium (Tl)	mg/L	<0.0002	<0.0002	<0.0002		
Dissolved Tin (Sn)	mg/L	<0.001	<0.001	<0.001		
Dissolved Titanium (Ti)	mg/L	<0.001	<0.001	<0.001		
Dissolved Uranium (U)	mg/L	0.0006	0.0001	0.0003		
Dissolved Vanadium (V)	mg/L	<0.001	<0.001	<0.001		
Dissolved Zinc (Zn)	mg/L	0.004	0.010	0.031		

Table D1 (Cont.): Bingay Groundwater Quality Analyses Summary

	Maxxam Report Date	26-Jul-11	26-Jul-11	04-Aug-11	Canadian Water Quality Guidelines for Aquatic Life	
	Sampling Date	13-Jul-11	13-Jul-11	21-Jul-11		
	Sampled by:	D. Thompson	D. Thompson	D. Thompson	Approved	Working
		Well				
	Units	MW11-28vS	MW11-1D	MW11-4D		
		Overburden	Bedrock	Bedrock		
Low Level Elements						
Total Mercury (Hg)	ug/L	0.003	<0.002	0.003	0.001[a]	
Dissolved Cadmium (Cd)	ug/L	0.010	0.014	<0.005		
Total Cadmium (Cd)	ug/L	0.010	0.045	0.026	0.005 [a]	
Extractable Petroleum Hydrocarbons						
EPH (C10-C19)	mg/L	<0.08	<0.08	<0.08		
EPH (C19-C32)	mg/L	<0.08	<0.08	<0.08		

Notes:

a - hardnes dependent

Gray shading indicates concentration above CWQG

Maxxam

Success Through Science®

Your Project #: BINJAY CREEK
Your C.O.C. #: A067970

Attention: DAN WATTERSON
WATTERSON GEOSCIENCE
685 PHEASANT RD
VERNON, BC
CANADA V1B 3B1

Report Date: 2011/08/04

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B167519
Received: 2011/07/26, 8:50

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2011/07/27	AB SOP-00005	SM 2320-B
Cadmium - low level CCME - Dissolved	1	N/A	2011/08/03	AB SOP-00043	EPA 200.8
Cadmium - low level CCME (Total)	1	2011/07/26	2011/08/04	AB SOP-00043	EPA 200.8
Chloride by Automated Colourimetry	1	N/A	2011/07/27	AB SOP-00020	EPA 325.2
Conductivity @25C	1	N/A	2011/07/27	AB SOP-00005	SM 2510-B
BC Hydrocarbons in Water by GC/FID	1	2011/07/29	2011/07/30	CAL SOP-00239	Based BCCSR Method 4
Fluoride	1	N/A	2011/07/28	AB SOP-00005	SM 4500-F C
Hardness	1	N/A	2011/08/03	CAL WI-00053	AEMM, Method 423
Mercury - Low Level (Total)	1	2011/08/02	2011/08/02	CAL SOP-00007	EPA 1631
Elements by ICP - Dissolved	1	N/A	2011/08/02	AB SOP-00042	EPA 200.7
Elements by ICP - Total	1	2011/07/31	2011/08/02	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	1	N/A	2011/08/02	AB SOP-00043	EPA 200.8
Elements by ICPMS - Total	1	2011/07/31	2011/08/02	AB SOP-00043	EPA 200.8
Ion Balance	1	N/A	2011/07/27	AB WI-00065	SM 1030E
Sum of cations, anions	1	N/A	2011/08/03	AB WI-00065	SM 1030E
Ammonia-N (Total)	1	N/A	2011/07/27	AB SOP-00007	EPA 350.1
Nitrate and Nitrite	1	N/A	2011/07/29		CAL SOP-00060
Nitrate + Nitrite-N (calculated)	1	N/A	2011/07/29	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	1	N/A	2011/07/28	AB SOP-00023	SM 4110-B
pH @25°C (Alkalinity titrator)	1	N/A	2011/07/27	AB SOP-00005	SM 4500-H+B
Sulphate by Automated Colourimetry	1	N/A	2011/07/27	AB SOP-00018	EPA 375.4
Total Dissolved Solids (Filt. Residue)	1	2011/07/28	2011/07/29	CAL SOP-00074	SM 2540-C
Total Dissolved Solids (Calculated)	1	N/A	2011/08/03		SM 1030 E
Total Kjeldahl Nitrogen	1	2011/07/29	2011/07/29	AB SOP-00008	EPA 351.1, 351.2
Phosphorous -P (Total, Dissolved)	1	2011/07/29	2011/07/29	AB SOP-00024	SM 4500-P
Total Phosphorous	1	2011/07/29	2011/07/29	AB SOP-00024	SM 4500-P
Total Suspended Solids (NFR)	1	2011/07/28	2011/07/28	CAL SOP-00075	SM 2540-D
Turbidity	1	N/A	2011/07/28	CAL SOP-00081	SM 2130-B

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

../2

Your Project #: BINJAY CREEK
Your C.O.C. #: A067970

Attention: DAN WATTERSON
WATTERSON GEOSCIENCE
685 PHEASANT RD
VERNON, BC
CANADA V1B 3B1

Report Date: 2011/08/04

CERTIFICATE OF ANALYSIS

-2-

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Cynny Hagen, Project Manager
Email: CHagen@maxxam.ca
Phone# (403) 735-2239 Ext:2239

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam

Success Through Science®

Maxxam Job #: B167519
Report Date: 2011/08/04

WATTERSON GEOSCIENCE
Client Project #: BINJAY CREEK

Sampler Initials: DT

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		BC2050		
Sampling Date		2011/07/21 20:25		
COC Number		A067970		
	Units	**V-28 S**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	meq/L	4.6	N/A	5038360
Cation Sum	meq/L	4.9	N/A	5038360
Hardness (CaCO3)	mg/L	230	0.5	5041541
Ion Balance	N/A	1.1	0.01	5038359
Dissolved Nitrate (NO3)	mg/L	<0.01	0.01	5041536
Nitrate plus Nitrite (N)	mg/L	<0.003	0.003	5041537
Dissolved Nitrite (NO2)	mg/L	<0.01	0.01	5041536
Total Dissolved Solids	mg/L	230	10	5038365
Misc. Inorganics				
Conductivity	uS/cm	410	1	5045259
pH	N/A	8.00	N/A	5045260
Total Dissolved Solids	mg/L	250	10	5045785
Total Suspended Solids	mg/L	<1	1	5045784
Low Level Elements				
Dissolved Cadmium (Cd)	ug/L	0.010	0.005	5039018
Total Cadmium (Cd)	ug/L	0.010	0.005	5039019
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.5	0.5	5045224
Alkalinity (Total as CaCO3)	mg/L	220	0.5	5045224
Bicarbonate (HCO3)	mg/L	270	0.5	5045224
Carbonate (CO3)	mg/L	<0.5	0.5	5045224
Dissolved Fluoride (F)	mg/L	0.35	0.05	5046014
Hydroxide (OH)	mg/L	<0.5	0.5	5045224
Dissolved Sulphate (SO4)	mg/L	7	1	5044072
Dissolved Chloride (Cl)	mg/L	2	1	5044026
Nutrients				
Total Ammonia (N)	mg/L	0.09	0.05	5042019
Dissolved Phosphorus (P)	mg/L	0.003	0.003	5052043
Total Phosphorus (P)	mg/L	0.007	0.003	5051975
Total Total Kjeldahl Nitrogen	mg/L	0.14	0.05	5052513
Dissolved Nitrite (N)	mg/L	<0.003	0.003	5045829
Dissolved Nitrate (N)	mg/L	<0.003	0.003	5045829

RDL = Reportable Detection Limit

Maxxam Job #: B167519
Report Date: 2011/08/04

WATTERSON GEOSCIENCE
Client Project #: BINJAY CREEK

Sampler Initials: DT

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		BC2050		
Sampling Date		2011/07/21 20:25		
COC Number		A067970		
	Units	**V-28 S**	**RDL**	**QC Batch**

Physical Properties				
Turbidity	NTU	1.6	0.1	5045787

RDL = Reportable Detection Limit

Maxxam

WATTERSON GEOSCIENCE
Maxxam Job #: B167519
Client Project #: BINJAY CREEK
Report Date: 2011/08/04

Sampler Initials: DT

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		BC2050	BC2050		
Sampling Date		2011/07/21 20:25	2011/07/21 20:25		
COC Number		A067970	A067970		
	Units	**V-28 S**	**V-28 S Lab-Dup**	**RDL**	**QC Batch**
Elements					
Dissolved Aluminum (Al)	mg/L	0.001	<0.001	0.001	5053372
Total Aluminum (Al)	mg/L	0.004	N/A	0.002	5053371
Dissolved Antimony (Sb)	mg/L	0.0013	0.0013	0.0006	5053372
Total Antimony (Sb)	mg/L	0.0016	N/A	0.0006	5053371
Dissolved Arsenic (As)	mg/L	0.0002	0.0002	0.0002	5053372
Total Arsenic (As)	mg/L	0.0008	N/A	0.0002	5053371
Dissolved Barium (Ba)	mg/L	0.76	N/A	0.01	5054240
Total Barium (Ba)	mg/L	0.81	N/A	0.01	5054188
Dissolved Beryllium (Be)	mg/L	<0.001	<0.001	0.001	5053372
Total Beryllium (Be)	mg/L	<0.001	N/A	0.001	5053371
Dissolved Boron (B)	mg/L	<0.02	N/A	0.02	5054240
Total Boron (B)	mg/L	<0.02	N/A	0.02	5054188
Dissolved Calcium (Ca)	mg/L	66	N/A	0.3	5054240
Total Calcium (Ca)	mg/L	70	N/A	0.3	5054188
Dissolved Chromium (Cr)	mg/L	<0.001	<0.001	0.001	5053372
Total Chromium (Cr)	mg/L	<0.001	N/A	0.001	5053371
Dissolved Cobalt (Co)	mg/L	<0.0003	<0.0003	0.0003	5053372
Total Cobalt (Co)	mg/L	<0.0003	N/A	0.0003	5053371
Dissolved Copper (Cu)	mg/L	0.0002	<0.0002	0.0002	5053372
Total Copper (Cu)	mg/L	0.0003	N/A	0.0002	5053371
Dissolved Iron (Fe)	mg/L	0.15	N/A	0.06	5054240
Total Iron (Fe)	mg/L	0.20	N/A	0.06	5054188
Dissolved Lead (Pb)	mg/L	<0.0002	<0.0002	0.0002	5053372
Total Lead (Pb)	mg/L	<0.0002	N/A	0.0002	5053371
Dissolved Lithium (Li)	mg/L	<0.02	N/A	0.02	5054240
Total Lithium (Li)	mg/L	<0.02	N/A	0.02	5054188
Dissolved Magnesium (Mg)	mg/L	16	N/A	0.2	5054240
Total Magnesium (Mg)	mg/L	17	N/A	0.2	5054188
Dissolved Manganese (Mn)	mg/L	0.024	N/A	0.004	5054240
Total Manganese (Mn)	mg/L	0.025	N/A	0.004	5054188
Dissolved Molybdenum (Mo)	mg/L	0.0028	0.0029	0.0002	5053372

N/A = Not Applicable
RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

Maxxam Job #: B167519
Report Date: 2011/08/04

WATTERSON GEOSCIENCE
Client Project #: BINJAY CREEK

Sampler Initials: DT

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		BC2050	BC2050		
Sampling Date		2011/07/21 20:25	2011/07/21 20:25		
COC Number		A067970	A067970		
	Units	**V-28 S**	**V-28 S Lab-Dup**	**RDL**	**QC Batch**
Total Molybdenum (Mo)	mg/L	0.0033	N/A	0.0002	5053371
Dissolved Nickel (Ni)	mg/L	<0.0005	<0.0005	0.0005	5053372
Total Nickel (Ni)	mg/L	<0.0005	N/A	0.0005	5053371
Dissolved Phosphorus (P)	mg/L	<0.1	N/A	0.1	5054240
Total Phosphorus (P)	mg/L	<0.1	N/A	0.1	5054188
Dissolved Potassium (K)	mg/L	0.8	N/A	0.3	5054240
Total Potassium (K)	mg/L	0.9	N/A	0.3	5054188
Dissolved Selenium (Se)	mg/L	<0.0002	<0.0002	0.0002	5053372
Total Selenium (Se)	mg/L	0.0002	N/A	0.0002	5053371
Dissolved Silicon (Si)	mg/L	3.9	N/A	0.1	5054240
Total Silicon (Si)	mg/L	4.2	N/A	0.1	5054188
Dissolved Silver (Ag)	mg/L	<0.0001	<0.0001	0.0001	5053372
Total Silver (Ag)	mg/L	<0.0001	N/A	0.0001	5053371
Dissolved Sodium (Na)	mg/L	6.7	N/A	0.5	5054240
Total Sodium (Na)	mg/L	7.2	N/A	0.5	5054188
Dissolved Strontium (Sr)	mg/L	0.27	N/A	0.02	5054240
Total Strontium (Sr)	mg/L	0.28	N/A	0.02	5054188
Dissolved Sulphur (S)	mg/L	2.2	N/A	0.2	5054240
Total Sulphur (S)	mg/L	2.2	N/A	0.2	5054188
Dissolved Thallium (Tl)	mg/L	<0.0002	<0.0002	0.0002	5053372
Total Thallium (Tl)	mg/L	<0.0002	N/A	0.0002	5053371
Dissolved Tin (Sn)	mg/L	<0.001	<0.001	0.001	5053372
Total Tin (Sn)	mg/L	<0.001	N/A	0.001	5053371
Dissolved Titanium (Ti)	mg/L	<0.001	<0.001	0.001	5053372
Total Titanium (Ti)	mg/L	<0.001	N/A	0.001	5053371
Dissolved Uranium (U)	mg/L	0.0006	0.0006	0.0001	5053372
Total Uranium (U)	mg/L	0.0007	N/A	0.0001	5053371
Dissolved Vanadium (V)	mg/L	<0.001	<0.001	0.001	5053372
Total Vanadium (V)	mg/L	0.002	N/A	0.001	5053371
Dissolved Zinc (Zn)	mg/L	0.004	<0.003	0.003	5053372
Total Zinc (Zn)	mg/L	0.007	N/A	0.003	5053371
Low Level Elements					
Total Mercury (Hg)	ug/L	0.003	N/A	0.002	5054256

N/A = Not Applicable
RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

Maxxam Job #: B167519
Report Date: 2011/08/04

WATTERSON GEOSCIENCE
Client Project #: BINJAY CREEK

Sampler Initials: DT

TOTAL PETROLEUM HYDROCARBONS (WATER)

Maxxam ID		BC2050		
Sampling Date		2011/07/21 20:25		
COC Number		A067970		
	Units	**V-28 S**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon				
EPH (C10-C19)	mg/L	<0.08	0.08	5049272
EPH (C19-C32)	mg/L	<0.08	0.08	5049272
Surrogate Recovery (%)				
O-TERPHENYL (sur.)	%	94	N/A	5049272

N/A = Not Applicable
RDL = Reportable Detection Limit

Package 1	6.3°C

Each temperature is the average of up to three cooler temperatures taken at receipt

General Comments

Results relate only to the items tested.

Maxxam

Success Through Science®

WATTERSON GEOSCIENCE
Attention: DAN WATTERSON
Client Project #: BINJAY CREEK
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: CB167519

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
5042019 IA0	Matrix Spike	Total Ammonia (N)	2011/07/27		NC	%	80 - 120
	Spiked Blank	Total Ammonia (N)	2011/07/27		105	%	86 - 110
	Method Blank	Total Ammonia (N)	2011/07/27	0.06, RDL=0.05		mg/L	
	RPD	Total Ammonia (N)	2011/07/27	2.9		%	20
5044026 ZI	Matrix Spike	Dissolved Chloride (Cl)	2011/07/27		NC	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2011/07/27		104	%	92 - 113
	Method Blank	Dissolved Chloride (Cl)	2011/07/27	<1		mg/L	
	RPD	Dissolved Chloride (Cl)	2011/07/27	0.7		%	20
5044072 ZI	Matrix Spike	Dissolved Sulphate (SO4)	2011/07/27		NC	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2011/07/27		109	%	91 - 116
	Method Blank	Dissolved Sulphate (SO4)	2011/07/27	<1		mg/L	
	RPD	Dissolved Sulphate (SO4)	2011/07/27	7.0		%	20
5045224 OMO	Spiked Blank	Alkalinity (Total as CaCO3)	2011/07/27		101	%	80 - 120
	Method Blank	Alkalinity (PP as CaCO3)	2011/07/27	<0.5		mg/L	
		Alkalinity (Total as CaCO3)	2011/07/27	0.7, RDL=0.5		mg/L	
		Bicarbonate (HCO3)	2011/07/27	0.8, RDL=0.5		mg/L	
		Carbonate (CO3)	2011/07/27	<0.5		mg/L	
		Hydroxide (OH)	2011/07/27	<0.5		mg/L	
	RPD	Alkalinity (PP as CaCO3)	2011/07/27	NC		%	20
		Alkalinity (Total as CaCO3)	2011/07/27	1.3		%	20
		Bicarbonate (HCO3)	2011/07/27	1.3		%	20
		Carbonate (CO3)	2011/07/27	NC		%	20
		Hydroxide (OH)	2011/07/27	NC		%	20
5045259 OMO	Spiked Blank	Conductivity	2011/07/27		100	%	92 - 106
	Method Blank	Conductivity	2011/07/27	<1		uS/cm	
	RPD	Conductivity	2011/07/27	0.1		%	20
5045260 OMO	Spiked Blank	pH	2011/07/27		100	%	97 - 102
	RPD	pH	2011/07/27	0.5		%	5
5045784 HE1	Spiked Blank	Total Suspended Solids	2011/07/28		95	%	81 - 105
	Method Blank	Total Suspended Solids	2011/07/28	<1		mg/L	
	RPD	Total Suspended Solids	2011/07/28	NC		%	20
5045785 HE1	Spiked Blank	Total Dissolved Solids	2011/07/29		99	%	80 - 113
	Method Blank	Total Dissolved Solids	2011/07/29	<10		mg/L	
	RPD	Total Dissolved Solids	2011/07/29	1.5		%	20
5045787 HE1	Spiked Blank	Turbidity	2011/07/28		96	%	93 - 99
	Method Blank	Turbidity	2011/07/28	<0.1		NTU	
	RPD	Turbidity	2011/07/28	3.5		%	20
5045829 RSM	Matrix Spike	Dissolved Nitrite (N)	2011/07/28		NC	%	80 - 120
		Dissolved Nitrate (N)	2011/07/28		NC	%	80 - 120
	Spiked Blank	Dissolved Nitrite (N)	2011/07/28		99	%	80 - 120
		Dissolved Nitrate (N)	2011/07/28		103	%	80 - 120
	Method Blank	Dissolved Nitrite (N)	2011/07/28	<0.003		mg/L	
		Dissolved Nitrate (N)	2011/07/28	<0.003		mg/L	
	RPD	Dissolved Nitrite (N)	2011/07/28	NC		%	20
		Dissolved Nitrate (N)	2011/07/28	1.1		%	20
5046014 OMO	Matrix Spike	Dissolved Fluoride (F)	2011/07/28		118	%	80 - 120
	Spiked Blank	Dissolved Fluoride (F)	2011/07/28		110	%	86 - 117
	Method Blank	Dissolved Fluoride (F)	2011/07/28	<0.05		mg/L	
	RPD	Dissolved Fluoride (F)	2011/07/28	1.6		%	20
5049272 SR2	Matrix Spike	O-TERPHENYL (sur.)	2011/07/30		90	%	50 - 130
		EPH (C10-C19)	2011/07/30		100	%	50 - 130
		EPH (C19-C32)	2011/07/30		105	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2011/07/30		103	%	50 - 130
		EPH (C10-C19)	2011/07/30		98	%	50 - 130
		EPH (C19-C32)	2011/07/30		102	%	50 - 130

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WATTERSON GEOSCIENCE
Attention: DAN WATTERSON
Client Project #: BINJAY CREEK
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB167519

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
5049272 SR2	Method Blank	O-TERPHENYL (sur.)	2011/07/30		92	%	50 - 130
		EPH (C10-C19)	2011/07/30	<0.08		mg/L	
		EPH (C19-C32)	2011/07/30	<0.08		mg/L	
	RPD	EPH (C10-C19)	2011/07/30	NC		%	30
		EPH (C19-C32)	2011/07/30	NC		%	30
5051975 IA0	Matrix Spike	Total Phosphorus (P)	2011/07/29		NC	%	80 - 120
	QC Standard	Total Phosphorus (P)	2011/07/29		89	%	80 - 120
	Spiked Blank	Total Phosphorus (P)	2011/07/29		98	%	83 - 111
	Method Blank	Total Phosphorus (P)	2011/07/29	<0.003		mg/L	
	RPD	Total Phosphorus (P)	2011/07/29	0.3		%	20
5052043 IA0	Matrix Spike	Dissolved Phosphorus (P)	2011/07/29		96	%	80 - 120
	QC Standard	Dissolved Phosphorus (P)	2011/07/29		90	%	80 - 120
	Spiked Blank	Dissolved Phosphorus (P)	2011/07/29		97	%	83 - 111
	Method Blank	Dissolved Phosphorus (P)	2011/07/29	<0.003		mg/L	
	RPD	Dissolved Phosphorus (P)	2011/07/29	NC		%	20
5052513 IA0	Matrix Spike	Total Total Kjeldahl Nitrogen	2011/07/29		NC	%	80 - 120
	QC Standard	Total Total Kjeldahl Nitrogen	2011/07/29		110	%	75 - 125
	Spiked Blank	Total Total Kjeldahl Nitrogen	2011/07/29		102	%	80 - 120
	Method Blank	Total Total Kjeldahl Nitrogen	2011/07/29	<0.05		mg/L	
	RPD	Total Total Kjeldahl Nitrogen	2011/07/29	8.3		%	20
5053371 TDB	Matrix Spike	Total Aluminum (Al)	2011/08/02		NC	%	80 - 120
		Total Arsenic (As)	2011/08/02		102	%	80 - 120
		Total Beryllium (Be)	2011/08/02		106	%	80 - 120
		Total Chromium (Cr)	2011/08/02		107	%	80 - 120
		Total Cobalt (Co)	2011/08/02		106	%	80 - 120
		Total Copper (Cu)	2011/08/02		96	%	80 - 120
		Total Lead (Pb)	2011/08/02		110	%	80 - 120
		Total Nickel (Ni)	2011/08/02		103	%	80 - 120
		Total Selenium (Se)	2011/08/02		105	%	80 - 120
		Total Silver (Ag)	2011/08/02		118	%	80 - 120
		Total Thallium (Tl)	2011/08/02		105	%	80 - 120
		Total Titanium (Ti)	2011/08/02		111	%	80 - 120
		Total Uranium (U)	2011/08/02		109	%	80 - 120
		Total Vanadium (V)	2011/08/02		113	%	80 - 120
		Total Zinc (Zn)	2011/08/02		100	%	80 - 120
	Spiked Blank	Total Aluminum (Al)	2011/08/03		117	%	80 - 120
		Total Antimony (Sb)	2011/08/03		119	%	80 - 120
		Total Arsenic (As)	2011/08/03		98	%	80 - 107
		Total Beryllium (Be)	2011/08/03		111	%	80 - 120
		Total Chromium (Cr)	2011/08/03		109	%	80 - 120
		Total Cobalt (Co)	2011/08/03		108	%	80 - 120
		Total Copper (Cu)	2011/08/03		106	%	80 - 120
		Total Lead (Pb)	2011/08/03		106	%	80 - 115
		Total Molybdenum (Mo)	2011/08/03		112	%	80 - 120
		Total Nickel (Ni)	2011/08/03		107	%	80 - 120
		Total Selenium (Se)	2011/08/03		94	%	80 - 120
		Total Silver (Ag)	2011/08/03		114	%	80 - 120
		Total Thallium (Tl)	2011/08/03		104	%	80 - 120
		Total Tin (Sn)	2011/08/03		111	%	80 - 120
		Total Titanium (Ti)	2011/08/03		111	%	80 - 120
		Total Uranium (U)	2011/08/03		112	%	80 - 120
		Total Vanadium (V)	2011/08/03		116	%	80 - 120
		Total Zinc (Zn)	2011/08/03		102	%	80 - 120
	Method Blank	Total Aluminum (Al)	2011/08/02	0.002, RDL=0.002		mg/L	
		Total Antimony (Sb)	2011/08/02	<0.0006		mg/L	

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WATTERSON GEOSCIENCE
Attention: DAN WATTERSON
Client Project #: BINJAY CREEK
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB167519

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
5053371 TDB	Method Blank	Total Arsenic (As)	2011/08/02	<0.0002		mg/L	
		Total Beryllium (Be)	2011/08/02	<0.001		mg/L	
		Total Chromium (Cr)	2011/08/02	<0.001		mg/L	
		Total Cobalt (Co)	2011/08/02	<0.0003		mg/L	
		Total Copper (Cu)	2011/08/02	<0.0002		mg/L	
		Total Lead (Pb)	2011/08/02	<0.0002		mg/L	
		Total Molybdenum (Mo)	2011/08/02	<0.0002		mg/L	
		Total Nickel (Ni)	2011/08/02	0.0006, RDL=0.0005		mg/L	
		Total Selenium (Se)	2011/08/02	<0.0002		mg/L	
		Total Silver (Ag)	2011/08/02	<0.0001		mg/L	
		Total Thallium (Tl)	2011/08/02	<0.0002		mg/L	
		Total Tin (Sn)	2011/08/02	<0.001		mg/L	
		Total Titanium (Ti)	2011/08/02	<0.001		mg/L	
		Total Uranium (U)	2011/08/02	<0.0001		mg/L	
		Total Vanadium (V)	2011/08/02	0.002, RDL=0.001		mg/L	
		Total Zinc (Zn)	2011/08/02	<0.003		mg/L	
	RPD	Total Aluminum (Al)	2011/08/02	11.8		%	20
		Total Antimony (Sb)	2011/08/02	NC		%	20
		Total Arsenic (As)	2011/08/02	NC		%	20
		Total Beryllium (Be)	2011/08/02	NC		%	20
		Total Chromium (Cr)	2011/08/02	NC		%	20
		Total Cobalt (Co)	2011/08/02	NC		%	20
		Total Copper (Cu)	2011/08/02	NC		%	20
		Total Lead (Pb)	2011/08/02	NC		%	20
		Total Molybdenum (Mo)	2011/08/02	7.1		%	20
		Total Nickel (Ni)	2011/08/02	NC		%	20
		Total Selenium (Se)	2011/08/02	NC		%	20
		Total Silver (Ag)	2011/08/02	NC		%	20
		Total Thallium (Tl)	2011/08/02	NC		%	20
		Total Tin (Sn)	2011/08/02	NC		%	20
		Total Titanium (Ti)	2011/08/02	NC		%	20
		Total Uranium (U)	2011/08/02	4.7		%	20
		Total Vanadium (V)	2011/08/02	NC		%	20
		Total Zinc (Zn)	2011/08/02	NC		%	20
5053372 TDB	Matrix Spike [BC2050-01]	Dissolved Aluminum (Al)	2011/08/02		105	%	80 - 120
		Dissolved Antimony (Sb)	2011/08/02		114	%	80 - 120
		Dissolved Arsenic (As)	2011/08/02		103	%	80 - 120
		Dissolved Beryllium (Be)	2011/08/02		105	%	80 - 120
		Dissolved Chromium (Cr)	2011/08/02		99	%	80 - 120
		Dissolved Cobalt (Co)	2011/08/02		99	%	80 - 120
		Dissolved Copper (Cu)	2011/08/02		94	%	80 - 120
		Dissolved Lead (Pb)	2011/08/02		97	%	80 - 120
		Dissolved Molybdenum (Mo)	2011/08/02		109	%	80 - 120
		Dissolved Nickel (Ni)	2011/08/02		97	%	80 - 120
		Dissolved Selenium (Se)	2011/08/02		107	%	80 - 120
		Dissolved Silver (Ag)	2011/08/02		93	%	80 - 120
		Dissolved Thallium (Tl)	2011/08/02		99	%	80 - 120
		Dissolved Tin (Sn)	2011/08/02		101	%	80 - 120
		Dissolved Titanium (Ti)	2011/08/02		102	%	80 - 120
		Dissolved Uranium (U)	2011/08/02		101	%	80 - 120
		Dissolved Vanadium (V)	2011/08/02		108	%	80 - 120
		Dissolved Zinc (Zn)	2011/08/02		98	%	80 - 120
	Spiked Blank	Dissolved Aluminum (Al)	2011/08/02		108	%	80 - 120
		Dissolved Antimony (Sb)	2011/08/02		112	%	80 - 120

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WATTERSON GEOSCIENCE
Attention: DAN WATTERSON
Client Project #: BINJAY CREEK
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB167519

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
5053372 TDB	Spiked Blank	Dissolved Arsenic (As)	2011/08/02		97	%	83 - 104
		Dissolved Beryllium (Be)	2011/08/02		103	%	80 - 120
		Dissolved Chromium (Cr)	2011/08/02		99	%	80 - 115
		Dissolved Cobalt (Co)	2011/08/02		100	%	80 - 120
		Dissolved Copper (Cu)	2011/08/02		97	%	80 - 116
		Dissolved Lead (Pb)	2011/08/02		101	%	80 - 116
		Dissolved Molybdenum (Mo)	2011/08/02		107	%	80 - 118
		Dissolved Nickel (Ni)	2011/08/02		99	%	80 - 116
		Dissolved Selenium (Se)	2011/08/02		100	%	80 - 117
		Dissolved Silver (Ag)	2011/08/02		96	%	80 - 119
		Dissolved Thallium (Tl)	2011/08/02		101	%	80 - 116
		Dissolved Tin (Sn)	2011/08/02		108	%	80 - 120
		Dissolved Titanium (Ti)	2011/08/02		95	%	80 - 115
		Dissolved Uranium (U)	2011/08/02		100	%	80 - 120
		Dissolved Vanadium (V)	2011/08/02		105	%	80 - 120
		Dissolved Zinc (Zn)	2011/08/02		98	%	80 - 120
	Method Blank	Dissolved Aluminum (Al)	2011/08/02	<0.001		mg/L	
		Dissolved Antimony (Sb)	2011/08/02	<0.0006		mg/L	
		Dissolved Arsenic (As)	2011/08/02	<0.0002		mg/L	
		Dissolved Beryllium (Be)	2011/08/02	<0.001		mg/L	
		Dissolved Chromium (Cr)	2011/08/02	<0.001		mg/L	
		Dissolved Cobalt (Co)	2011/08/02	<0.0003		mg/L	
		Dissolved Copper (Cu)	2011/08/02	<0.0002		mg/L	
		Dissolved Lead (Pb)	2011/08/02	<0.0002		mg/L	
		Dissolved Molybdenum (Mo)	2011/08/02	<0.0002		mg/L	
		Dissolved Nickel (Ni)	2011/08/02	<0.0005		mg/L	
		Dissolved Selenium (Se)	2011/08/02	<0.0002		mg/L	
		Dissolved Silver (Ag)	2011/08/02	<0.0001		mg/L	
		Dissolved Thallium (Tl)	2011/08/02	<0.0002		mg/L	
		Dissolved Tin (Sn)	2011/08/02	<0.001		mg/L	
		Dissolved Titanium (Ti)	2011/08/02	<0.001		mg/L	
		Dissolved Uranium (U)	2011/08/02	<0.0001		mg/L	
		Dissolved Vanadium (V)	2011/08/02	<0.001		mg/L	
		Dissolved Zinc (Zn)	2011/08/02	<0.003		mg/L	
	RPD [BC2050-01]	Dissolved Aluminum (Al)	2011/08/02	NC		%	20
		Dissolved Antimony (Sb)	2011/08/02	NC		%	20
		Dissolved Arsenic (As)	2011/08/02	NC		%	20
		Dissolved Beryllium (Be)	2011/08/02	NC		%	20
		Dissolved Chromium (Cr)	2011/08/02	NC		%	20
		Dissolved Cobalt (Co)	2011/08/02	NC		%	20
		Dissolved Copper (Cu)	2011/08/02	NC		%	20
		Dissolved Lead (Pb)	2011/08/02	NC		%	20
		Dissolved Molybdenum (Mo)	2011/08/02	1.2		%	20
		Dissolved Nickel (Ni)	2011/08/02	NC		%	20
		Dissolved Selenium (Se)	2011/08/02	NC		%	20
		Dissolved Silver (Ag)	2011/08/02	NC		%	20
		Dissolved Thallium (Tl)	2011/08/02	NC		%	20
		Dissolved Tin (Sn)	2011/08/02	NC		%	20
		Dissolved Titanium (Ti)	2011/08/02	NC		%	20
		Dissolved Uranium (U)	2011/08/02	0.4		%	20
		Dissolved Vanadium (V)	2011/08/02	NC		%	20
		Dissolved Zinc (Zn)	2011/08/02	NC		%	20
5054188 DP0	Matrix Spike	Total Barium (Ba)	2011/08/02		97	%	80 - 120
		Total Boron (B)	2011/08/02		107	%	80 - 120
		Total Calcium (Ca)	2011/08/02		NC	%	80 - 120

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WATTERSON GEOSCIENCE
Attention: DAN WATTERSON
Client Project #: BINJAY CREEK
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB167519

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
5054188 DP0	Matrix Spike	Total Iron (Fe)	2011/08/02		117	%	80 - 120
		Total Lithium (Li)	2011/08/02		101	%	80 - 120
		Total Magnesium (Mg)	2011/08/02		NC	%	80 - 120
		Total Manganese (Mn)	2011/08/02		101	%	80 - 120
		Total Phosphorus (P)	2011/08/02		104	%	80 - 120
		Total Potassium (K)	2011/08/02		102	%	80 - 120
		Total Silicon (Si)	2011/08/02		NC	%	80 - 120
		Total Sodium (Na)	2011/08/02		NC	%	80 - 120
		Total Strontium (Sr)	2011/08/02		102	%	80 - 120
	Spiked Blank	Total Barium (Ba)	2011/08/02		98	%	80 - 120
		Total Boron (B)	2011/08/02		108	%	80 - 120
		Total Calcium (Ca)	2011/08/02		105	%	80 - 120
		Total Iron (Fe)	2011/08/02		109	%	80 - 120
		Total Lithium (Li)	2011/08/02		102	%	80 - 120
		Total Magnesium (Mg)	2011/08/02		101	%	80 - 120
		Total Manganese (Mn)	2011/08/02		102	%	89 - 110
		Total Phosphorus (P)	2011/08/02		100	%	80 - 120
		Total Potassium (K)	2011/08/02		103	%	80 - 120
		Total Silicon (Si)	2011/08/02		106	%	80 - 120
		Total Sodium (Na)	2011/08/02		102	%	85 - 119
		Total Strontium (Sr)	2011/08/02		103	%	80 - 120
	Method Blank	Total Barium (Ba)	2011/08/02	<0.01		mg/L	
		Total Boron (B)	2011/08/02	<0.02		mg/L	
		Total Calcium (Ca)	2011/08/02	<0.3		mg/L	
		Total Iron (Fe)	2011/08/02	<0.06		mg/L	
		Total Lithium (Li)	2011/08/02	<0.02		mg/L	
		Total Magnesium (Mg)	2011/08/02	<0.2		mg/L	
		Total Manganese (Mn)	2011/08/02	<0.004		mg/L	
		Total Phosphorus (P)	2011/08/02	<0.1		mg/L	
		Total Potassium (K)	2011/08/02	<0.3		mg/L	
		Total Silicon (Si)	2011/08/02	<0.1		mg/L	
		Total Sodium (Na)	2011/08/02	<0.5		mg/L	
		Total Strontium (Sr)	2011/08/02	<0.02		mg/L	
		Total Sulphur (S)	2011/08/02	<0.2		mg/L	
	RPD	Total Barium (Ba)	2011/08/02	0.2		%	20
		Total Boron (B)	2011/08/02	NC		%	20
		Total Calcium (Ca)	2011/08/02	0.8		%	20
		Total Iron (Fe)	2011/08/02	NC		%	20
		Total Lithium (Li)	2011/08/02	NC		%	20
		Total Magnesium (Mg)	2011/08/02	0.2		%	20
		Total Manganese (Mn)	2011/08/02	NC		%	20
		Total Phosphorus (P)	2011/08/02	NC		%	20
		Total Potassium (K)	2011/08/02	1.0		%	20
		Total Silicon (Si)	2011/08/02	1.3		%	20
		Total Sodium (Na)	2011/08/02	0.3		%	20
		Total Strontium (Sr)	2011/08/02	0.3		%	20
		Total Sulphur (S)	2011/08/02	0.2		%	20
5054240 DP0	Matrix Spike	Dissolved Barium (Ba)	2011/08/02		97	%	80 - 120
		Dissolved Boron (B)	2011/08/02		100	%	80 - 120
		Dissolved Calcium (Ca)	2011/08/02		NC	%	80 - 120
		Dissolved Iron (Fe)	2011/08/02		102	%	80 - 120
		Dissolved Lithium (Li)	2011/08/02		98	%	80 - 120
		Dissolved Magnesium (Mg)	2011/08/02		97	%	80 - 120
		Dissolved Manganese (Mn)	2011/08/02		98	%	80 - 120
		Dissolved Phosphorus (P)	2011/08/02		103	%	80 - 120

WATTERSON GEOSCIENCE
Attention: DAN WATTERSON
Client Project #: BINJAY CREEK
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB167519

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
5054240 DP0	Matrix Spike	Dissolved Potassium (K)	2011/08/02		99	%	80 - 120
		Dissolved Silicon (Si)	2011/08/02		90	%	80 - 120
		Dissolved Sodium (Na)	2011/08/02		95	%	80 - 120
		Dissolved Strontium (Sr)	2011/08/02		99	%	80 - 120
	Spiked Blank	Dissolved Barium (Ba)	2011/08/02		99	%	85 - 104
		Dissolved Boron (B)	2011/08/02		103	%	75 - 125
		Dissolved Calcium (Ca)	2011/08/02		106	%	80 - 120
		Dissolved Iron (Fe)	2011/08/02		106	%	80 - 120
		Dissolved Lithium (Li)	2011/08/02		98	%	80 - 116
		Dissolved Magnesium (Mg)	2011/08/02		104	%	91 - 113
		Dissolved Manganese (Mn)	2011/08/02		102	%	89 - 111
		Dissolved Phosphorus (P)	2011/08/02		103	%	89 - 109
		Dissolved Potassium (K)	2011/08/02		103	%	80 - 120
		Dissolved Silicon (Si)	2011/08/02		95	%	80 - 120
		Dissolved Sodium (Na)	2011/08/02		99	%	84 - 110
		Dissolved Strontium (Sr)	2011/08/02		101	%	85 - 106
	Method Blank	Dissolved Barium (Ba)	2011/08/02	<0.01		mg/L	
		Dissolved Boron (B)	2011/08/02	<0.02		mg/L	
		Dissolved Calcium (Ca)	2011/08/02	<0.3		mg/L	
		Dissolved Iron (Fe)	2011/08/02	<0.06		mg/L	
		Dissolved Lithium (Li)	2011/08/02	<0.02		mg/L	
		Dissolved Magnesium (Mg)	2011/08/02	<0.2		mg/L	
		Dissolved Manganese (Mn)	2011/08/02	<0.004		mg/L	
		Dissolved Phosphorus (P)	2011/08/02	<0.1		mg/L	
		Dissolved Potassium (K)	2011/08/02	<0.3		mg/L	
		Dissolved Silicon (Si)	2011/08/02	<0.1		mg/L	
		Dissolved Sodium (Na)	2011/08/02	<0.5		mg/L	
		Dissolved Strontium (Sr)	2011/08/02	<0.02		mg/L	
		Dissolved Sulphur (S)	2011/08/02	<0.2		mg/L	
	RPD	Dissolved Calcium (Ca)	2011/08/02	0.3		%	20
		Dissolved Iron (Fe)	2011/08/02	NC		%	20
		Dissolved Magnesium (Mg)	2011/08/02	0.6		%	20
		Dissolved Manganese (Mn)	2011/08/02	NC		%	20
		Dissolved Potassium (K)	2011/08/02	0.1		%	20
		Dissolved Sodium (Na)	2011/08/02	0.9		%	20
5054256 VGG	Matrix Spike	Total Mercury (Hg)	2011/08/02		109	%	80 - 120
	Spiked Blank	Total Mercury (Hg)	2011/08/02		98	%	80 - 120
	Method Blank	Total Mercury (Hg)	2011/08/02	<0.002		ug/L	
	RPD	Total Mercury (Hg)	2011/08/02	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B167519

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ghayasuddin Khan, M.Sc., B.Ed., P.Chem, Senior Analyst, Water Lab

LUBA SHYMUSHOVSKA, Senior Analyst, Organic Department

===

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8, Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

Chain of Custody

A067970

Contact @Maxxam is Cynny Hagen

Page: ____ of ____

	Invoice To:	C/O Report Address ☐
Company:	Thompson Drilling Ltd	
Contact:	Dennis	
Address:	15-4775 Woodlane W.	
	Prov: Windermere	PC: BC
Contact #s:	Ph: V0B 2L2	Cell: 250 341 5561

Report To:	Same as Invoice ☑
Watterson Geoscience Inc	
685 Pheasant Road	
Vernon BC V1B 3B1	
Prov: cell 250 550	PC: 8560
Ph: Daniel Watterson	

Report Distribution (E-Mail):
dan@wattersongeoscience.com
thompsondrillingltd@cyberlink.ca

REGULATORY GUIDELINES:
- ☐ AT1
- ☐ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	Bingay Creek
Site Location:	
Quote #:	
Sampled By:	Dennis Thompson

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve)
- Date Required:
- ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

SOIL: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill

WATER: ☐BTEX F1; ☐VOCs; ☐BTEX F1-F2; ☐BTEX F1-F4; ☑ Routine Water ☑ Turb ☑ F; ☐ TOC; ☐ DOC; Regulated Metals (CCME / AT1): Total, Dissolved; Mercury ☑ Total ☐ Dissolved

Other Analysis: Total P; Total dissolved P; TSS, TDS; NH3, TKN; Extractable Petroleum Hydrocarbons

HOLD - Do not Analyze; # of Containers Submitted

#	Sample ID	Depth (unit)	Matrix (GW / SW / Soil)	Date/Time Sampled YY/MM/DD 24:00	Routine Water	Regulated Metals Total	Regulated Metals Dissolved	Mercury	Total P	Total dissolved P	TSS, TDS	NH3, TKN	Extractable Petroleum Hydrocarbons
1	V-28 S	128ft	GW	11/7/21 20:25	✓	✓	✓	✓	✓	✓	✓	✓	✓
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

	Date (YY/MM/DD):	Time (24:00):
Relinquished By (Signature/Print): Dennis D. Thompson	11/07/2021	11:00
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions:

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:

RECEIVED Date: JUL 26 2011 Time: 8:50

Maxxam Job #: B167519

Custody Seal	Temperature	Ice
taped	7, 7, 5	✓

Lab Comments:

AB FCD-00331 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam

Success Through Science®

Site Location: BINGAY CREEK
Your C.O.C. #: A067971

Attention: DAN WATTERSON
WATTERSON GEOSCIENCE
685 PHEASANT RD
VERNON, BC
CANADA V1B 3B1

Report Date: 2011/07/26
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B163763
Received: 2011/07/15, 10:30

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	2	N/A	2011/07/17	AB SOP-00005	SM 2320-B
Cadmium - low level CCME - Dissolved	2	N/A	2011/07/21	AB SOP-00043	EPA 200.8
Cadmium - low level CCME (Total)	2	2011/07/15	2011/07/21	AB SOP-00043	EPA 200.8
Chloride by Automated Colourimetry	2	N/A	2011/07/17	AB SOP-00020	EPA 325.2
Conductivity @25C	2	N/A	2011/07/17	AB SOP-00005	SM 2510-B
BC Hydrocarbons in Water by GC/FID	2	2011/07/20	2011/07/20	CAL SOP-00239	Based BCCSR Method 4
Fluoride	2	N/A	2011/07/17	AB SOP-00005	SM 4500-F C
Hardness	2	N/A	2011/07/21	CAL WI-00053	AEMM, Method 423
Mercury - Low Level (Total)	2	2011/07/21	2011/07/21	CAL SOP-00007	EPA 1631
Elements by ICP - Dissolved	2	N/A	2011/07/21	AB SOP-00042	EPA 200.7
Elements by ICP - Total	2	2011/07/20	2011/07/21	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	2	N/A	2011/07/21	AB SOP-00043	EPA 200.8
Elements by ICPMS - Total	2	2011/07/20	2011/07/21	AB SOP-00043	EPA 200.8
Ion Balance	2	N/A	2011/07/17	AB WI-00065	SM 1030E
Sum of cations, anions	2	N/A	2011/07/21	AB WI-00065	SM 1030E
Ammonia-N (Total)	2	N/A	2011/07/21	AB SOP-00007	EPA 350.1
Nitrate and Nitrite	2	N/A	2011/07/20		CAL SOP-00060
Nitrate + Nitrite-N (calculated)	2	N/A	2011/07/20	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	2	N/A	2011/07/20	AB SOP-00023	SM 4110-B
pH @25°C (Alkalinity titrator)	2	N/A	2011/07/17	AB SOP-00005	SM 4500-H+B
Sulphate by Automated Colourimetry	2	N/A	2011/07/17	AB SOP-00018	EPA 375.4
Total Dissolved Solids (Filt. Residue)	2	2011/07/20	2011/07/21	CAL SOP-00074	SM 2540-C
Total Dissolved Solids (Calculated)	2	N/A	2011/07/21		SM 1030 E
Total Kjeldahl Nitrogen	2	2011/07/21	2011/07/21	AB SOP-00008	EPA 351.1, 351.2
Phosphorous -P (Total, Dissolved)	2	2011/07/21	2011/07/21	AB SOP-00024	SM 4500-P
Total Phosphorous	2	2011/07/21	2011/07/21	AB SOP-00024	SM 4500-P
Total Suspended Solids (NFR)	2	2011/07/20	2011/07/21	CAL SOP-00075	SM 2540-D
Turbidity	2	N/A	2011/07/20	CAL SOP-00081	SM 2130-B

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

../2

Site Location: BINGAY CREEK
Your C.O.C. #: A067971

Attention: DAN WATTERSON
WATTERSON GEOSCIENCE
685 PHEASANT RD
VERNON, BC
CANADA V1B 3B1

Report Date: 2011/07/26
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

-2-

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Cynny Hagen, Project Manager
Email: CHagen@maxxam.ca
Phone# (403) 735-2239 Ext:2239

==
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Total cover pages: 2

Success Through Science®

Maxxam Job #: B163763
Report Date: 2011/07/26

WATTERSON GEOSCIENCE

Site Location: BINGAY CREEK
Sampler Initials: DT

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		BA0648	BA0648		BA0649		
Sampling Date		2011/07/13	2011/07/13		2011/07/13 14:05		
COC Number		A067971	A067971		A067971		
	Units	**DW-1**	**DW-1 Lab-Dup**	**RDL**	**DW-4**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	meq/L	6.5	N/A	N/A	7.9	N/A	5013110
Cation Sum	meq/L	6.1	N/A	N/A	7.5	N/A	5013110
Hardness (CaCO3)	mg/L	290	N/A	0.5	330	0.5	5013108
Ion Balance	N/A	0.94	N/A	0.01	0.95	0.01	5013109
Dissolved Nitrate (NO3)	mg/L	<0.01	N/A	0.01	<0.01	0.01	5013111
Nitrate plus Nitrite (N)	mg/L	<0.003	N/A	0.003	<0.003	0.003	5013112
Dissolved Nitrite (NO2)	mg/L	<0.01	N/A	0.01	<0.01	0.01	5013111
Total Dissolved Solids	mg/L	300	N/A	10	370	10	5013113
Misc. Inorganics							
Conductivity	uS/cm	560	N/A	1	690	1	5013874
pH	N/A	7.99	N/A	N/A	7.90	N/A	5013875
Total Dissolved Solids	mg/L	300	N/A	10	360	10	5021331
Total Suspended Solids	mg/L	12	N/A	1	9	1	5021815
Low Level Elements							
Dissolved Cadmium (Cd)	ug/L	0.014	N/A	0.005	<0.005	0.005	5013104
Total Cadmium (Cd)	ug/L	0.045	N/A	0.005	0.026	0.005	5010030
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.5	N/A	0.5	<0.5	0.5	5013873
Alkalinity (Total as CaCO3)	mg/L	330	N/A	0.5	390	0.5	5013873
Bicarbonate (HCO3)	mg/L	400	N/A	0.5	480	0.5	5013873
Carbonate (CO3)	mg/L	<0.5	N/A	0.5	<0.5	0.5	5013873
Dissolved Fluoride (F)	mg/L	0.32	N/A	0.05	0.66	0.05	5013876
Hydroxide (OH)	mg/L	<0.5	N/A	0.5	<0.5	0.5	5013873
Dissolved Sulphate (SO4)	mg/L	<1	N/A	1	<1	1	5013807
Dissolved Chloride (Cl)	mg/L	1	N/A	1	1	1	5013804
Nutrients							
Total Ammonia (N)	mg/L	1.0	N/A	0.05	4.7 (1)	0.5	5025232
Dissolved Phosphorus (P)	mg/L	<0.003	N/A	0.003	<0.003	0.003	5026665
Total Phosphorus (P)	mg/L	0.018	N/A	0.003	0.013	0.003	5026660
Total Total Kjeldahl Nitrogen	mg/L	1.3	N/A	0.05	4.5 (2)	0.5	5026600

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range. Ammonia greater than TKN. Results are within acceptable limits of precision.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam

WATTERSON GEOSCIENCE

Maxxam Job #: B163763
Report Date: 2011/07/26

Site Location: BINGAY CREEK
Sampler Initials: DT

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		BA0648	BA0648		BA0649		
Sampling Date		2011/07/13	2011/07/13		2011/07/13 14:05		
COC Number		A067971	A067971		A067971		
	Units	**DW-1**	**DW-1 Lab-Dup**	**RDL**	**DW-4**	**RDL**	**QC Batch**
Dissolved Nitrite (N)	mg/L	<0.003	N/A	0.003	<0.003	0.003	5015072
Dissolved Nitrate (N)	mg/L	<0.003	N/A	0.003	<0.003	0.003	5015072
Physical Properties							
Turbidity	NTU	36	36	0.1	50	0.1	5022911

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam

WATTERSON GEOSCIENCE

Maxxam Job #: B163763
Report Date: 2011/07/26

Site Location: BINGAY CREEK
Sampler Initials: DT

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		BA0648	BA0649		
Sampling Date		2011/07/13	2011/07/13 14:05		
COC Number		A067971	A067971		
	Units	**DW-1**	**DW-4**	**RDL**	**QC Batch**
Elements					
Dissolved Aluminum (Al)	mg/L	0.004	0.002	0.001	5023059
Total Aluminum (Al)	mg/L	1.1	0.11	0.001	5023443
Dissolved Antimony (Sb)	mg/L	<0.0006	<0.0006	0.0006	5023059
Total Antimony (Sb)	mg/L	<0.0006	0.0008	0.0006	5023443
Dissolved Arsenic (As)	mg/L	<0.0002	<0.0002	0.0002	5023059
Total Arsenic (As)	mg/L	0.0017	0.0022	0.0002	5023443
Dissolved Barium (Ba)	mg/L	8.5	2.8	0.01	5025386
Total Barium (Ba)	mg/L	8.6	2.9	0.01	5025384
Dissolved Beryllium (Be)	mg/L	<0.001	<0.001	0.001	5023059
Total Beryllium (Be)	mg/L	<0.001	<0.001	0.001	5023443
Dissolved Boron (B)	mg/L	<0.02	0.05	0.02	5025386
Total Boron (B)	mg/L	<0.02	0.05	0.02	5025384
Dissolved Calcium (Ca)	mg/L	64	81	0.3	5025386
Total Calcium (Ca)	mg/L	66	84	0.3	5025384
Dissolved Chromium (Cr)	mg/L	<0.001	<0.001	0.001	5023059
Total Chromium (Cr)	mg/L	0.003	0.004	0.001	5023443
Dissolved Cobalt (Co)	mg/L	<0.0003	0.0004	0.0003	5023059
Total Cobalt (Co)	mg/L	0.0003	0.0006	0.0003	5023443
Dissolved Copper (Cu)	mg/L	0.0014	0.0005	0.0002	5023059
Total Copper (Cu)	mg/L	0.0029	0.0025	0.0002	5023443
Dissolved Iron (Fe)	mg/L	0.06	0.08	0.06	5025386
Total Iron (Fe)	mg/L	2.8	6.5	0.06	5025384
Dissolved Lead (Pb)	mg/L	<0.0002	<0.0002	0.0002	5023059
Total Lead (Pb)	mg/L	0.0006	0.0008	0.0002	5023443
Dissolved Lithium (Li)	mg/L	0.07	0.15	0.02	5025386
Total Lithium (Li)	mg/L	0.07	0.15	0.02	5025384
Dissolved Magnesium (Mg)	mg/L	31	32	0.2	5025386
Total Magnesium (Mg)	mg/L	32	34	0.2	5025384
Dissolved Manganese (Mn)	mg/L	0.030	0.029	0.004	5025386
Total Manganese (Mn)	mg/L	0.036	0.037	0.004	5025384
Dissolved Molybdenum (Mo)	mg/L	0.0005	0.0010 (1)	0.0002	5023059
Total Molybdenum (Mo)	mg/L	0.0014	0.0009	0.0002	5023443

RDL = Reportable Detection Limit
(1)   Dissolved greater than total. Results within acceptable limits of precision.

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Maxxam Job #: B163763
Report Date: 2011/07/26

WATTERSON GEOSCIENCE

Site Location: BINGAY CREEK
Sampler Initials: DT

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		BA0648	BA0649		
Sampling Date		2011/07/13	2011/07/13 14:05		
COC Number		A067971	A067971		
	Units	**DW-1**	**DW-4**	**RDL**	**QC Batch**
Dissolved Nickel (Ni)	mg/L	0.0006	0.0030	0.0005	5023059
Total Nickel (Ni)	mg/L	0.0016	0.0042	0.0005	5023443
Dissolved Phosphorus (P)	mg/L	<0.1	<0.1	0.1	5025386
Total Phosphorus (P)	mg/L	0.1	0.1	0.1	5025384
Dissolved Potassium (K)	mg/L	5.8	17	0.3	5025386
Total Potassium (K)	mg/L	6.3	17	0.3	5025384
Dissolved Selenium (Se)	mg/L	<0.0002	<0.0002	0.0002	5023059
Total Selenium (Se)	mg/L	<0.0002	<0.0002	0.0002	5023443
Dissolved Silicon (Si)	mg/L	2.6	2.5	0.1	5025386
Total Silicon (Si)	mg/L	5.7	2.9	0.1	5025384
Dissolved Silver (Ag)	mg/L	<0.0001	<0.0001	0.0001	5023059
Total Silver (Ag)	mg/L	<0.0001	<0.0001	0.0001	5023443
Dissolved Sodium (Na)	mg/L	4.4	2.3	0.5	5025386
Total Sodium (Na)	mg/L	4.5	2.4	0.5	5025384
Dissolved Strontium (Sr)	mg/L	1.1	0.22	0.02	5025386
Total Strontium (Sr)	mg/L	1.1	0.23	0.02	5025384
Dissolved Sulphur (S)	mg/L	<0.2	0.3 (1)	0.2	5025386
Total Sulphur (S)	mg/L	0.2	0.3	0.2	5025384
Dissolved Thallium (Tl)	mg/L	<0.0002	<0.0002	0.0002	5023059
Total Thallium (Tl)	mg/L	<0.0002	<0.0002	0.0002	5023443
Dissolved Tin (Sn)	mg/L	<0.001	<0.001	0.001	5023059
Total Tin (Sn)	mg/L	<0.001	<0.001	0.001	5023443
Dissolved Titanium (Ti)	mg/L	<0.001	<0.001	0.001	5023059
Total Titanium (Ti)	mg/L	0.030	0.002	0.001	5023443
Dissolved Uranium (U)	mg/L	0.0001	0.0003	0.0001	5023059
Total Uranium (U)	mg/L	0.0002	0.0005	0.0001	5023443
Dissolved Vanadium (V)	mg/L	<0.001	<0.001	0.001	5023059
Total Vanadium (V)	mg/L	0.005	0.002	0.001	5023443
Dissolved Zinc (Zn)	mg/L	0.010	0.031 (2)	0.003	5023059
Total Zinc (Zn)	mg/L	0.016	0.026	0.003	5023443
Low Level Elements					
Total Mercury (Hg)	ug/L	<0.002	0.003	0.002	5018627

RDL = Reportable Detection Limit
(1) Dissolved greater than total. Results are within limits of uncertainty(MU).
(2) Dissolved greater than total. Results within acceptable limits of precision.

Maxxam Job #: B163763
Report Date: 2011/07/26

WATTERSON GEOSCIENCE

Site Location: BINGAY CREEK
Sampler Initials: DT

TOTAL PETROLEUM HYDROCARBONS (WATER)

Maxxam ID		BA0648	BA0649	BA0649		
Sampling Date		2011/07/13	2011/07/13 14:05	2011/07/13 14:05		
COC Number		A067971	A067971	A067971		
	Units	**DW-1**	**DW-4**	**DW-4 Lab-Dup**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon						
EPH (C10-C19)	mg/L	<0.08	<0.08	<0.08	0.08	5021492
EPH (C19-C32)	mg/L	<0.08	<0.08	<0.08	0.08	5021492
Surrogate Recovery (%)						
O-TERPHENYL (sur.)	%	90	87	87	N/A	5021492

N/A = Not Applicable
RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

Maxxam Job #: B163763
Report Date: 2011/07/26

WATTERSON GEOSCIENCE

Site Location: BINGAY CREEK
Sampler Initials: DT

Package 1	5.3°C

Each temperature is the average of up to three cooler temperatures taken at receipt

General Comments

Results relate only to the items tested.

Maxxam

Success Through Science®

WATTERSON GEOSCIENCE
Attention: DAN WATTERSON
Client Project #:
P.O. #:
Site Location: BINGAY CREEK

Quality Assurance Report

Maxxam Job Number: CB163763

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
5013804 SLI	Matrix Spike	Dissolved Chloride (Cl)	2011/07/17		NC	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2011/07/17		106	%	92 - 113
	Method Blank	Dissolved Chloride (Cl)	2011/07/17	<1		mg/L	
	RPD	Dissolved Chloride (Cl)	2011/07/17	0.7		%	20
5013807 SLI	Matrix Spike	Dissolved Sulphate (SO4)	2011/07/17		NC	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2011/07/17		106	%	91 - 116
	Method Blank	Dissolved Sulphate (SO4)	2011/07/17	<1		mg/L	
	RPD	Dissolved Sulphate (SO4)	2011/07/17	1.4		%	20
5013873 RP0	Spiked Blank	Alkalinity (Total as CaCO3)	2011/07/17		100	%	80 - 120
	Method Blank	Alkalinity (PP as CaCO3)	2011/07/17	<0.5		mg/L	
		Alkalinity (Total as CaCO3)	2011/07/17	<0.5		mg/L	
		Bicarbonate (HCO3)	2011/07/17	<0.5		mg/L	
		Carbonate (CO3)	2011/07/17	<0.5		mg/L	
		Hydroxide (OH)	2011/07/17	<0.5		mg/L	
	RPD	Alkalinity (PP as CaCO3)	2011/07/17	NC		%	20
		Alkalinity (Total as CaCO3)	2011/07/17	0.3		%	20
		Bicarbonate (HCO3)	2011/07/17	0.3		%	20
		Carbonate (CO3)	2011/07/17	NC		%	20
		Hydroxide (OH)	2011/07/17	NC		%	20
5013874 RP0	Spiked Blank	Conductivity	2011/07/17		98	%	92 - 106
	Method Blank	Conductivity	2011/07/17	<1		uS/cm	
	RPD	Conductivity	2011/07/17	0.4		%	20
5013875 RP0	Spiked Blank	pH	2011/07/17		100	%	97 - 102
	RPD	pH	2011/07/17	1.2		%	5
5013876 RP0	Matrix Spike	Dissolved Fluoride (F)	2011/07/17		107	%	80 - 120
	Spiked Blank	Dissolved Fluoride (F)	2011/07/17		93	%	86 - 117
	Method Blank	Dissolved Fluoride (F)	2011/07/17	<0.05		mg/L	
	RPD	Dissolved Fluoride (F)	2011/07/17	NC		%	20
5015072 RSM	Matrix Spike	Dissolved Nitrite (N)	2011/07/20		111	%	80 - 120
		Dissolved Nitrate (N)	2011/07/20		114	%	80 - 120
	Spiked Blank	Dissolved Nitrite (N)	2011/07/20		118	%	80 - 120
		Dissolved Nitrate (N)	2011/07/20		118	%	80 - 120
	Method Blank	Dissolved Nitrite (N)	2011/07/20	<0.003		mg/L	
		Dissolved Nitrate (N)	2011/07/20	<0.003		mg/L	
	RPD	Dissolved Nitrite (N)	2011/07/20	NC		%	20
		Dissolved Nitrate (N)	2011/07/20	5.1		%	20
5018627 JMS	Matrix Spike	Total Mercury (Hg)	2011/07/20		111	%	80 - 120
	Spiked Blank	Total Mercury (Hg)	2011/07/20		106	%	80 - 120
	Method Blank	Total Mercury (Hg)	2011/07/20	<0.002		ug/L	
	RPD	Total Mercury (Hg)	2011/07/20	NC		%	20
5021331 HE1	Spiked Blank	Total Dissolved Solids	2011/07/21		100	%	80 - 113
	Method Blank	Total Dissolved Solids	2011/07/21	<10		mg/L	
	RPD	Total Dissolved Solids	2011/07/21	1.1		%	20
5021492 SDD	Matrix Spike						
	[BA0648-02]	O-TERPHENYL (sur.)	2011/07/21		84	%	50 - 130
		EPH (C10-C19)	2011/07/21		93	%	50 - 130
		EPH (C19-C32)	2011/07/21		102	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2011/07/21		89	%	50 - 130
		EPH (C10-C19)	2011/07/21		94	%	50 - 130
		EPH (C19-C32)	2011/07/21		101	%	50 - 130
	Method Blank	O-TERPHENYL (sur.)	2011/07/20		96	%	50 - 130
		EPH (C10-C19)	2011/07/20	<0.08		mg/L	
		EPH (C19-C32)	2011/07/20	<0.08		mg/L	
	RPD [BA0649-02]	EPH (C10-C19)	2011/07/20	NC		%	30
		EPH (C19-C32)	2011/07/20	NC		%	30

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5021815 HE1	Spiked Blank	Total Suspended Solids	2011/07/21		96	%	81 - 105
	Method Blank	Total Suspended Solids	2011/07/21	<1		mg/L	
	RPD	Total Suspended Solids	2011/07/21	NC		%	20
5022911 HE1	Spiked Blank	Turbidity	2011/07/20		96	%	93 - 99
	Method Blank	Turbidity	2011/07/20	<0.1		NTU	
	RPD [BA0648-01]	Turbidity	2011/07/20	0.8		%	20
5023059 TDB	Matrix Spike	Dissolved Aluminum (Al)	2011/07/21		NC	%	80 - 120
		Dissolved Antimony (Sb)	2011/07/21		102	%	80 - 120
		Dissolved Arsenic (As)	2011/07/21		94	%	80 - 120
		Dissolved Beryllium (Be)	2011/07/21		100	%	80 - 120
		Dissolved Chromium (Cr)	2011/07/21		96	%	80 - 120
		Dissolved Cobalt (Co)	2011/07/21		97	%	80 - 120
		Dissolved Copper (Cu)	2011/07/21		91	%	80 - 120
		Dissolved Lead (Pb)	2011/07/21		90	%	80 - 120
		Dissolved Molybdenum (Mo)	2011/07/21		NC	%	80 - 120
		Dissolved Nickel (Ni)	2011/07/21		92	%	80 - 120
		Dissolved Selenium (Se)	2011/07/21		96	%	80 - 120
		Dissolved Silver (Ag)	2011/07/21		82	%	80 - 120
		Dissolved Thallium (Tl)	2011/07/21		94	%	80 - 120
		Dissolved Tin (Sn)	2011/07/21		89	%	80 - 120
		Dissolved Titanium (Ti)	2011/07/21		98	%	80 - 120
		Dissolved Uranium (U)	2011/07/21		96	%	80 - 120
		Dissolved Vanadium (V)	2011/07/21		NC	%	80 - 120
		Dissolved Zinc (Zn)	2011/07/21		80	%	80 - 120
	Spiked Blank	Dissolved Aluminum (Al)	2011/07/21		116	%	80 - 120
		Dissolved Antimony (Sb)	2011/07/21		97	%	80 - 120
		Dissolved Arsenic (As)	2011/07/21		92	%	83 - 104
		Dissolved Beryllium (Be)	2011/07/21		102	%	80 - 120
		Dissolved Chromium (Cr)	2011/07/21		99	%	80 - 115
		Dissolved Cobalt (Co)	2011/07/21		100	%	80 - 120
		Dissolved Copper (Cu)	2011/07/21		99	%	80 - 116
		Dissolved Lead (Pb)	2011/07/21		99	%	80 - 116
		Dissolved Molybdenum (Mo)	2011/07/21		99	%	80 - 118
		Dissolved Nickel (Ni)	2011/07/21		99	%	80 - 116
		Dissolved Selenium (Se)	2011/07/21		98	%	80 - 117
		Dissolved Silver (Ag)	2011/07/21		98	%	80 - 119
		Dissolved Thallium (Tl)	2011/07/21		99	%	80 - 116
		Dissolved Tin (Sn)	2011/07/21		99	%	80 - 120
		Dissolved Titanium (Ti)	2011/07/21		98	%	80 - 115
		Dissolved Uranium (U)	2011/07/21		99	%	80 - 120
		Dissolved Vanadium (V)	2011/07/21		102	%	80 - 120
		Dissolved Zinc (Zn)	2011/07/21		101	%	80 - 120
	Method Blank	Dissolved Aluminum (Al)	2011/07/21	<0.001		mg/L	
		Dissolved Antimony (Sb)	2011/07/21	<0.0006		mg/L	
		Dissolved Arsenic (As)	2011/07/21	<0.0002		mg/L	
		Dissolved Beryllium (Be)	2011/07/21	<0.001		mg/L	
		Dissolved Chromium (Cr)	2011/07/21	<0.001		mg/L	
		Dissolved Cobalt (Co)	2011/07/21	<0.0003		mg/L	
		Dissolved Copper (Cu)	2011/07/21	<0.0002		mg/L	
		Dissolved Lead (Pb)	2011/07/21	<0.0002		mg/L	
		Dissolved Molybdenum (Mo)	2011/07/21	<0.0002		mg/L	
		Dissolved Nickel (Ni)	2011/07/21	<0.0005		mg/L	
		Dissolved Selenium (Se)	2011/07/21	<0.0002		mg/L	
		Dissolved Silver (Ag)	2011/07/21	<0.0001		mg/L	
		Dissolved Thallium (Tl)	2011/07/21	<0.0002		mg/L	

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Quality Assurance Report (Continued)

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5023059 TDB	Method Blank	Dissolved Tin (Sn)	2011/07/21	<0.001		mg/L	
		Dissolved Titanium (Ti)	2011/07/21	<0.001		mg/L	
		Dissolved Uranium (U)	2011/07/21	<0.0001		mg/L	
		Dissolved Vanadium (V)	2011/07/21	<0.001		mg/L	
		Dissolved Zinc (Zn)	2011/07/21	<0.003		mg/L	
	RPD	Dissolved Aluminum (Al)	2011/07/21	8.3		%	20
		Dissolved Antimony (Sb)	2011/07/21	NC		%	20
		Dissolved Arsenic (As)	2011/07/21	1.9		%	20
		Dissolved Beryllium (Be)	2011/07/21	NC		%	20
		Dissolved Chromium (Cr)	2011/07/21	NC		%	20
		Dissolved Cobalt (Co)	2011/07/21	NC		%	20
		Dissolved Copper (Cu)	2011/07/21	3.0		%	20
		Dissolved Lead (Pb)	2011/07/21	NC		%	20
		Dissolved Molybdenum (Mo)	2011/07/21	2.0		%	20
		Dissolved Nickel (Ni)	2011/07/21	2.2		%	20
		Dissolved Selenium (Se)	2011/07/21	NC		%	20
		Dissolved Silver (Ag)	2011/07/21	NC		%	20
		Dissolved Thallium (Tl)	2011/07/21	NC		%	20
		Dissolved Tin (Sn)	2011/07/21	NC		%	20
		Dissolved Titanium (Ti)	2011/07/21	NC		%	20
		Dissolved Uranium (U)	2011/07/21	NC		%	20
		Dissolved Vanadium (V)	2011/07/21	1.5		%	20
		Dissolved Zinc (Zn)	2011/07/21	NC		%	20
5023443 TDB	Matrix Spike	Total Aluminum (Al)	2011/07/21		NC	%	80 - 120
		Total Antimony (Sb)	2011/07/21		117	%	80 - 120
		Total Arsenic (As)	2011/07/21		92	%	80 - 120
		Total Beryllium (Be)	2011/07/21		109	%	80 - 120
		Total Chromium (Cr)	2011/07/21		101	%	80 - 120
		Total Cobalt (Co)	2011/07/21		100	%	80 - 120
		Total Copper (Cu)	2011/07/21		94	%	80 - 120
		Total Lead (Pb)	2011/07/21		99	%	80 - 120
		Total Molybdenum (Mo)	2011/07/21		108	%	80 - 120
		Total Nickel (Ni)	2011/07/21		97	%	80 - 120
		Total Selenium (Se)	2011/07/21		89	%	80 - 120
		Total Silver (Ag)	2011/07/21		104	%	80 - 120
		Total Thallium (Tl)	2011/07/21		95	%	80 - 120
		Total Tin (Sn)	2011/07/21		105	%	80 - 120
		Total Titanium (Ti)	2011/07/21		102	%	80 - 120
		Total Uranium (U)	2011/07/21		102	%	80 - 120
		Total Vanadium (V)	2011/07/21		106	%	80 - 120
		Total Zinc (Zn)	2011/07/21		88	%	80 - 120
	Spiked Blank	Total Aluminum (Al)	2011/07/21		115	%	80 - 120
		Total Antimony (Sb)	2011/07/21		114	%	80 - 120
		Total Arsenic (As)	2011/07/21		93	%	80 - 107
		Total Beryllium (Be)	2011/07/21		110	%	80 - 120
		Total Chromium (Cr)	2011/07/21		102	%	80 - 120
		Total Cobalt (Co)	2011/07/21		102	%	80 - 120
		Total Copper (Cu)	2011/07/21		101	%	80 - 120
		Total Lead (Pb)	2011/07/21		102	%	80 - 115
		Total Molybdenum (Mo)	2011/07/21		105	%	80 - 120
		Total Nickel (Ni)	2011/07/21		103	%	80 - 120
		Total Selenium (Se)	2011/07/21		90	%	80 - 120
		Total Silver (Ag)	2011/07/21		107	%	80 - 120
		Total Thallium (Tl)	2011/07/21		97	%	80 - 120
		Total Tin (Sn)	2011/07/21		106	%	80 - 120

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Quality Assurance Report (Continued)

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5023443 TDB	Spiked Blank	Total Titanium (Ti)	2011/07/21		99	%	80 - 120
		Total Uranium (U)	2011/07/21		101	%	80 - 120
		Total Vanadium (V)	2011/07/21		106	%	80 - 120
		Total Zinc (Zn)	2011/07/21		95	%	80 - 120
	Method Blank	Total Aluminum (Al)	2011/07/21	0.001, RDL=0.001		mg/L	
		Total Antimony (Sb)	2011/07/21	<0.0006		mg/L	
		Total Arsenic (As)	2011/07/21	0.0004, RDL=0.0002		mg/L	
		Total Beryllium (Be)	2011/07/21	<0.001		mg/L	
		Total Chromium (Cr)	2011/07/21	<0.001		mg/L	
		Total Cobalt (Co)	2011/07/21	<0.0003		mg/L	
		Total Copper (Cu)	2011/07/21	<0.0002		mg/L	
		Total Lead (Pb)	2011/07/21	<0.0002		mg/L	
		Total Molybdenum (Mo)	2011/07/21	<0.0002		mg/L	
		Total Nickel (Ni)	2011/07/21	<0.0005		mg/L	
		Total Selenium (Se)	2011/07/21	<0.0002		mg/L	
		Total Silver (Ag)	2011/07/21	<0.0001		mg/L	
		Total Thallium (Tl)	2011/07/21	<0.0002		mg/L	
		Total Tin (Sn)	2011/07/21	<0.001		mg/L	
		Total Titanium (Ti)	2011/07/21	<0.001		mg/L	
		Total Uranium (U)	2011/07/21	<0.0001		mg/L	
		Total Vanadium (V)	2011/07/21	0.001, RDL=0.001		mg/L	
		Total Zinc (Zn)	2011/07/21	<0.003		mg/L	
	RPD	Total Aluminum (Al)	2011/07/21	1.5		%	20
		Total Antimony (Sb)	2011/07/21	NC		%	20
		Total Arsenic (As)	2011/07/21	1.4		%	20
		Total Beryllium (Be)	2011/07/21	NC		%	20
		Total Chromium (Cr)	2011/07/21	NC		%	20
		Total Cobalt (Co)	2011/07/21	NC		%	20
		Total Copper (Cu)	2011/07/21	1.4		%	20
		Total Lead (Pb)	2011/07/21	NC		%	20
		Total Molybdenum (Mo)	2011/07/21	4.3		%	20
		Total Nickel (Ni)	2011/07/21	NC		%	20
		Total Selenium (Se)	2011/07/21	NC		%	20
		Total Silver (Ag)	2011/07/21	NC		%	20
		Total Thallium (Tl)	2011/07/21	NC		%	20
		Total Tin (Sn)	2011/07/21	NC		%	20
		Total Titanium (Ti)	2011/07/21	NC		%	20
		Total Uranium (U)	2011/07/21	2.1		%	20
		Total Vanadium (V)	2011/07/21	NC		%	20
		Total Zinc (Zn)	2011/07/21	NC		%	20
5025232 IA0	Matrix Spike	Total Ammonia (N)	2011/07/21		101	%	80 - 120
	Spiked Blank	Total Ammonia (N)	2011/07/21		98	%	86 - 110
	Method Blank	Total Ammonia (N)	2011/07/21	<0.05		mg/L	
	RPD	Total Ammonia (N)	2011/07/21	NC		%	20
5025384 VGG	Matrix Spike	Total Barium (Ba)	2011/07/21		95	%	80 - 120
		Total Boron (B)	2011/07/21		103	%	80 - 120
		Total Calcium (Ca)	2011/07/21		NC	%	80 - 120
		Total Iron (Fe)	2011/07/21		108	%	80 - 120
		Total Lithium (Li)	2011/07/21		104	%	80 - 120
		Total Magnesium (Mg)	2011/07/21		NC	%	80 - 120
		Total Manganese (Mn)	2011/07/21		96	%	80 - 120
		Total Phosphorus (P)	2011/07/21		101	%	80 - 120
		Total Potassium (K)	2011/07/21		103	%	80 - 120
		Total Silicon (Si)	2011/07/21		NC	%	80 - 120
		Total Sodium (Na)	2011/07/21		103	%	80 - 120

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Quality Assurance Report (Continued)

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5025384 VGG	Matrix Spike	Total Strontium (Sr)	2011/07/21		100	%	80 - 120
	Spiked Blank	Total Barium (Ba)	2011/07/21		95	%	80 - 120
		Total Boron (B)	2011/07/21		103	%	80 - 120
		Total Calcium (Ca)	2011/07/21		103	%	80 - 120
		Total Iron (Fe)	2011/07/21		110	%	80 - 120
		Total Lithium (Li)	2011/07/21		99	%	80 - 120
		Total Magnesium (Mg)	2011/07/21		100	%	80 - 120
		Total Manganese (Mn)	2011/07/21		98	%	89 - 110
		Total Phosphorus (P)	2011/07/21		100	%	80 - 120
		Total Potassium (K)	2011/07/21		99	%	80 - 120
		Total Silicon (Si)	2011/07/21		105	%	80 - 120
		Total Sodium (Na)	2011/07/21		100	%	85 - 119
		Total Strontium (Sr)	2011/07/21		100	%	80 - 120
	Method Blank	Total Barium (Ba)	2011/07/21	<0.01		mg/L	
		Total Boron (B)	2011/07/21	<0.02		mg/L	
		Total Calcium (Ca)	2011/07/21	<0.3		mg/L	
		Total Iron (Fe)	2011/07/21	<0.06		mg/L	
		Total Lithium (Li)	2011/07/21	<0.02		mg/L	
		Total Magnesium (Mg)	2011/07/21	<0.2		mg/L	
		Total Manganese (Mn)	2011/07/21	<0.004		mg/L	
		Total Phosphorus (P)	2011/07/21	<0.1		mg/L	
		Total Potassium (K)	2011/07/21	<0.3		mg/L	
		Total Silicon (Si)	2011/07/21	<0.1		mg/L	
		Total Sodium (Na)	2011/07/21	<0.5		mg/L	
		Total Strontium (Sr)	2011/07/21	<0.02		mg/L	
		Total Sulphur (S)	2011/07/21	<0.2		mg/L	
	RPD	Total Barium (Ba)	2011/07/21	1.8		%	20
		Total Boron (B)	2011/07/21	NC		%	20
		Total Calcium (Ca)	2011/07/21	0.5		%	20
		Total Iron (Fe)	2011/07/21	NC		%	20
		Total Lithium (Li)	2011/07/21	NC		%	20
		Total Magnesium (Mg)	2011/07/21	1.1		%	20
		Total Manganese (Mn)	2011/07/21	0.4		%	20
		Total Phosphorus (P)	2011/07/21	8.4		%	20
		Total Potassium (K)	2011/07/21	NC		%	20
		Total Silicon (Si)	2011/07/21	0.08		%	20
		Total Sodium (Na)	2011/07/21	2.6		%	20
		Total Strontium (Sr)	2011/07/21	1.5		%	20
		Total Sulphur (S)	2011/07/21	0.3		%	20
5025386 VGG	Matrix Spike	Dissolved Barium (Ba)	2011/07/21		96	%	80 - 120
		Dissolved Boron (B)	2011/07/21		96	%	80 - 120
		Dissolved Calcium (Ca)	2011/07/21		NC	%	80 - 120
		Dissolved Iron (Fe)	2011/07/21		103	%	80 - 120
		Dissolved Lithium (Li)	2011/07/21		96	%	80 - 120
		Dissolved Magnesium (Mg)	2011/07/21		94	%	80 - 120
		Dissolved Manganese (Mn)	2011/07/21		93	%	80 - 120
		Dissolved Phosphorus (P)	2011/07/21		105	%	80 - 120
		Dissolved Potassium (K)	2011/07/21		95	%	80 - 120
		Dissolved Silicon (Si)	2011/07/21		88	%	80 - 120
		Dissolved Sodium (Na)	2011/07/21		NC	%	80 - 120
		Dissolved Strontium (Sr)	2011/07/21		NC	%	80 - 120
	Spiked Blank	Dissolved Barium (Ba)	2011/07/21		96	%	85 - 104
		Dissolved Boron (B)	2011/07/21		99	%	75 - 125
		Dissolved Calcium (Ca)	2011/07/21		103	%	80 - 120
		Dissolved Iron (Fe)	2011/07/21		106	%	80 - 120

Maxxam

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Quality Assurance Report (Continued)

Maxxam Job Number: CB163763

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
5025386 VGG	Spiked Blank	Dissolved Lithium (Li)	2011/07/21		97	%	80 - 116
		Dissolved Magnesium (Mg)	2011/07/21		102	%	91 - 113
		Dissolved Manganese (Mn)	2011/07/21		96	%	89 - 111
		Dissolved Phosphorus (P)	2011/07/21		100	%	89 - 109
		Dissolved Potassium (K)	2011/07/21		98	%	80 - 120
		Dissolved Silicon (Si)	2011/07/21		94	%	80 - 120
		Dissolved Sodium (Na)	2011/07/21		97	%	84 - 110
		Dissolved Strontium (Sr)	2011/07/21		98	%	85 - 106
	Method Blank	Dissolved Barium (Ba)	2011/07/21	<0.01		mg/L	
		Dissolved Boron (B)	2011/07/21	<0.02		mg/L	
		Dissolved Calcium (Ca)	2011/07/21	<0.3		mg/L	
		Dissolved Iron (Fe)	2011/07/21	<0.06		mg/L	
		Dissolved Lithium (Li)	2011/07/21	<0.02		mg/L	
		Dissolved Magnesium (Mg)	2011/07/21	<0.2		mg/L	
		Dissolved Manganese (Mn)	2011/07/21	<0.004		mg/L	
		Dissolved Phosphorus (P)	2011/07/21	<0.1		mg/L	
		Dissolved Potassium (K)	2011/07/21	<0.3		mg/L	
		Dissolved Silicon (Si)	2011/07/21	<0.1		mg/L	
		Dissolved Sodium (Na)	2011/07/21	<0.5		mg/L	
		Dissolved Strontium (Sr)	2011/07/21	<0.02		mg/L	
		Dissolved Sulphur (S)	2011/07/21	<0.2		mg/L	
	RPD	Dissolved Calcium (Ca)	2011/07/21	0.6		%	20
		Dissolved Iron (Fe)	2011/07/21	NC		%	20
		Dissolved Magnesium (Mg)	2011/07/21	0.3		%	20
		Dissolved Manganese (Mn)	2011/07/21	NC		%	20
		Dissolved Potassium (K)	2011/07/21	0.2		%	20
		Dissolved Sodium (Na)	2011/07/21	0.9		%	20
5026600 IA0	Matrix Spike	Total Total Kjeldahl Nitrogen	2011/07/21		NC	%	80 - 120
	QC Standard	Total Total Kjeldahl Nitrogen	2011/07/21		110	%	75 - 125
	Spiked Blank	Total Total Kjeldahl Nitrogen	2011/07/21		107	%	80 - 120
	Method Blank	Total Total Kjeldahl Nitrogen	2011/07/21	<0.05		mg/L	
	RPD	Total Total Kjeldahl Nitrogen	2011/07/21	3.1		%	20
5026660 IA0	Matrix Spike	Total Phosphorus (P)	2011/07/21		100	%	80 - 120
	QC Standard	Total Phosphorus (P)	2011/07/21		86	%	80 - 120
	Spiked Blank	Total Phosphorus (P)	2011/07/21		92	%	83 - 111
	Method Blank	Total Phosphorus (P)	2011/07/21	<0.003		mg/L	
	RPD	Total Phosphorus (P)	2011/07/21	3.4		%	20
5026665 IA0	Matrix Spike	Dissolved Phosphorus (P)	2011/07/21		97	%	80 - 120
	QC Standard	Dissolved Phosphorus (P)	2011/07/21		88	%	80 - 120
	Spiked Blank	Dissolved Phosphorus (P)	2011/07/21		96	%	83 - 111
	Method Blank	Dissolved Phosphorus (P)	2011/07/21	<0.003		mg/L	
	RPD	Dissolved Phosphorus (P)	2011/07/21	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B163763

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ghayasuddin Khan, M.Sc., B.Ed., P.Chem, Senior Analyst, Water Lab

Janet Gao, Senior Analyst, Organics Department

LILI ZHOU, Senior analyst, Inorganic department.

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

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Chain of Custody A067971

Page: ____ of ____

	Invoice To: (C/O Report Address ☐)	Report To: (Same as Invoice ☐)	Report Distribution (E-Mail):	REGULATORY GUIDELINES:
Company:	Thompson Drilling Ltd	Dan Watterson	dan@wattersongeoscience.com	☐ AT1
Contact:	Don Nis	Watterson Geoscience	thompson drillingLtd@	☐ CCME
Address:	15-4775 Woodlane W.	685 Pheasant Rd.	cyberlink.ca	☐ Regulated Drinking Water
	Prov: Windermere BC V0B2L2	Prov: Vernon BC PC:		☐ Other:
Contact #s:	Ph: Cell 250 341 5564	Ph: V1B 3B1 Cell:		

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name:
Site Location: Bingay Creek
Quote #:
Sampled By: Dennis Thompson

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☐ REGULAR (5 to 7 Days)

See reverse for package specifics

#	Sample ID	Depth (unit)	Matrix (GW) SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill			WATER: ☐BTEX F1 ☐VOCs	☐BTEX F1-F2 ☐BTEX F1-F4	☑Routine Water ☑Turb ☑F	☐TOC ☐DOC	Regulated Metals (CCME / AT1): Total	Dissolved	Mercury ☑Total ☐Dissolved	Total P	Total dissolved P	TSS, TDS	NH3, TKN	Extractable Pet and eum Hydrocarbons					HOLD - Do not Analyze	# of Containers Submitted
1	DW-1	98.48m		11/07											✓		✓	✓	✓	✓	✓	✓	✓	✓						
2	DW-4	148.2m		11/07/13 14:05											✓		✓	✓	✓	✓	✓	✓	✓	✓						
3																														
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12																														

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Dennis D. Thompson Date (YY/MM/DD): 11/07/14 Time (24:00):
Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions: contact @ Maxxam is Cynny Hagen

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #: B163763		
JRC	JUL 15 2011	1030	Custody Seal	Temperature	Ice
Lab Comments:			No	4, 3, 9	Yes

AB FCD-00331 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

Appendix VII

2011 Preliminary Geotechnical Study

By WSA Engineering Ltd.

December 16, 2011

APPENDIX 4

Geotechnical Report

ENGINEERING LTD

December 16, 2011

Centermount Coal Ltd.
Suite 1385 – 1095 West Pender Street
Vancouver, BC
V6E 2M6

Attn: Ted Nunn, P. Eng.

RE: PRELIMINARY GEOTECHNICAL STUDY
CENTERMOUNT COAL LTD., BINGAY CREEK MINE PROPERTY
ELKFORD, BC

INTRODUCTION

At the request of Mr. Ted Nunn, P. Eng., of Centerpoint Centermount Coal Ltd., (Centermount) WSA Engineering Ltd., (WSA) has completed a preliminary geotechnical study for the pre-feasibility level design of the proposed Bingay Creek coal mine, located approximately 22 km north of Elkford, BC on the west side of the Elk River valley bottom (see Figure 1). The purpose of this geotechnical study is to provide preliminary geotechnical design parameters for location and construction of waste dumps, overburden cut slopes, pit wall slopes, and building and equipment foundations. It is understood that a more detailed geotechnical study will be completed in the future for feasibility level design. This preliminary study relies heavily on existing information from past investigations and reports, and limited field investigations conducted by WSA.

AUTHOR'S BIOGRAPHY

The study has been undertaken and authored by Bryan Woods, P. Eng. Mr. Woods completed his Bachelor of Applied Science (B.ASc.) in Geological Engineering (Geotechnical) at the University of British Columbia (UBC) in 1992. Mr. Woods received several awards for academic distinction, and graduated with First Class honours. Mr. Woods' career began with HBT Agra (formerly Hardy BBT, now Amec Earth & Environmental) in Burnaby, BC where he gained a wide variety of experience in geotechnical engineering and engineering geology. In 1996, Mr. Woods returned to the Kootenay Region of BC, where he specialized in soil and rock slope engineering in the Resource Sector at R.T. Banting Engineering Ltd.

Mr. Woods was a founding partner of his own engineering consulting firm in 1997, which eventually evolved into WSA Engineering Ltd. In recent years Mr. Woods has provided engineering expertise on a wide range of projects for private, commercial, industrial, and public sector clients, and over the past 4 years has managed

WSA's affiliated civil construction company WSA Ventures Ltd., (WSAV). WSAV has undertaken several design-build civil construction and earthworks projects in partnership with WSA, with a total construction value of approximately $4 million.

Mr. Woods' education and professional experiences have provided him with a strong background and technical understanding in soil and rock mechanics, groundwater characterization and control, slope stability analysis and stabilization, foundation engineering, earthworks and civil construction, and project management.

PROJECT DESCRIPTION

It is understood that Centermount, a subsidiary of Centerpoint Resources Inc., proposes to develop the Bingay Creek property as an open pit mine, which is projected to produce approximately 2 million tonnes per year (tpy) of metallurgical grade coal. The coal would be processed at an on-site plant, and transported to a shipping terminal via rail line. Waste rock would be placed in permanent stockpiles within a short haul distance of the pit, and/or dumped back into exhausted areas of the pit. Water is proposed to be removed from the tailings at the plant, allowing the tailings to be deposited in the waste dumps along with reject coal and rock, and hence it is envisioned that a tailings pond will not be required.

The pit would be designed for a maximum depth of 300 m, but there would likely be some additional high-grade excavation into the base as wall stability would allow. Typically this would be achieved by stepping the excavation away from the walls to avoid undercutting of the main pit slopes. In addition there would be underground hydraulic mining conducted into the walls of the pit and to a limited extent below the base.

RESOURCE MATERIALS

Resource materials provided to WSA by Centermount for use in this assessment includes:

- Topographic mapping with an orthophoto overlay and historical exploration drill hole locations
- Air photos providing stereoscopic coverage of the study area at a scale of approximately 1:10,000
- Core logs and geophysical logs for 2004/2005 and 2010 rotary and diamond drill core holes
- Report entitled "Bingay Creek Property Small Mine Permit Submission", dated January 11, 2005 and prepared by Northwest Corporation for Hillsborough Resources Ltd.
- Report entitled "Regional Structural Examination (Bingay Creek Area), dated October 12, 2010 and prepared by Munroe Geological Services Ltd., for Centerpoint Resources Inc.
- Report entitled "Geological Examination of Trench Works on the Bingay Creek Property, Elk River Valley north of Elkford, British Columbia", dated October 12, 2010 and prepared by Munroe Geological Services Ltd., for Centermount Coal Ltd.

- Report entitled “Draft - Preliminary Hydrogeological Investigation, Proposed Bingay Coal Mine, Elkford, BC” dated August 2011 and prepared by Watterson Geoscience Inc., for Centermount Coal Ltd.

Additional references used in preparation of this report and referenced in the text below, includes:

- Read J & Stacey P (2009). *Guidelines for Open Pit Slope Design,* CSRO Publishing, Australia.
- Wyllie DC & Mah CW (2004). *Rock Slope Engineering,* Civil and Mining. “Based on *Rock Slope Engineering* (third edition, 1981) by Dr Evert Hoek and Dr John Bray”.
- Hoek E (2004). *Esitmates of rock mass strength,* Discussion paper # 4, April 2004.
- Hoek E (2006). *Practical Rock Engineering,* Course Notes updated 2006.

SITE DESCRIPTION

The Bingay Creek property is situated on the west side of the Elk River valley, approximately 22 km north of Elkford, BC (see Figure 1). The Elk River Valley has a broad ‘U’ shape, which is typical of glacially scoured valleys, and drains from north to south. In the vicinity of the Bingay Creek property, the orientation of the Elk River channel is approximately north-south, and it is offset to the east side of the valley bottom. The historical floodplain varies up to 700 m wide, and the river channel meanders within an approximate 50 m to 100 m wide active floodplain. Access is provided by the Elk Forest Service Road (FSR) which runs along the west side of the Elk River valley bottom.

The floodplain is flanked on the west by gently sloping terraces that are elevated approximately 10 m to 15 m above the historical floodplain elevations. With the exception of Bingay Hill, which rises out of the gently sloping terrace north of Bingay Creek, the ground continues gently sloping to the toe of the valley hillside. East of the floodplain, the ground is moderately sloping and elevated between 25 m and 50 m above the historical floodplain elevation. The river has undercut the slopes on both sides of the historic floodplain, creating oversteepened and raveling slopes in localized areas, such as upstream on the west side and downstream on the east side south of the Bingay Creek confluence.

The proposed open pit mine would encompass an area of approximately 95 ha, roughly centered on Bingay Hill which is at the core of the coal deposit. The approximate pit limits and plant layout are illustrated on the attached site plan in Figure 2. The pit limits extends approximately 1,700 m north-south and between 400 m and 900 m east-west. The western limit of the pit would run approximately parallel to the FSR and offset approximately 50 m to the east, while the south and east limits would allow a nominal 50 m buffer from the Bingay Creek and Elk River floodplains. The northern extent would be set at the economic limit.

A portion of the existing Elk River FSR would be relocated to the west side of the valley bottom to accommodate construction of the plant facility, and a new access road and bridge would be constructed across the Elk River north of the plant to connect with a new primary access road up the east side of the valley. A coal conveyor and power line would also be constructed across the river at the north end of the site, and a new rail spur line would be constructed on the east side of the valley parallel with the new road access.

FIELD INVESTIGATIONS

An initial field review of the site was conducted by Mr. Bryan Woods, P. Eng., of WSA on June 13, 2011 and consisted of a brief helicopter overview flight and vehicle reconnaissance of the existing access roads within the study area. Mr. Woods subsequently conducted a four (4) day field investigation from July 12 to 15, 2011, which was completed with excavation of two shallow test pits with Centermount's excavator, and a series of vehicle, ATV, and foot traverses throughout the study area to collect data on surficial soils and bedrock.

Field observation and traverse points were mapped with a hand-held Ground Postioning System (GPS) device, and are plotted on the enclosed Field Observation Point Map. Also enclosed are copies of Mr. Woods' field notes with observation points which correspond to the numbered points on the map.

GEOLOGY

Regional Bedrock Geology

The Bingay Creek property is underlain by a thick sequence of folded and faulted sedimentary rocks. In stratagraphic sequence, the rocks include the Upper Jurassic age Mist Mountain Formation and Morrissey Formation, followed by the Lower Jurassic age Fernie Formation, followed by the Triassic age Spray River Group which includes the Whitehorse Formation and the Sulphur Mountain Formation.

The bedrock of most significance to the project is the Mist Mountain Formation, which measures approximately 500 m in total thickness and is composed of primarily siltstone and mudstone, cherty sandstone, carbonaceous shale, and coal. Coal accounts for approximately 10% of the total formation, and is disseminated throughout the stratigraphic sequence in beds varying in thickness from 0.3 m to 10 m.

Underlying the coal bearing strata, the Morrissey Formation is composed of primarily sandstone and shale, with minor occurrence of non-marine coal, and the Fernie Formation is composed of primarily shale, with some siltstone and sandstone, and minor limestone. Finally the spray river group consists primarily of sandstone and siltstone, with minor occurrences of limestone and dolomite.

The sedimentary rocks have been folded and faulted into approximate north-south axis synclinal folds by west to east tectonic compressive forces. A major low angle thrust fault, the Bourgeau Thrust, is mapped along the west side of the valley bottom, approximately following the toe of the mountain slope. A vertical fault has been mapped along the opposite side of the valley (east side), also running along the toe of the mountain slope, and there are a couple of cross faults running southwest to northeast in the northern part of the property.

The prominent structural feature within the property is a synclinal fold named the Bingay Syncline, which is composed of the Mist Mountain Formation from the ground surface to depths of at least 400 m. At the core of the syncline is a topographic knoll that is locally termed Bingay Hill. This knoll is capped with relatively hard sandstone of the Mist Mountain Formation, which has protected the softer underlying siltstone, mudstone, shale, and coal layers from erosion. The western limb of the syncline dips near-vertical, while the eastern limb dips 50^{o} to 60^{o}. The syncline axis plunges approximately 40^{o} to the north. West and east of Bingay Hill, the limbs are inferred to be composed of the relatively soft Fernie Formation shale, which has been easily eroded by glacial scour and post-glacial runoff.

Surficial Geology

Surficial soils at the site consist of primarily glacial till, glaciofluvial gravel, fluvial sand and gravel, locally derived colluviums. Fluvial deposits are primarily associated with the active and historical floodplain of the Elk River and Bingay Creek. Glaciofluvial deposits are situated in the valley bottom terraces and fans, particularly on the west side of the Elk River near the project site. Glacial till blankets the lower valley slopes and underlies the fluvial soil deposits. Although not observed in surface exposures, lacustrine silt and clay deposits are known to overly the glacial till beneath more recent fluvial soil deposits in the valley bottom. Deposits of glaciofluvial soil are typically underlain by glacial till (and localized lacustrine deposits), except in the vicinity of Bingay Hill where glaciofluvial soils have been observed directly overlying bedrock.

Geomorphological History

The Elk River valley has a classical 'U' shape, indicative of formation by glacial scour. During the last major glacial period, the valley would have been almost completely filled with ice and only the mountain peaks would have protruded above. As the ice thinned during deglaciation, thinner valley ice flows would have sculpted the bedrock in the valley bottom to the form that is similar to which currently exists beneath the surficial soil deposits. In the vicinity of the site, this sculpting includes the formation ofBingay Hill as a roche moutonnée, or sheep's back ridge, which is a feature formed when the ice scour is resisted by a hard rock mass. As is characteristic of such landforms, the up-ice (in this case north) side has a gently inclined and smooth surface, while the down-ice (south) side has a rough and steeply inclined face due to plucking by the passing ice.

Drill hole data suggests that a deep trough has been eroded on the west side of Bingay Hill, which deepens to the north, possibly scoured by ice flowing out of the Bingay Creek valley that split around the Bingay Hill obstruction. As the glacial ice thickness diminished, glacial till was deposited at the base, blanketing the valley bottom and the sides of Bingay Hill. Further recession resulted in localized ponding of glacial meltwater, and deposition of fine textured lacustrine soils in low points of the till blanket. The release of large water flows from the melting glaciers in the upper reaches of the Elk River and Bingay Creek drainages resulted in broad scale deposition of glaciofluvial soils in the valley bottom, over top of the glacial till and localized lacustrine soil deposits. Finally, the present day Elk River and Bingay Creek water courses downcut through the surficial soils, and deposited fluvial deposits within their floodplains. Within the vicinity of the Bingay property, the Elk River channel appears to be predominantly scoured into the glacial till blanket.

NATURAL HAZARDS

Potential natural hazards which could affect the proposed mine development areas that have been considered in this assessment include:

- Flooding and channel avulsion of the Elk River
- Flooding and channel avulsion of Bingay Creek
- Flooding and channel avulsion of smaller streams within the study area
- Landslides, debris torrents, and snow avalanches from mountain slopes west of the site

All of these hazards are typical of the mountainous terrain and geographic area of the site, and could pose significant hazards to life and property. WSA has completed a reconnaissance level assessment of these hazards within the mine area, with field observations of the terrain within and upslope of the site, and a thorough stereoscopic review of air photos provided by Centermount.

The Elk River appears to be moderately well confined within its current channel and active floodplain, which will be setback at least 50 m from the mine pit excavation. While there is active bank erosion around outside bends of the channel in several places upstream and down of the site, opposite the mine site the channel has been eroded down into either bedrock or dense/hard glacial till. In either case, erosion rates are relatively slow. In addition, the terraces that flank the west side of the channel and active floodplain are elevated at least 10 m above the channel, which makes the possibility of flooding and/or channel avulsion to the west toward the mine site virtually impossible.

The Bingay Creek channel is well confined with its active floodplain, which has eroded at least 10 m below the valley bottom terrace through coarse textured glaciofluvial soil. The south limit of the pit will be situated on the terrace and setback at least 50 m from the floodplain and at least 10 m above it. While there is some localized erosion on outside channel bends, the possibility of flooding and/or channel avulsion into the mine area is remote.

Horn-Nickle Creek passes through the site between the proposed pit and plant areas, and an unnamed stream passes through the north end of the site. Both these drain off the mountain slope to the west and flow southeast across the gently sloping terrace toward the Elk River. The steams are relatively small and there is no evidence of significant channel erosion or avulsion. Due to the relative gentle gradient and small size of the stream channels, a severe flood event would likely result in shallow inundation across broad areas of the terrace, and is unlikely to result in severe erosion and/or avulsion of the stream channels. Such flooding is not expected to present a serious hazard to life or property.

Review of the airphotos and visual reconnaissance of the terrain upslope of the mine site, did not reveal any evidence of large scale slope instabilities, historical debris flow or torrent channels, or snow avalanche paths that could pose a significant hazard to life or property at the site.

In conclusion, the proposed Bingay Creek mine site does not appear to be situated within the path of any natural hazards that could pose a significant risk to life or property.

GEOLOGY AND PIT WALLS

Geological core logging data from the numerous exploration holes drilled on and around Bingay Hill has been used by Centermount to create a three dimensional geologic model of the bedrock. The model shows that the west limb of the Bingay Syncline dips near-vertical with some overturning, while the east limb dips fairly consistently at 50^o to 60^o to the west.

Based on the currently proposed pit limits, it is anticipated that the pit walls will be excavated primarily within the Mist Mountain Formation. The west pit slope will likely run approximately parallel with the west limb of the syncline. The excavation will likely start within the Morrisey Formation, then progress into the lower part of the formation with increasing depth. The south end of the pit will likely follow along the bottom side ofthe 9/10 coal seam within the lower part of the Mist Mountain Formation. The eastern side of the pit will cut on a diagonal through the east limb of the syncline, exposing the full range of the Mist Mountain Formation. The northern slope of the pit will cut nearly perpendicular across the west limb of the syncline, within the mid portion of the Mist Mountain Formation.

OPEN PIT ASSESSMENT AND DESIGN

Pit Ground Water Conditions

It is understood that the pit will be advanced to a depth of several hundred meters, while the regional groundwater level is relatively close to the ground surface. Considerable sources of groundwater include the obvious surface water sources of Bingay Creek and Elk River (and their associated fluvial sediment aquifers adjacent to and underlying their channels), as well as a significant aquifer created by a deep glaciofluvial soil deposit lying to the west of Bingay Hill, which appears to be up to 70 m deep with the water table at about 20 m depth.

Groundwater seepage into the pit excavation will need to be addressed with both surficial materials and bedrock. Based on our current understanding of the pit limits, seepage from surficial materials (overburden) would be primarily a concern for excavations into the glaciofluvial deposit west and north of Bingay Hill, where the excavation reaches bedrock at depths that are significantly below the groundwater level. The glaciofluvial materials are expected to be highly permeable, which will result in relatively high water flows from excavation faces. Groundwater pressure and seepage forces could also substantially affect the stability of the slopes. One option for managing water seepage and stability would be to excavate the slopes at a stable angle and install a groundwater collection system at the toe, or install an impermeable barrier (such as a grout curtain) offset some appropriate distance from the excavation to prevent lateral flow of groundwater into the excavation. The south and east pit margins are expected to intercept bedrock at shallow depth, and so seepage from surficial materials is not expected to be a significant concern.

Bedrock excavations within the pit would generally be well below the regional groundwater level. Seepage rates from the bedrock would be governed by the rock's hydraulic conductivity, which in turn would be generally controlled by the degree ofjointed and connectivity of the joints. In general, the bedrock formations within the Bingay Syncline are not considered to be particularly well-jointed, and hydrogeological investigation and testing has shown that the bedrock typically has a low hydraulic conductivity, particularly the non coal-bearing rocks that line the limbs of the syncline and should form the east footwall. It is therefore anticipated that groundwater flow from the bedrock should not be a particular concern, except possibly for discrete shear zones. It is expected that as the pit is advanced deeper into the syncline, that there would be initial rushes of water draining from the joints and fractures, but once the water stored within the rock is released, steady state flow from the adjacent aquifers through the bedrock to the pit faces should be relatively slow, and most likely manageable with conventional pit dewatering practices.

Bedrock Pit Wall Design

Planar and circular stability analysis of the bedrock mass behind the pit slopes requires, as a minimum, knowledge (or estimates) of the following physical and strength properties:

- Apparent angle of friction, phi (φ)
- Apparent cohesion (c)
- Unit weight, gamma (γ)

Since detailed field investigations and laboratory testing has not yet been completed for this site, reasonably conservative estimates must be made based on preliminary field observations and data, and comparison with published correlations. A simplifying assumption must be made, that the rock mass is homogeneous. This is obviously a quite inaccurate assumption in the case of sedimentary rock of variable composition such as is prevalent at the site. However, stability analyses following this assumption are generally considered sufficiently accurate for preliminary design purposes.

The majority of the rock within the Mist Mountain Formation consists of siltstone, mudstone, and sandstone. Mudstone occurs as both relatively strong rock interbedded with siltstone, and as weak rock interbedded with coal seams. Using the "simple means" field strength tests (Wyllie & Mah, 2004), estimates have been made by WSA for the Mist Mountain Formation rocks as shown in Table 1.

Table 1 – Mist Mountain Formation Rock Properties

Rock Type	Compressive Strength (MPa)	Internal Friction (degrees)	Apparent Friction (degrees)	Unit Weight (kN/m^3)	Component (%)
Siltstone/Mudstone	25 to 50	25	35	25	45
Sandstone	50 to 100	30	40	25	25
Mudstone (weak)	5 to 25	20	30	20	20
Coal	5 to 25	20	30	15	10

The internal friction angle included in Table 1 applies to sliding along smooth planar surfaces. In the case of sliding along natural bedrock fractures, the roughness of the fracture surfaces results in a larger effective friction angle, which can be estimated by adding the average angle of the surface asperities to the internal friction angle. Based on observations of the bedrock fractures in the field, an asperity angle of 10^o would likely be appropriate for the site. The Component (%) column in the table is an estimate of the percent of the total Mist Mountain formation thickness that is made up of each of these rock types. The percentages have been derived from study of published data and WSA's review of the core logging data from the site exploration holes. WSA has used these component percent estimates to develop weighted average (design) values for the physical and strength properties of the rock mass, as summarized in Table 2.

Table 2 – Mist Mountain Formation Rock Design Properties

	Compressive Strength (MPa)	**Apparent Friction (degrees)**	**Unit Weight (kN/m^3)**
Design Values	25	35	23

The compressive strength design value in Table 2 has been derived from the lower bound of the compressive strength ranges shown in Table 1, since laboratory testing has not been completed to accurately estimate the rock strengths, and the shear strength value derived from the compressive strength estimate, will have a dominant influence on rock slope stability assessments.

Cohesive strength (c) of the intact rock can be derived from the compressive strength using the Mohr-Coulomb Failure Criterion, which yields c = 6.5 MPa. However, the cohesive strength of the intact rock is not relevant to stability analyses of the rock mass, because the rock mass contains many existing fractures, along which the rock has little or no cohesive strength. An estimate of the rock mass strength can be made using the Hoek-Brown method, which factors the intact rock strength based on characteristics of the rock joints, quantified by the Rock Mass Rating (RMR), and more recently by the Geologic Strength Index (GSI) and material constant m_i. Hoek summarized rock mass strength predictions from Hoek et al., 2002 and Barton, 2000 with a series of curves plotting the ratio of rock mass strength over laboratory strength vs. GSI, RMR, and Q rating, for a variety of m_i values and disturbance (D) conditions (Hoek, 2004). Use of the graphs to predict rock mass strength requires determination of an average rock mass value, at least one of these rating systems (GSI, RMR, or Q), and estimation of the m_i and D values.

The core logging information provided by Centermount included computations and evaluations of RQD and Q ratings for core from diamond drill holes completed in 2010 within the Bingay Creek property. RQD was computed for 15 of the holes, and evaluations of Q rating were completed for 10 of the holes. WSA has used this data to calculate an average RQD = 51, and Q = 26. RMR can be estimated from Q with the equation RMR = 9 x ln Q + 44, which yields RMR = 74.

Based on field observations and discontinuity mapping, and Q ratings of the drill core, the rock is expected to fit into the category of “Blocky”, which is defined as “cubical blocks formed by three intersecting discontinuity sets”. Surface conditions of the discontinuities, as observed in ground exposures, could be rated at “Good” to “Very Good”, which are defined as rough and very rough respectively. However, observations from core logging indicate primarily smooth surfaces, which would indicate a “Fair” surface condition. Assuming the surface condition lies somewhere between smooth and rough, the GSI of the rock mass would be between 55 and 65. Based on the rock types and percentages summarized in Table 1, the weighted average m_i constant should be between 6 and 11.

Based on these estimated values of Q, RMR, GSI, and m_i =5 and assuming an undisturbed rock mass (D=0), the ratio of rock mass strength to laboratory strength is estimated to be between 0.14 and 0.28. Based on our estimated intact rock cohesive strength of 6.5 MPa, the estimated rock mass cohesive strength is between 0.9 MPa and 1.8 MPa.

Circular Stability Analysis

A simplified circular failure analysis has been undertaken using circular failure charts for homogeneous materials, which have been developed for a material density equal to 18.5 kN/m^3, and a variety of groundwater conditions (Wyllie & Mah, 2004). Assuming fully saturated conditions with the estimated physical and strength properties provided above (assuming average apparent friction angle of 35^o) and a 300 m deep pit with an apparent rock mass cohesive strength of between 0.9 MPa and 1.8 MPa, the Factor of Safety (FS) of a 50^o slope would range between 1.3 and 2.1. It is expected that this analysis is conservative, since the estimated unit weight of the Mist Mountain Formation rock is considerably greater than what the charts are based on and groundwater conditions are expected to be more favorable than the fully saturated condition analyzed. Additionally, cable bolting can be employed to increase the effective cohesion of the rock mass near the pit face and increase the FS.

Although a FS equal to at least 1.3 is customary for design of open pit mine slopes, an FS greater than 1.3 should be targeted for preliminary design to account for unknown ground conditions. Therefore, it is recommended that a maximum overall pit slope angle of 50^o be used for preliminary design to satisfy rock mass strength conditions. The actual overall slope design angle must consider both the maximum slope determined by the circular stability analysis, and the results of the planar failure analysis discussed in the following sections, with the lesser values governing design.

A somewhat reliable means of conducting a “reality check” of this assessment is to compare the proposed pit depth and slope angle to compiled empirical data of stable and unstable open pit mine slopes (Read and Stacey, 2009). Such a comparison with a 300 m slope height and 50^o slope angle indicates that this configuration is very close to the boundary between statistically stable and unstable slopes. While this type of comparison should not form the basis of design, it does reinforce the need to undertake more detailed investigation and analysis of the rock mass to verify the design strength parameters prior to progressing pit design beyond the pre-feasibility stage.

Planar Failure Analysis

Bedrock geology mapping was conducted from all natural and man-made bedrock exposures within the proposed Bingay mine area, which include the bedrock exposed at the bulk sample excavation site at the north end of Bingay Hill, natural sandstone cliff exposures along the west flank and crest of Bingay Hill, small rock knoll exposures on the east flank of Bingay Hill, and a bedrock cliff exposure on the west side of the Elk River channel directly east of Bingay Hill. The mapping generally found a fairly consistent set of conjugate joints oriented roughly perpendicular to the bedding. Typically one set would measure 3 m to 4 m in length, with a spacing of several meters, while the second set would measure about 1 m in length, with a spacing of 1 m to 2 m. The longer set were generally tight and exhibited a limited amount of slip movement, while the shorter joints were observed to be open and rough, with no visible sign of slip movement.

The joint and bedding measurements recorded with the field mapping were grouped into a number of different traverses based on their common spatial relationship to the syncline structure and proposed pit quadrants. The data from the various traverses were then plotted on equal angle lower hemisphere stereonet projections, and compared with corresponding pit slope orientations grouped according to north, south, east, and west quadrants. The field measurements of bedding orientations appear to be similar to the geologic model that has been developed based on the drill hole data. WSA's bedrock mapping data is summarized in the attached spead sheet, and the traverse locations are illustrated on Figure 2. Individual data recording points are located on the enclosed Field Observation Point Map and detailed in the attached field notes.

The following sections provide the results of the analyses of the assumed pit wall plane orientations versus the orientations of the anticipated bedding and joint planes and intersections. These analyses are preliminary in nature. Further investigations and detailed analysis will be required to more precisely characterize the structure and strength parameters of the bedrock forming the pit walls in order to conduct detailed stability analyses.

West Pit Slopes

The orientation of the west pit slope will likely be close to parallel with the bedding strike. Stereonet projections of bedrock structure data collected on the west side of the study area found the bedding is dipping nearly vertical with a strike of about 015^{o} (90/015) and two conjugate joint set oriented 80/305 and 50/125, and 80/105 and 35/232. The first set intersect along an approximate horizontal line which presents no stability concern, and the second set intersects with a slope of about 30^{o} to the west which is into the pit slope and therefore also of no concern to stability.

The primary and substantial concern for the west pit slope is toppling failures on the bedding planes. Evidence of toppling failures was observed during the field mapping along the west flank of Bingay Hill. In the case of excavation (pit) slopes oriented nearly parallel to the strike of the bedding, the potential for toppling failures will be primarily governed by the inclination angle of the pit wall, and the groundwater pressure within the rock mass near the slope face. Assuming the bedding dip is 90^o (vertical) and the angle of friction between the bedding planes is 40^o, toppling will be theoretically feasible for slopes steeper than 50^o (Rock Slope Engineering, 4th Edition, 2004) without consideration of groundwater, which could further drive toppling by reduction of shear strength between bedding layers. The potential for toppling will also be greatest for pit slopes that are aligned within 10^o of the bedding strike.

Based on the results of this assessment, it is recommended that the overall inclination of the west pit slope be limited to 50^o, in order to provide a reasonable level of protection against large-scale toppling failures. In addition, a comprehensive slope dewatering program should be budgeted for portions of the pit slope which are expected to encounter overturned bedding orientations (bedding dipping into the slope). Budgets should also be provided for installing cable anchors to reduce toppling of critical bench and ramp cut slopes. Skewing the orientation of the pit slope to the strike of the bedding will also substantially reduce the toppling potential.

East Pit Slopes

The orientation of the east pit slope will likely be close to parallel with the bedding strike, and it is anticipated that the slope would likely follow the bedding planes down the east limb of the syncline. It is also anticipated that the footwall wall will be composed of reasonably competent sandstone and/or shale of the Morrissey Formation. Excavations steeper than the bedding planes would likely result in daylighting of weak, steeply dipping bedding layers, which would result in a high probability of slope failure. Stereonet projections of bedrock structure data collected on the east side of the study area, found the bedding is dipping approximately 50^o with a strike of about 240^o (50/240) and conjugate joint set oriented 45/050 and 85/330. The set intersect oblique to and into the pit slope, and therefore presents no concern for stability.

Based on the results of this assessment, it is recommended that all slopes on the east side of the pit follow the bedding surfaces, including bench and ramp slopes. The result will be an overall pit slope somewhat less than the inclination of the bedding. A budget should be allowed for rock bolting localized areas of weak, unstable bedding, and areas where localized flattening of the bedding might result in daylighting of the bedding planes.

North Pit Slopes

The orientation of the north pit slope will likely cut across the bedding. Stereonet projections of bedrock structure data collected on the north side of the study area, found a conjugate joint set oriented 80/310 and 35/120. The set intersect along a nearly horizontal line, and therefore presents no concern for stability. The 35/120 joint set however, does dip out of the slope and may present a marginal concern for stability of southwest facing slopes (northeast pit slopes).

Based on the results of this assessment, it is recommended that all slopes on the north side of the pit be inclined no steeper than 50^o. A budget should be allowed for rock bolting localized areas of unstable blocks, particularly in the northeast quadrant.

South Pit Slopes

The orientation of the south pit slope will likely follow the bedding and the plunge of the synclinal fold axis, which is approximately 40^o. Stereonet projections of bedrock structure data collected on the south side of the study area found the bedding is dipping about 50^o with a strike of about 290^o (50/290), and a conjugate joint set oriented 95/200 and 30/125. The set intersect into the slope, and therefore presents no concern for stability. The bedding does dip out of the slope and may present a concern for stability if weak bedding planes are daylighted.

Based on the results of this assessment, it is recommended that all slopes on the south side of the pit follow the bedding surfaces, including bench and ramp slopes. The result will be an overall pit slope somewhat less than the inclination of the bedding. A budget should be allowed for rock bolting localized areas of weak, unstable bedding, and areas where localized flattening of the bedding might result in daylighting of the bedding planes.

Overburden Excavations

Based on the current estimate of the pit limits extending to about 50 m east of the Elk River FSR, overburden cut depths will be in the range of 30 m to 70 m along the west side, where the cut would extend into the old scour/erosion channel between Bingay Hill and the west valley slope. Around the north end of the pit the overburden excavation depths are expected to vary between 20 m and 80 m, and at the south end about 20 m. Bedrock is expected to be relatively shallow along the east side of the pit excavation, resulting in overburden excavations of less than 20 m.

Depending on the location, the cut slopes are expected to encounter three primary soil types including: coarse textured glaciofluvial gravel; fine textured glaciolacustrine clay/silt; and silt/sand/gravel glacial till. Groundwater, which will strongly influence slope stability, will be encountered at a wide range of depths. For the purpose of preliminary design, a slope stability program was used to check the stability of excavations extending to 70 m depth through overburden materials with a water table at 20 m depth below the ground surface. The overburden (from the bedrock surface upward) was modeled as a 2 m layer of clay, followed by gravel to the ground surface. The clay was assigned a conservative friction value of 20 degrees with zero cohesion, and the gravel a friction value of 38°. The stability analysis based on these parameters, found that a cut slope of 3H:1V would have a Factor of Safety (FS) equal to approximately 1.5.

This analysis is expected to be somewhat conservative, because it assumed no drawdown on the groundwater surface from the excavation face. In addition, groundwater dewatering or barrier (grout curtain) construction would, by design, substantially lower groundwater levels at the excavation faces and allow steeper excavation slopes.

Global Stability

The core drilling completed to date does not appear to have identified any large scale faults or shear zones within the pit area, although the geologic model does indicate the presence of a steeply dipping plane of offset that slid the west limb of the Bingay Syncline upward and to the east along the plane of the east limb. This plane of offset is inferred to be a relative small scale thrust fault that developed toward the latter stages of the syncline development. The axis of the pit will be located east of this potential thrust fault, and the fault trace will be encountered dipping steeply downward into the west pit slope. Consequently, the development of the pit cannot create a potential for large scale sliding along the fault.

Similarly, the proposed open pit mine would be located east of the main Bourgeau Thrust fault, which was also developed by overthrusting from west to east. Given the geometry of the thrust fault and the location and scale of the proposed mine pit below the fault, the pit development cannot create a potential for large scale sliding along the fault.

Design Slopes Summary

Based on the various stability analyses discussed above, the recommended preliminary design pit slope angles for bedrock and overburden are detailed in Table 3, below.

Table 3 –Summary of Recommended Pit Design Slopes

	Overburden Slope (H:V)	Overall Bedrock Slope (degrees)
West	3:1	50
East	2:1	Bedding Slope (max. 50)
North	3:1	50

South	3:1	Bedding Slope (max. 50)

UNDERGROUND MINING

It is anticipated that underground mining to access higher value coal seams behind and below the open pit mine walls and base would be encounter bedding dips varying from near vertical on the west side, to horizontal in the base at the syncline axis, and 50^o on the east side. RQD, Q, and RMR ratings of the core were typically as follows:

Table 4 – Typical RQD and Q ratings of Bingay Core

Rock Type	RQD (%)	Q	RMR*
Siltstone/Mudstone	45 to 85 (Fair)	5 to 75 (Good)	58 to 83 (Good)
Sandstone	75 to 100 (Good)	15 to 85 (Good)	68 to 84 (Good)
Mudstone (weak)	25 to 60 (Fair)	5 to 20 (Fair)	58 to 71 (Good)
Coal	0 to 20 (Very Poor)	0 to 5 (Very Poor)	44 to 58 (Fair)

* $RMR = 9 \ln Q + 44$

Table 4 includes both qualitative ratings derived from the Centermount core logging data, as well as the corresponding qualitative (numerical) ratings (i.e. Very Poor to Good) that approximately correspond with the ranges in numerical ratings (Hoek, 2006).

These ratings in Table 4 can be used for preliminary design of tunnel support requirements and mining methods. It is expected that the Q index of the thick coal seams will be practically zero, which should make removal by caving and hydraulic mining quite productive. Where the formation dip is steep, such as on the west side of the syncline structure, pillar supports can be formed in the relative competent sandstone and siltstone layers. Toward the bottom of the syncline where the bedding turns horizontal, underground mining will be limited by the capacity of coal pillars.

WASTE DUMPS

The mine plan identifies four (4) separate waste dump areas, all of which would be situated on the gently sloping glaciofluvial terrace on the east side of the valley. Two dumps are proposed on the south side of Bingay Creek either side of the FSR, a large dump directly west of the pit and a fourth located north of the plant site within the construction laydown area. Drill holes in these areas have encountered well drained, sand

and gravel soils up to 60 m deep, with groundwater at about 20 m depth. The waste rock itself is expected to be highly permeable, so it is expected that freely drained conditions within the bodies of the dumps can be maintained. For preliminary design purposes, waste rock dumps should be designed with final slopes of 2H:1V to achieve a factor of safety (FS) of at least 1.5.

It is understood that a separate dump(s) would be created for waste rock with relative high selenium contents, and that these dumps will either be covered with impermeable material to prevent leaching, or will be hauled back to the pit for permanent disposal. The glacial till soil underlying the lower valley slopes would likely make ideal material for temporary or permanent covers.

PLANT FOUNDATIONS

The undisturbed native soils in the vicinity of the proposed plant site area are expected to be well suited for support of structures founded on conventional spread and strip footings. For preliminary design, footings should be designed for an allowable soil resistance of 150 kPa under Serviceability Limit States (SLS) design, and a factored ultimate resistance of 225 kPa under Ultimate Limit States (ULS) design. The seismic Site Class rating is 'D' (i.e. Stiff Soil).

The ultimate bearing resistance is based on a geotechnical resistance factor (F) of 0.5 for shallow foundations. It is estimated that footing settlements under a soil bearing pressure of 150 kPa under SLS loading conditions would not exceed 25 mm.

FURTHER GEOTECHNICAL INVESTIGATIONS AND FEASIBILITY LEVEL DESIGN

Specific details regarding further geotechnical investigations that are required to advance the pit and waste dump designs for the project cannot be determined until a preliminary model of the mine is produced following the preliminary recommendations provided above. However, it is generally expected that the following drill hole investigations will be required as summarized in Table 2, below. Also included in Table 2 are estimates of the cost for drilling, and analysis and design.

Table 5 – Feasibility Stage Investigation and Assessment Costs

	WASTE DUMPS	PIT SLOPES	
		OVERBURDE	ROCK

		N	
#TEST HOLES	6	20	12
AVERAGE DEPTH (m)	30	40	200
SAMPLING	SPT @ 1.5 m Standpipes Shelby Tubes	SPT @ 1.5 m Standpipes Shelby Tubes	Oriented core
DRILL COST	$30,000	$120,000	$600,000
ANALYSIS & DESIGN COST	$30,000	$50,000	$150,000
TOTAL	**$60,000**	**$170,000**	**$750,000**

CLOSURE

This report has been prepared for the exclusive use of Centermount Coal Ltd.., and is in accordance with generally accepted geotechnical engineering principles and practice. No other warranty, either expressed or implied, is made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSA Engineering Ltd., accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that the information provided above meets with your current requirements. If you have any questions, or require any further information, please contact the undersigned.

Respectfully submitted,
WSA ENGINEERING LTD.

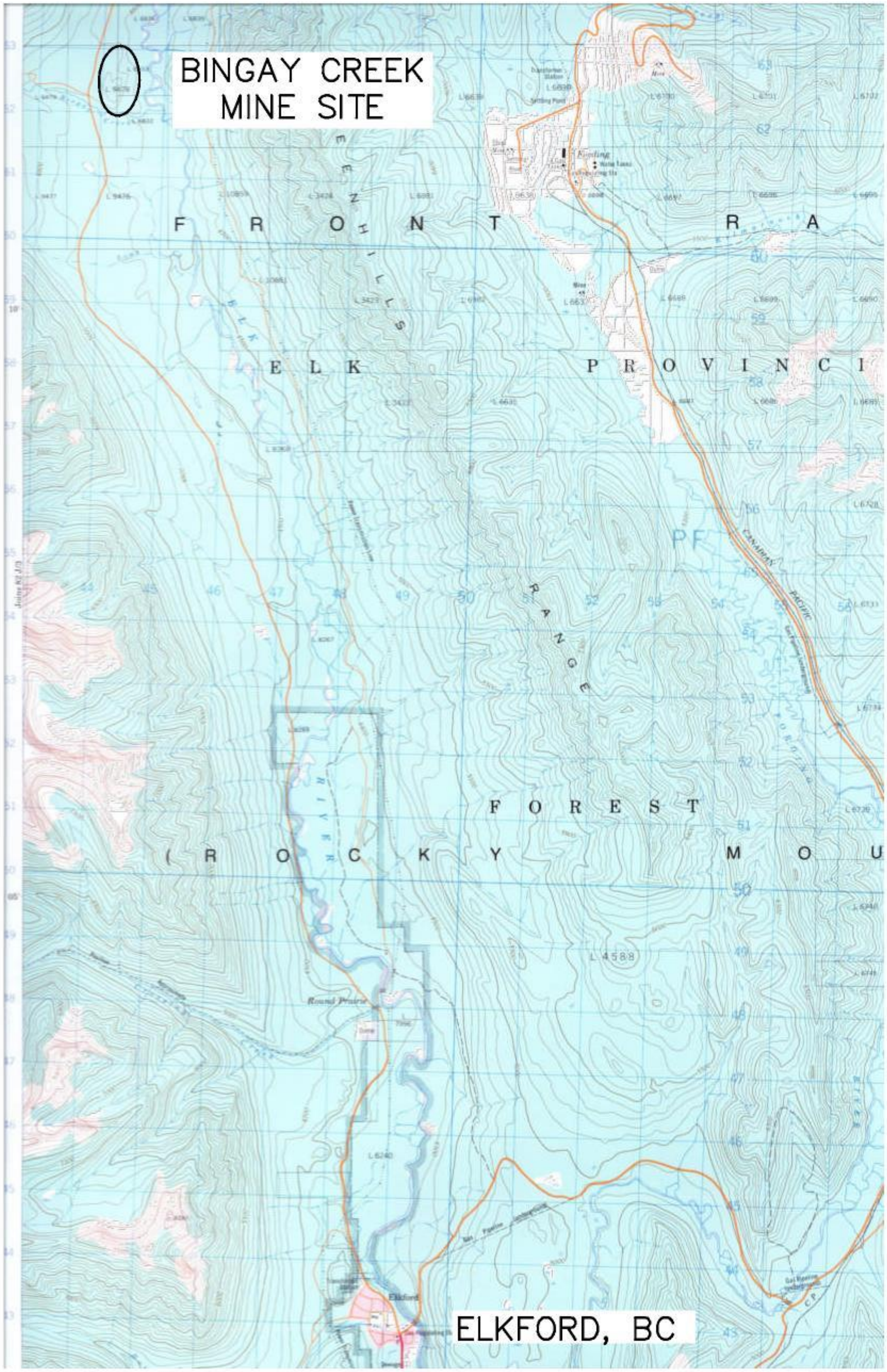
Bryan E. Woods, P.Eng.

Geotechnical Engineer

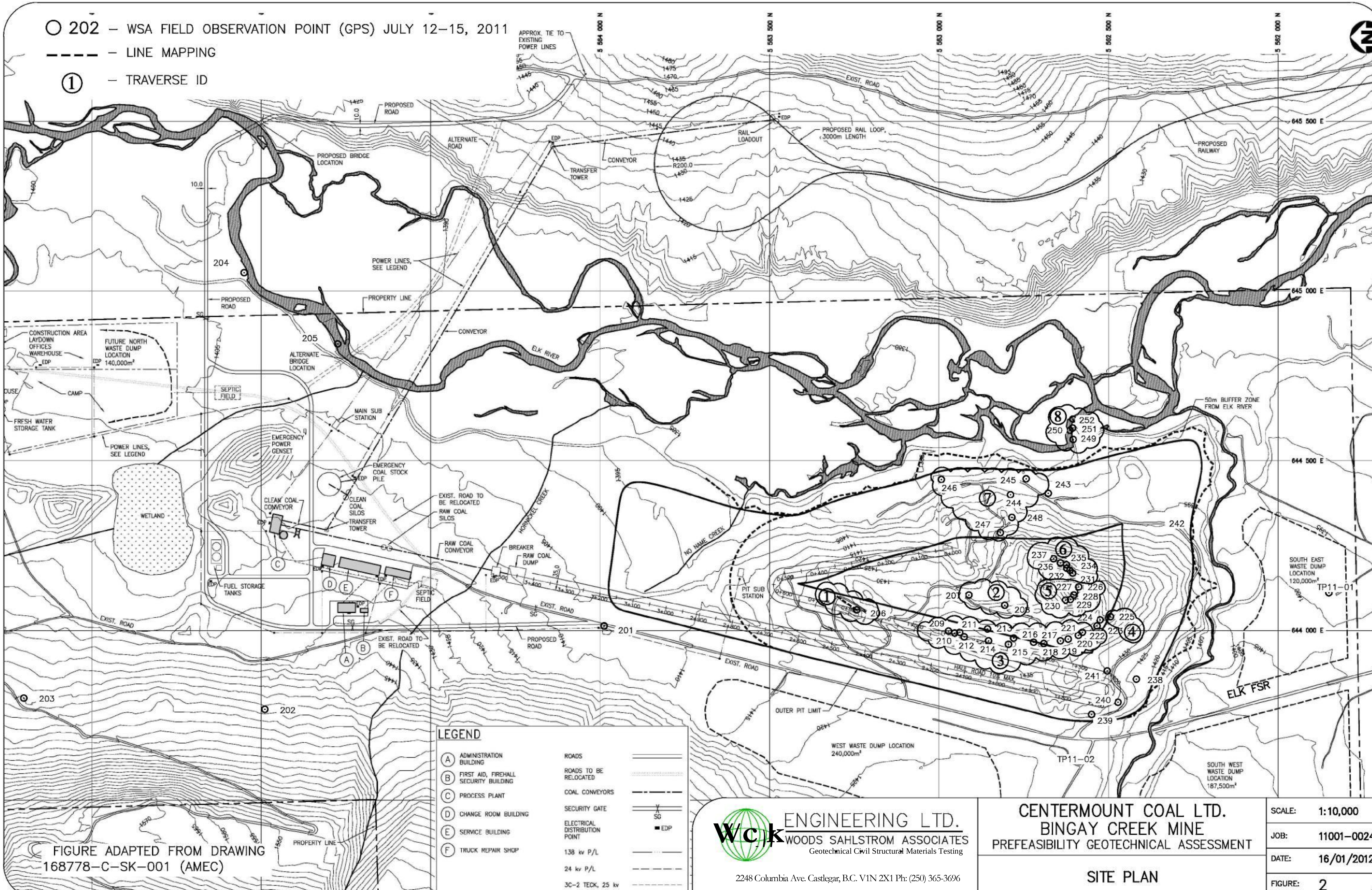
BEW:er

Attachments: Figure 1 – Location Map (1:50,000)
Figure 2 – Site Plan (1:10,000)
Soil Hydrometer Gradation (2 pages)
Bedrock Mapping Data (1 page)

Enclosed: Field Observation Point Map (1:10,000)
Field Notes (9 pages)



VSA ENGINEERING LTD. WOODS S AHLS TROM ASSOCIATES Geotechnical • Civil Structural Materia1s Testing	CENTERMOUNT COAL LTD. BINGAY CREEK MINE PREFEASIBILTY GEOTECHNICAL ASSESSMENT	SCALE:	1:100,000
		DATE:	16/01/2012
224 8 C o1umbia Ave. C ast1egar, B .C . V 1 N 2X 1 Ph: (250) 3 6 5 -3 6 9	LOCATION MAP	JOB:	11001-024
		FIGURE:	1



202 – WSA FIELD OBSERVATION POINT (GPS) JULY 12–15, 2011
– LINE MAPPING
① – TRAVERSE ID
ELK RIVER
NO NAME CREEK
HORNICKEL CREEK
EXIST. ROAD
ELK FSR
PROPOSED RAIL LOOP, 3000m LENGTH
RAIL LOADOUT
PROPOSED RAILWAY
50m BUFFER ZONE FROM ELK RIVER
SOUTH EAST WASTE DUMP LOCATION 120,000m²
SOUTH WEST WASTE DUMP LOCATION 187,500m²
WEST WASTE DUMP LOCATION 240,000m²
FUTURE NORTH WASTE DUMP LOCATION 140,000m²
OUTER PIT LIMIT
PIT SUB STATION
MAIN SUB STATION
WETLAND
TP11–01
TP11–02
LEGEND
A ADMINISTRATION BUILDING
B FIRST AID, FIREHALL SECURITY BUILDING
C PROCESS PLANT
D CHANGE ROOM BUILDING
E SERVICE BUILDING
F TRUCK REPAIR SHOP
ROADS
ROADS TO BE RELOCATED
COAL CONVEYORS
SECURITY GATE
ELECTRICAL DISTRIBUTION POINT
138 kv P/L
24 kv P/L
3C–2 TECK, 25 kv
FIGURE ADAPTED FROM DRAWING 168778–C–SK–001 (AMEC)
WCK ENGINEERING LTD.
WOODS SAHLSTROM ASSOCIATES
Geotechnical Civil Structural Materials Testing
2248 Columbia Ave. Castlegar, B.C. V1N 2X1 Ph: (250) 365-3696
CENTERMOUNT COAL LTD.
BINGAY CREEK MINE
PREFEASIBILITY GEOTECHNICAL ASSESSMENT
SITE PLAN
SCALE: 1:10,000
JOB: 11001–0024
DATE: 16/01/2012
FIGURE: 2

WSA ENGINEERING LIMITED

ASTM D422 - 63
PARTICLE SIZE ANALYSIS OF SOILS

PROJECT NAME:	Bingay Creek Mine
PROJECT NUMBER:	11001-024
CLIENT NAME:	Centermount Coal Ltd.
DATE TESTED:	September 20, 2011
SAMPLE LOCATION:	Observation Point 197
SAMPLE DESCRIPTION:	Glacial Till SA#1
TESTED BY:	John Proulx

SIEVE ANALYSIS		HYDROMETER ANALYSIS
SIZE OF OPENING IN INCHES	U.S STANDARD SERIES	GRAIN SIZE IN MILLIMETERS

GRAIN SIZE IN MILLIMETERS

COBBLES	GRAVEL		SAND			FINES
	COURSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION

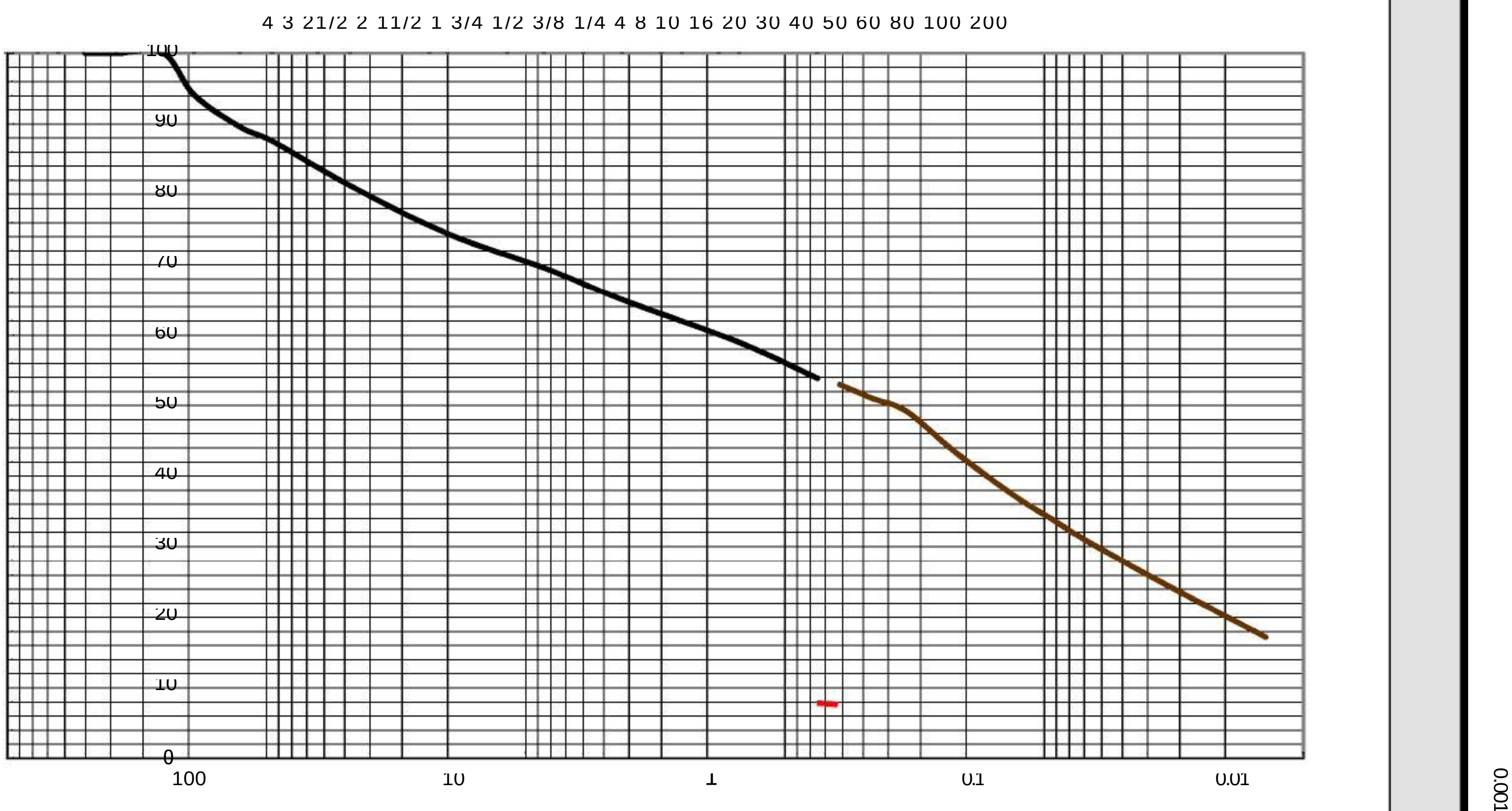
ENGINEERING LIMITED

ASTM D422 - 63

PARTICLE SIZE ANALYSIS OF SOILS

PROJECT NAME:	Bingay Creek Mine
PROJECT NUMBER:	11001-024
CLIENT NAME:	Centermount Coal Ltd.
DATE TESTED:	September 20, 2011
SAMPLE LOCATION:	Observation Point 198
SAMPLE DESCRIPTION:	Glacial Till SA#2
TESTED BY:	John Proulx

SIEVE ANALYSIS		HYDROMETER ANALYSIS	
SIZE OF OPENING IN INCHES	U.S STANDARD SERIES	GRAIN SIZE IN MILLIMETERS	



	COURSE	FINE	COARSE	MEDIUM	FINE	
COBBLES	GRAVEL		SAND			FINES

UNIFIED SOIL CLASSIFICATION

Comment	Traverse	Point	Chainage (m)	Dip	Strike	Type	Length (m)	Rock
Line Trav W Wall #10	1	206		90	27	BED		sst
	1		0.3 to 2.1	70	300	SHR	4	
	1		3.7	85	120	NPF	1	sst
	1		3.7	20	103	PJ	5	sst
	1		6.6	40	316	PJ	5	sst
	1		7.4	20	103	PF	4	sst
	1		8	80	216	BED		sst
	1		9.7	24	125	PF	1	sst
	1		12.8	50	306	NPF	1	sst
	1		15	56	300	NPF	1.5	arg
	1		17.9	36	144	NPF	1	sst
	1		19.5	88	220	BED		sst
	1		21.7 to 26	60	144	NPF		arg
	1		21.7 to 26	30	100	PJ		arg
	1		26.8	78	308	NPF		arg
	1		27.1	78	308	NPF	1	arg
	1		28.4	8	157	NPF	1	sst
	1		28.8	88	224	BED		sst
	1		30.1	22	293	NPF	1.5	sst
	1		31	22	118	NPF	1	sst
	1		32	46	140	NPF	1	sst
	1		32.2	60	155	NPF	1	sst
	1		32.4	80	305	NPF	1	sst
	1		32.6	80	305	NPF	1	sst
	1		32.7	80	305	NPF	1	sst
	1		32.9	88	224	BED		sst
	1		32.9	80	305	NPF	1	sst
	1		33.1	80	305	NPF	1	sst
	1		33.2	80	305	NPF	1	sst
	1		33.4	80	305	NPF	1	sst
	1		33	21	94	NPF	1.5	sst
	1		46.8	42	144	NPF	1	
	1		47	80	217	BED		sst
	1		48	42	144	NPF	1	
	1		48.7	60	123	NPF	0.5	
	1		50	80	220	BED		sst
	1		51.1	47	130	NPF	1	
	1		52.1	50	125	NPF	1	
	1		52.7	80	220	BED		sst
	1		52.9	50	125	NPF	1	
	1		53.7	50	125	NPF	1	
	1		55.2	50	125	NPF	1	
Road cuts	2	207		80	10	BED		sst
	2	207		56	360	NPF	1	sst
	2	207		26	120	NPF	1	sst
	2	207		50	290	NPF	1	sst
	2	207		42	263	NPF	1	sst
	2	208		78	180	BED		sst
	2	208		66	284	J		sst
	2	208		18	85	J		sst
Trav w side sst ridge	3	209		80	20	BED		sst
	3	209		20	310	NPF		sst
	3	209		54	270	NPF		sst
	3	209		74	113	PJ		sst
	3	210		70	15	BED		sst
Comment	**Traverse**	**Point**	**Chainage (m)**	**Dip**	**Strike**	**Type**	**Length (m)**	**Rock**

	3	210	15	210	NPF	sst
	3	210	75	120	PJ	sst
	3	210	28	252	NPF	sst
	3	210	58	130	PJ	sst
	3	211	84	25	BED	sst
	3	211	78	140	PJ	sst
	3	211	46	234	NPF	sst
	3	211	30	226	NPF	sst
	3	212	74	15	BED	sst
	3	212	73	100	PJ	sst
	3	212	74	110	PJ	sst
	3	212	28	240	NPF	sst
	3	213	90	10	BED	sst
	3	213	73	100	PJ	sst
	3	213	74	110	PJ	sst
	3	213	28	240	NPF	sst
	3	214	78	260	BED	sst
	3	214	82	92	PJ	sst
	3	214	5	165	NPF	sst
	3	214	70	98	PJ	sst
	3	216	78	20	BED	sst
	3	216	68	96	NPF	sst
	3	216	70	103	NPF	sst
	3	217	72	353	BED	sst
	3	217	50	80	NPF	sst
	3	217	40	250	NPF	sst
	3	217	80	343	BED	sst
	3	217	24	93	NPF	sst
	3	217	70	244	NPF	sst
	3	218	60	95	PJ	sst
	3	218	68	80	PJ	sst
	3	218	80	355	BED	sst
	3	219	80	2	BED	sst
	3	219	50	118	J	sst
	3	219	50	220	J	sst
	3	219	74	120	J	sst
	3	219	80	68	J	sst
	3	219	80	186	J	sst
	3	220	70	182	BED	sst
	3	220	151	262	J	sst
	3	220	80	102	J	sst
	3	220	35	228	J	sst
	3	221	74	360	BED	sst
	3	221	76	85	J	sst
	3	221	10	360	J	sst
	3	221	14	220	J	sst
	3	222	70	343	BED	sst
	3	223	73	330	BED	sst
	3	223	90	75	J	sst
	3	223	35	190	J	sst
Bingay Hill road trav	4	225	70	310	BED	sst
	4	225	84	210	PJ	sst
	4	225	87	200	PJ	sst
	4	225	40	124	NPF	sst
	4	225	46	120	NPF	sst

Bingay Creek Coal Ltd.

Comment	Traverse	Point	Chainage (m)	Dip	Strike	Type	Length (m)	Rock
	4	225		58	220	NPF		sst
	4	225		75	200	PJ		sst
	4	225		70	340	BED		sst
West side Bingay Peak	5	226		50	290	BED		sst
	5	226		78	186	PJ		sst
	5	226		38	285	NPF		sst
	5	227		56	280	BED		sst
	5	227		18	48	NPF		sst
	5	227		75	170	NPF		sst
	5	228		72	290	BED		sst
	5	228		20	185	NPF		sst
	5	228		80	32	NPF		sst
	5	229		70	320	BED		sst
	5	229		74	58	PJ		sst
	5	229		40	170	NPF		sst
	5	230		60	326	BED		sst
East side Bingay Peak	6	231		50	240	BED		sst
	6	231		70	350	J		sst
	6	231		40	100	J		sst
	6	233		48	250	BED		sst
	6	233		82	4	PJ		sst
	6	233		32	115	NPF		sst
	6	234		40	250	BED		sst
	6	234		75	350	J		sst
	6	234		40	160	J		sst
	6	235		54	245	BED		sst
	6	236		60	45	PJ		sst
	6	236		30	70	J		sst
	6	238		85	340	BED		sst
	6	238		60	210	NPF		sst
	6	238		50	230	NPF		sst
East flank of Bingay Hill	7	244		45	250	BED		sst
	7	224		75	330	PJ	3	sst
	7	224		40	100	NPF	.5 to 1	sst
	7	245		52	235	BED		sst
	7	245		84	320	PJ		sst
	7	245		30	45	NPF		sst
	7	245		40	50	NPF		sst
	7	245		48	105	NPF		sst
	7	246		60	233	BED		sst
	7	246		60	227	BED		sst
	7	246		30	80	NPF		sst
	7	246		38	315	NPF		sst
	7	247		80	266	BED		sst
	7	247		82	349	J		sst
	7	248		52	232	BED		sst
	7	248		40	55	J		sst
River bank below camp	8	249		48	246	BED		sst
	8	249		40	234	BED		sst
	8	249		40	244	BED		sst
	8	249		60	30	NPF		sst
	8	249		62	30	NPF		sst
	8	249		90	325	NPF		sst
	8	249		86	332	NPF		sst
	8	249		70	154	NPF		sst

Bingay Creek Coal Ltd.
WSA Engineering Ltd., Bedrock Mapping Data

Comment	Traverse	Point	Chainage (m)	Dip	Strike	Type	Length (m)	Rock
	8	249		60	280	PJ		sst
	8	250		54	260	BED		sst
	8	250		48	23	NPF		sst
	8	250		75	165	PJ		sst
	8	251		48	260	BED		sst
	8	251		50	26	PJ		sst
	8	251		50	32	PJ		sst
	8	251		63	323	NPF		sst
	8	251		70	326	NPF		sst
	8	252		40	260	BED		sst
	8	252		80	160	PJ		sst

○ 202 – WSA FIELD OBSERVATION POINT (GPS) JULY 12–15, 2011
-------- LINE MAPPING
① – TRAVERSE ID

FIGURE ADAPTED FROM DRAWING 168778 C SK C01 (AMEC)

NO.	DATE	ISSUES	NO.	DATE	REVISIONS	BY	APPD

WSA ENGINEERING LTD.
WOODS SAHLSTROM ASSOCIATES
Geotechnical Civil Structural Materials Testing
2248 Columbia Ave. Castlegar, B.C. V1N 2X1 Ph (250) 365-3696

DSGN:	BW
DWN:	SC
CHK:	BW
DATE DWN.	16/01/2012

CENTERMOUNT COAL LTD.
BINGAY CREEK MINE
PREFEASIBILITY GEOTECHNICAL ASSESSMENT

FIELD OBSERVATION POINT MAP

SCALE:	1:5,000
FILE:	11001–024
JOB:	11001–024.
SHEET:	A

July 12, 2011 Centermount Coal

TP11-01 - 34V Drill Site
- TP in clearing @ NW corner

0-5m+ Gravel, little Sand, trace Clay/silt coating, compact to dense, gray w/ tan bands, Cobbles to 0.2m, few boulders to 0.3m Ø, moist
- visible horizontal layering & orientation of particles.
- occasional boulders to 0.6m Ø
- Minor slough, No Seepage

TP11-02 - 28V Drill site
8m SE of well

0-5m+ Gravel, little Sand, trace Clay/silt coating, compact to dense, gray, moist
- below ~2m some silt, increasing w/ depth & more moisture
- Hard digging - boulders locked in by particle orient. (Particles are "platey")

Hard digging w/ depth 5.9 - "Minor seep"/"no seep"

July 13/11 Centermount Coal
Bingay Creek
- Mil road @ Bingay Creek
- Soil on both sides is coarse gravel as encountered in TP11-01 & T11-02.

[]196 - Top of First SB on Bingay Ck. FSR - Soil in terrace is coarse gravel w/ some sand.

[]197 - BC FSR Rd. Cut at end of terrace
- Soil is Silt & Sand w/ some gravel Glacial Till
- SA #1
- Dense, gray, trace clay, low plastic.
- good liner material?
- Cont. North Road Cut is glacial till. Some seepage from weathered veneer.

[]198 - Soil Cut on uphill side of landing - till is lighter colour w/ nuggety texture (Frost), hard
- SA #2

LEVEL

☐ 199 - Landing at end of
Buggy FSR
- gentle (5% - 10%) slope
w/ Mb
• Small deposit of Fluvial
Sand w/ little gravel & trace
to some silt @ SW corner of
landing.

☐ 200 - shallow test pit
w/ shovel @ Top edge of
cutblock
0-4" Duff
4"-16" Silt, some sand, trace gravel,
Oxidized brown, loose, damp
16"-18"+ Till - Silt & Sand, some gravel,
dense, dark gray.

- 15m north @ treeline is
headwall of 2m - 3m deep
dry gully. Till in base.

☐ 201 - Borrow pit on west side of
Elk ML
- Terrace soil is 0.5m Silt & Sand over
dense coarse gravel w/ some sand

☐ 202 - Rd. cut starting up
gr ... the ML
- ... el w/
So ... one
an ... race
... -ly
- fa ...
... -ly
de ...
• SB ... ML
- C ... il!
☐ 203 ... @
2m ...
- See ...
ro ...
☐ 204 ... d
10 ... mall
- D ... s ~
2 ... avel over
d ... al till.
- riv ... cutting
Slop ... ravelling.
- good ... f bank

LEVEL

☐205 - upstream end of eroded bank - another good crossing location
- upstream of bend w/ erosion
- similar to ☐204 but further downstream.

July 14/11

☐206 - South end of line - Map on west wall of #10 Seam pit. Line is horizontal trending 060 NE.
(1)

~~Dip~~ Dip/Strike

0.0m - Bedding ~~027/90~~ 90/027
- Hard sandstone w/ smooth irregular, slickenslide coal contact.

0.3-2.1m Shear zone near vert. & perp. to rock face. 70/300

3.7m Intersecting joints
J1 · Minor joint 85/120 NP
J2 · Major joint 20/103 - 5m +
- daylights @ ground surface

6.6m J3 Major joint 40/316
- daylights ?

Photo 1 - Shear zone @ POC
Photo 2 - Major joints

7.4m - Subparallel fracture of J2

9.7 - J2 - variable surface not well developed - Fracture 24/125

12.8 NP Fracture 50/306 J3

15.0 Dominant Fracture 1.5m in argillite 56/300 J3

17.9 Fracture in sandstone 36/144 - J2

21.7-26.0 Weak crumbled zone in possible wedge failure
- South side NP 90/144
- North side 30/100 J2

Photo 3 ~~4~~ Broken wedge
- J2 has Calcite coating
- photo 5

26.75 NP Joint 78/308
- repeat @ 27.1m

28.4m - 2m Joint 08/157 in SST
- variable orient.

30.1m 1.5m J 22/293 - variable

31.0m 1m J 22/118 - variable

LEVEL

32.0m - 1m J 46/140
32.2 - 1m J 60/155
32.4-33.4 7x 1m J 80/305
33.0 - 1.5m J 21/094
33.4-46.9 - fractured weak & broken rock
46.9 Rusty J 42/144 1m
[illegible] - Same
[illegible] Rusty J 60/123 0.5m
51.[illegible] " " 47/130 1m
- slabs breaking on 10/014
52.[illegible], 52.9, 53.7, 55.2 - similar
Joints 40-60/120-150
Core weak, broken rock
Bedding Measurements

52.7	80/220 SST
50.0	80/220
47.0	80/217
[illegible]	88/224
28.8	88/224
19.5	88/220
8.0	80/216

207 - Road cut on Bingay Hill
- Fractured SST bedding 80/010
- Fractures 56/300, 26/120, 50/290
42/263

208 - Rd. Cut on west side of SST ridge a bit further up road. Bedding 78/180
Joints 66/284, 18/085

209 - Start traverse along west side of SST ridge on west side of Bingay Hill. Record bedding & joint attitudes when possible.

N

209	Bedding	80/020
	Joint	20/310
	Joint	54/270
	Joint	74/113
210	Bedding	70/015
	Joint	15/210
	Joint	75/120
	Joint	28/[illegible]
		58/130
211	Bedding	84/025
	Joint	78/140
	Joint	46/234
	Joint	30/226

- bit of toppling failures Photo?

LEVEL

☐234 - Above Camp
Bedding 40/250
Joint 75/350
Joint 40/060
☐235 Thinly laminated SST
underlying more massive SST
Bedding 54/245
☐236 - 5m x 1m-2m x 1m-1.5m rock
slab (SST) slid off bluff
face along joint 60/045
Joint 30/070
- Joints mostly orthogonal to
bedding.
☐237 - Toppling - Photo
Bedding 66/230
Joint 32/090, 32/075
Joint 80/330
- End of good mappable rock
outcrops on ridge.
☐238 8m x 15m massive SST
outcrop
bedding 85/340
Joint 60/210, 50/230
- Jointing not well developed.

July 15/11 Continued Bingay
☐239 - Bingay Camp road @
base of grade ~50m from
Elk ML
- SST exposed in cutbank.
- Possibly overlain by thin
till veneer. Cut thru
end of ridge ahead is
coarse gravel.
☐240 Top of first grade - Till veneer
over SST Bedrock.
$\frac{Mbv}{R}$ / $\frac{Fg}{Mv/R}$ (eskers).
☐241 Borrow pit in end of Esker
$\frac{Fg}{Mv/R}$
- Gentle ground around South
end of Bingay Hill is
Mbv//R
- Dropping down grade there
appears to be a lot of
Fg above road.
☐242 - on Fgt
☐243 - @ Drill pad first past Camp site
Rd. cut across end of $\frac{Fg}{Mbv/R}$
ridge.

LEVEL

Camp sits on Fat and
below → river is Fat aswell.

☐ 244 - SST outcrop on ridge north
of camp.
Bedding 45/250
Joint 75/330 Perv. 3m
Joint 40/100 NP 0.5m
☐ 245 SST outcrop next to Rd.
north of Camp
Bedding 52/235
Joint ~~52/235~~ 84/320
Joint 30/045 - poor
Joint 40/050 - poor } NP
Joint 48/105 - simp
☐ 246 cut into side of rock bnds
on east side of Rd. north of
Camp
Bedding 60/233, 60/227
Joint 30/180
Joint 38/315
- Not good jointing visible
☐ 247 - Trail cut on Bingay WV East
Bedding 80/266
Joint 82/349
Joint

☐ 248 - SST exposed by excavation
on south side of drill pad
Bedding 52/232
Joint 40/055
☐ 249 - Rock outcrop @ river bnd
below Camp
Massive SST
Bedding 48/246, 40/234
40/244
Joint 60/030, 62/030
Joint 90/325, 86/332
70/154
Joint 60/280 Perv.
☐ 250 - Bit farther DS on bluff (east)
Bedding. 54/260
Joint 48/023 NP
Joint 75/165
☐ 251 Bit farther DS (East)
Bedding 48/260
Joint 50/026, 50/032 Perv.
Joint 63/323, 70/326
- Looks like tension fracture
w/ no displacement. Dips
across beds. NP
Photo (mossy rock) x 3

LEVEL

[·]252 - at river bed → south
bedding 40/260
Joint 80/160

[·]253 - Logging trail climbing slope in cutblock off Bingay Creek ML
- slope above lower terrace
is Mb. Dry, no seepage!

[·]254 Edge of Fat escarpment above Bingay Ck. floodplain
- Slope 80% (38°) dry, stable
- probably good number to use for Ø when assessing slope stability for waste rock Dump.

[·]255 - Edge of Mb slope into Bingay Creek - walk down to check out slopes.
Slope drops @50% for about 15m, then steep 100°.
old slide scarps
- probably undercut by creek
- dry, no seep.

Appendix VIII

2011 Bingay Main three Boreholes Selenium Analysis

By SGS VANCOUVER INC.

Appendix IX

2011 The Geological & Block modeling of Bingay Creek Deposit III

By Gemcom Software International INC.

August 25, 2011

Appendix X

Canada Bingay Creak Deposit Resource/ Reserve Report

By China Coal Import and Export Company

2011．5

2012 Appendices:

Table: **2012 Bingay Coal Exploration Project Detail**

Hole Number	Coordinates (UTM, NAD83)				Drill Hole		All Hole Location map	Pad Hole map	Pad map	Well Core Log	Wireline log	Samples	Assay Samples		Cross Section	
	Easting	Northing	Elevation	Depth (m)	Azimuth	Dip						Coal	Coal			
													Canada	China		
2012-01Ra	643849.0	5563464.0	1429.2	350.52	129	45	X	P12	X	X	X	8	8			JR Drilling
2012-02Ra	644164.0	5563943.0	1400.0	426.72	135	50	X	P5	X	X	X	76	76			JR Drilling
2012-03Ra	644336.0	5563812.0	1395.0	159.88	125	51	X	P7	X	X	X					JR Drilling
2012-04Da	643940.0	5562580.0	1445.0	118.17	200	51	X	P19	X	X	X	10	10			Spring Mac
2012-05Da	644110.0	5562600.0	1485.0	218.85	200	51	X	P18	X	X	X	18	18			Spring Mac
2012-06Da	644120.0	5562455.0	1460.0	280.75	135	51	X	P20	X	X	X	5	5			Spring Mac
2012-07Da	644005.0	5563120.0	1429.0	218.82	135	51	X	P12	X	X	X					Spring Mac
2012-08Da	644348.0	5562562.2	1397.5	87.78	290	47	X	CAMP	X	X	X	27	27			Spring Mac
BH12-1a	644050.0	5562270.0	1419.5	279.08	180	70	X	ROAD/P20-P21		X	X					JR Drilling
BH12-2a	644456.0	5562789.0	1390.0	102.18		69	X	P16	X	X	X					JR Drilling
BH12-3a	644470.0	5562716.0	1395.0	305.00		60	X	P16	X	X	X					JR Drilling
MW12-1D	644405.0	5562369.0	1403.0	107.67			X	P9	X	X	X					JR Drilling
MW12-2D	644456.0	5562790.0	1395.0	102.18			X	P16	X	X	X					JR Drilling

Appendix I

2012 Bingay Main Coal Sample, Analysis Results & Certificates

Appendix II

2012 Bingay Main Coal Borehole CoreLog Lithology Description & Core Box Photos

DRILL HOLE 2012-01Ra
Reverse Circulation (Hammer and tricone)
G.P.S. 643849E 5563464N
Orientation 129°/45°
Field Log from cuttings as per driller and geologist
Overburden thickness 64.62m
Casing shoe depth 36.88m

	Depth	Depth			Water	Coal Quality	
Cased	**From feet (m)**	**To feet (m)**	**Lithology**	**Description**	**G/M -ft(m)**	**Sample Tag**	**Notes**
6 inch	0 (0)	93 (28.35)	Gravel	Unconsolidated gravel and sand	0.5-70 (21)		
6 inch	93 (28.35)	105 (32)	Clay		2.0-90 (27.43)		Water zone above impermeable clay
6 inch	105 (32)	121 (36.88)	Gravel	Unconsolidated gravel and sand			
NOTE: THOUGHT THIS SANDSTONE WAS MOOSE MT., BUT APPEARS TO BE TOO FAR BELOW COAL ? QUITE A THICK SANDSTONE ANYWAY.							
6 inch	121 (36.88)	150 (45.72)	Sandstone	Medium grained quartzitic sandstone hard but badly broken below overburden so continued setting casing to pervent caving.			
6 inch	150 (45.72)	170 (51.82)	Sandstone	Coarse grained quartzitic sandstone dull grey to dull black			
				Calcite filled fracture zone 155 (47.24) to 158 (48.16)	2.0-155 (47.24)		
6 inch	170 (51.82)	195 (59.44)	Sandstone	Medium grained quartzitic sandstone dull grey to black. Hard competent unit unfractured and good hammer drilling	0.0-160 (48.77)		
6 inch	195 (59.44)	200 (60.96)	Sandstone	Medium to coarse grained highly broken and keeps caving into hole with risk of getting stuck in the hole. Requires more casing.			
				Caving was between 192 (58.52) and 195 (59.44)			
6 inch	200 (60.96)	210 (64)	Sandstone	Medium grained sandstone dull grey to black Moderately hard and drilled fairly quickly with the tri-cone			
6 inch	210 (64)	212 (64.62)	Sandstone	Medium grained sandstone dull grey to black and very hard.			
CASED TO 212 FEET (64.62 METERS)							
	212 (64.62)	250 (76.20)	Sandstone	Medium grained sandstone dull grey to black and very hard			
6" TRI-CONE BIT TO 250 FEET (76.20 METERS)				**SWITCH TO DOWNHOLE HAMMER AT 250 FEET**			
	250 (76.20)	290 (88.39)	Sst/Slst/Mdst	Sandstone 20%/Siltstone 30%/Mudstone 50% Mostly shaly and much softer and fast drilling. Minor calcite probably from infilled fractures.			
	290 (88.39)	310 (94.49)	Sltst/Mdst	Siltstone and mudstone, Siltstone is muddy and occasional thin sandstone ledges and medium hard. No Fizz. Larger pieces of calcite common throughout from wider infilled fractures.			
	310 (94.49)	325 (99.06)	Mudslst/Mdst	Muddy siltstone and mudstone. Slightly sandy in part. Large pieces of calcite scattered throughout as in last interval.			
	325 (99.06)	330 (100.58)	Sandstone	Medium grained and very hard. Medium grey to dark grey.	10.0-330 (100.58)		
	330 (100.58)	350 (106.68)	Mudslst/Mdst	Muddy siltstone and mudstone with minor thin sandstone beds. Small calcite chips from fracture infills scattered throughout.			
	350 (106.68)	370 (112.78)	Mudslst/Mdst	Muddy siltstone and mudstone with minor thin sandstone beds. Small calcite chips from fracture infills scattered throughout.			
	370 (112.78)	390 (118.87)	Mudslst/Mdst	Muddy siltstone and mudstone with minor thin sandstone beds. Small calcite chips from fracture infills scattered throughout.			
	390 (118.87)	410 (124.97)	Mudslst/Mdst	Muddy siltstone and mudstone with minor thin sandstone beds. Small calcite chips from fracture infills scattered throughout.			
	410 (124.97)	430 (131.06)	Mudslst/Mdst	Muddy siltstone and mudstone with minor thin sandstone beds. Small calcite chips from fracture infills scattered throughout.			
	430 (131.06)	450 (137.16)	Mudslst/Mdst	Muddy siltstone and mudstone with minor thin sandstone beds. Small calcite chips from fracture infills scattered throughout.			

	450 (137.16)	470 (143.26)	Mudslst/Mdst	Muddy siltstone and mudstone with minor calcite chips scattered			
	470 (143.26)	490 (149.35)	Mudslst/Mdst	Muddy siltstone and mudstone with minor calcite chips scattered			
	490 (149.35)	502 (153.01)	Mudslst/Mdst	Muddy siltsone and mudstone with minor calcite chips scattered			
	502 (153.01)	504 (153.62)	Sandstone	Sandstone, well indurated and hard drilling			
	504 (153.62)	510 (155.45)	Mudslst/Mdst	Muddy siltsone and mudstone with minor calcite chips scattered			
	510 (155.45)	530 (161.54)	Mudslst/Mdst	Muddy siltstone and mudstone, medium hard with less calcite chips from infilled fractures than previous samples			
	530 (161.45)	545 (166.12)	Mudslst/Mdst	Muddy silstone and mudstone as above			
	545 (166.12)	550 (167.64)	Sandstone	Sandstone, medium grained, hard, large flat calcite fragments from fracture infill.			
	550 (167.64)	570 (173.74)	Mudslst/Mdst	Mudstone and silty mudstone medium hard.			
	570 (173.74)	590 (179.83)	Sandstone	Sandstone, poorly indurated, soft and crumbly, easy drilling, no calcite pieces. Most of it turns to a muddy solution when drilling and what is left in the screen is the sandstone.			
	590 (179.83)	598 (182.27)	Mudstone	Mudstone, dark grey, soft, good drilling			
	598 (182.27)	603 (183.79)	Sandstone	Sandstone, hard.			
	603 (183.79)	606 (184.71)	Mudstone	Mudstone, slightly silty, medium hard.			
	606 (184.71)	613 (186.84)	Sandstone	Sandstone, hard.			
	613 (186.84)	623 (189.89)	Mudslst/Mdst	Muddy siltstone and mudstone, medium hard			
	623 (189.89)	629 (191.72)	Sandstone	Sandstone, very hard, medium grained. Oily residue in discharge			
	629 (191.72)	639 (194.77)	Mudstone	Mudstone			
	639 (194.77)	642 (195.68)	Sandstone	Sandstone, very hard, medium grained. Oily residue in discharge			
	642 (195.68)	645 (196.60)	Mudstone	Mudstone, medium hard, very minor calcite specks.			
	645 (196.60)	684 (208.48)	Sandstone	Sandstone, very hard, medium grained. Oily residue in discharge			
	684 (208.48)	688 (209.70)	Mudstone	Mudstone, medium hard, very minor calcite specks.			
	688 (209.70)	790 (240.79)	Sandstone	Sandstone, very hard, minor calcite pieces.			
	790 (240.79)	798 (243.23)	Mudstone	Soft carbonaceous mudstone, very small carbonaceous stringers and fragments turning the water dark.			
	798 (243.23)		Coal	Very thin coal			No. 2A from Hole 2012-18a Numbering
	798 (243.23)	819 (249.63)	Sandstone	MOOSE MTN., Sandstone, medium grained and hard.			
	819 (249.63)	819.5 (249.78)	Mudstone	Carbonaceous mudstone, slightly coaly			
	819.5 (249.78)	866 (263.96)	Sandstone	MOOSE MTN. Sandstone, quartzitic, medium to coarse grained. No calcite chips anymore.			
	866 (263.96)	872 (265.79)	COAL	Coal sample taken		Teck #21452	No. 3L from Hole 2012-18a Numbering
	872 (265.79)	873 (266.09)	Mudstone	Medium hard			
	873 (266.09)	887 (270.36)	Sandstone	Sandstone , nocalcite, no fracturing			
	887 (270.36)	892 (271.88)	COAL	Sample taken		Teck #21453	No. 3 from Hole 2012-18a numbering
	892 (271.88)	903 (275.23)	Mudstone	Medium hard			
	903 (275.23)	904 (275.54)	Sandstone	Hard			
	904 (275.54)	909 (277.06)	Mudstone	Medium hard			
	909 (277.06)	910 (277.37)	Mudstone	Coaly and carbonaceous			
	910 (277.37)	914 (278.59)	Mudstone	with a thin sandstone bed at the base			
	914 (278.59)	914.5 (278.74)	Sandstone				
	914.5 (278.74)	920 (280.42)	Mudstone				
	920 (280.42)	926 (282.24)	Sandstone				
	926 (282.24)	932 (284.07)	COAL	Sample taken		Teck #21454	No. 4 from HOLE 2012-18A numbering
	932 (284.07)	937 (285.60)	COAL	Sample taken		Teck #21455	No. 4 from HOLE 2012-18A numbering
	937 (285.60)	962 (293.22)	Sltst/Mdst	Mudstone and Muddy siltstone, calcite chips throughout from infilled fractures. Moderately hard, mediu,m grey brown.			

	962 (293.22)	965 (294.13)	Sandstone	Hard, medium grained			
	965 (294.13)	981 (299.01)	Mudstone				
	981 (299.01)	986 (300.53)	Sandstone	Hard			
	986 (300.53)	993 (302.67)	Sltst/Mdst	Siltstone and mudstone, Siltstone is muddy and occasional thin			
	993 (302.67)	1029 (313.64)	Sandstone	Fine to medium grained and hard			
	1029 (313.64)	1061 (323.39)	Sltst/Mdst				
	1061 (323.39)	1070 (326.14)	COAL	Coal with a parting of indeterminate thickness in the bottom third. Sample taken.		TECK #21456	No.5 from Hole 2012-18a numbering
	1070 (326.14)	1073 (327.05)	Sandstone				
	1073 (327.05)	1075 (327.66)	Mudstone				
	1075 (327.66)	1085 (330.71)	COAL	Sample taken		Teck #21457	No. 6 from Hole 2012-18a numbering
	1085 (330.71)	1087 (331.32)	Mudstone				
	1087 (331.32)	1092 (332.84)	COAL	Sample taken		Teck #21458	No. 7 from Hole 2012-18a numbering
	1092 (332.84)	1106 (337.11)	COAL	Sample taken		Teck #21459	No. 7 from Hole 2012-18a numbering
	1106 (337.11)	1150 (350.52)	Siltst/Mudst	Siltstone, mudstone and minor sandstone	20 1148(349.91)		
				T.D. 1150 feet (350.52 meters)			

DRILL HOLE 2012-02Ra
Reverse Circulation (Hammer and tricone)
G.P.S. **644164E 5563943N**
Orientation **135°/50°**
Field Log from cuttings as per driller and geologist
Overburden thickness 94 ft (28.65m)
Casing shoe depth 239 ft (72.85m)

	Depth	Depth			Water	Coal Quality	
Cased	**From feet (m)**	**To feet (m)**	**Lithology**	**Description**	**G/M -ft(m)**	**Sample Tag**	**Notes**
6 inch	0 (0)	18 (5.49)	Clay and gravel	Unconsolidated overburden			
	18 (5.49)	34 (10.36)	Gravel		10 ft 1.0 GPM		
	34 (10.36)	94 (28.65)	Clay	Very soft clayey mud			
	94 (28.65)	122 (37.18)	Mudstone	Fractures and in parts minor silty	0.0 GPM		
	122 (37.18)	129 (39.32)	Clay	Soft clayey mud. Could be a large fracture zone filled with mud through time since the beds are vertical?			
	129 (39.32)	185 (56.39)	Mudstone	Dark grey, medium hard, Calcite from fracture infills			
				scattered throughout. 148 (45.11) to 149 (45.42) fracture zone.			
	185 (56.39)	187 (57)	Mudstone	Fractured			
	187 (57)	390 (118.87)	Mudstone	Mudstone with minor silt at times. Water is getting a black film at the bottom of the interval suggesting we may be nearing coal zones?	0.0 GPM		
	390 (118.87)	410 (124.97)	Mudstone	Mudstone, medium hard good drilling. Water loss into the formation still. Minor calcite fragments from infilled fractures.			
	410 (124.97)	430 (131.06)	Mudstone	Mudstone medium to dark grey and medium hard. Some minor black film on the water. Minor calcite pieces throughout sample.			
	430 (131.06)	450 (137.16)	Mudstone	Mudstone moderately hard with large broken chips.Very little calcite.			
	450 (137.16)	470 (143.26)	Mudstone	Mudstone, medium hard medium grey brown. Minor calcite chips and good drilling			
	470 (143.26)	485 (147.83)	Mudstone	Mudstone, medium hard			
	485 (147.83)	499 (152.10)	Silty mudstone	Silty mudstone greasy in appearance light grey moderately hard.			
	499 (152.10)	505 (153.92)	Sandstone	Sandstone, fine to medium grained and hard.			
	505 (153.92)	506 (154.23)	Silty mudstone	Mudstone, light grey medium hard and silty			
	506 (154.23)	510 (155.45)	Sandstone	Sandstone,medium grained and hard			
	510 (155.45)	512 (156.06)	Mudstone	Mudstone, medium grey, medium hard			
	512 (156.06)	518 (157.89)	Sandstone	Sandstone, fine to medium grained and hard.			
	518 (157.89)	520 (158.50)	Mudstone	Mudstone, medium grey, medium hard			
	520 (158.50)	523 (159.41)	Sandstone	Sandstone, fine to medium grained and hard.			
	523 (159.41)	526 (160.32)	Siltstone	Siltstone medium hard			
	526 (160.32)	561 (170.99)	Sandstone	Sandstone very hard from 540 on, minor calcite pieces.			
	561 (170.99)	561.5 (171.15)	Coaly Mudstone	Soft carbonaceous mudstone turns water black			2A seam

	561.5 (171.15)	567 (172.85)	Sandstone	MOOSE MTN. ? Sandstone, softer , coarse grained easy drilling.			Moose Mtn. sandstone
	567 (172.85)	569 (173.43)	Mudstone	Mudstone, slightly carbonaceous turns water black.			
	569 (172.43)	626 (190.80)	Sandstone	MOOSE MTN. ? Sandstone, softer , coarse grained easy; Black film in water from plant debris in sandstone. Calcite chips throughout.			Moose Mtn. Sandstone
	626 (190.80)	630 (192.02)	Mudstone	Mudstone carbonaceous			
	630 (192.02)	638 (194.46)	Sandstone	Sandstone with coal traces from plant debris			
	638 (194.46)	641 (195.38)	COAL	COAL		120451	3L seam
	641 (195.38)	642 (195.68)	COAL	COAL		No Sample	
	642 (195.68)	652 (198.73)	Sandstone	Sandstone			
	652 (198.73)	657 (200.25)	COAL	COAL		120452	3L seam
	657 (200.25)	660 (201.68)	COAL	COAL		120453	3L seam
	660 (201.68)	663 (202.08)	COAL	COAL brownish		120454	Parting
	663 (202.08)	666 (203.00)	COAL	COAL brownish		120455	Parting
	666 (203.00)	669 (203.91)	COAL	COAL brownish		120456	Parting
	669 (203.91)	671 204.52)	COAL	COAL only 2 foot run finishing drill rod		120457	Parting
	671 (204.52)	674 (205.44)	COAL	COAL brownish		120458	Parting
	674 (205.44)	677 (206.35)	COAL	COAL good coal		120459	3 seam
	677 (206.35)	680 (207.26)	COAL	COAL good coal		120460	3 seam
	680 (207.26)	683 (208.18)	COAL	COAL good coal		120461	3 seam
	683 (208.18)	686 (209.09)	COAL	COAL		120462	3 seam
	686 (209.09)	689 (210.01)	COAL	COAL		120463	3 seam dirty
	689 (210.01)	692 (210.92)	COAL	COAL		120464	3 seam dirty
	692 (210.92)	695 (211.84)	COAL	COAL		120465	3 seam dirty
	695 (211.84)	698 (212.75)	COAL	COAL		120466	3 seam dirty
	698 (212.75)	701 (213.66)	COAL	COAL		120467	3 seam
	701 (213.66)	704 (214.58)	COAL	COAL		120468	3 seam
	704 (214.58)	707 (215.49)	COAL	COAL		120469	3 seam
	707 (215.49)	709 (216.10)	COAL	COAL only 2 foot sample and into sandstone again		120470	3 seam
	709 (216.10)	722 (220.06)	Sandstone	Sandstone			
	722 (220.06)	724 (220.66)	Coaly Mudstone	Mudstone coaly			
	724 (220.66)	729 (222.20)	Sandstone	Sandstone			
	729 (222.20)	732(223.11)	COAL	COAL		120471	
	732 (223.11)	735 (224.03)	COAL/Sandstone	COAL bottom foot back into sandstone		120472	
	735 (224.03)	736 (224.33)	Sandstone	Sandstone			
	736 (224.33)	762(232.26)	Mudstone	Mudstone			
	762 (232.26)	764 (232.87)	Sandstone	Sandstone very hard			
	764 (232.87)	775 (236.22)	Sandstone	Sandstone			
	775 (236.22)	778 (237.13)	Mudstone	Mudstone medium to dark grey and medium hard			
	778 (237.13)	785 (239.27)	Sandstone	Sandstone			
	785(239.27)	788 (240.18)	Mudstone	Mudstone			
	788 (240.18)	791 (241.10)	COAL/Mudstone	COAL with some mudstone mixed in		120473	4 seam ?
	791 (241.10)	794 (242.01)	COAL/Mudstone	COAL with some mudstone mixed in		120474	4 seam ?
	794 (242.01)	797 (242.93)	COAL/Mudstone	COAL top 1.5 feet and mudstone bottom 1.5 feet		120475	4 seam ?
	797 (242.93)	806 (245.67)	Sandstone	Sandstone			
	806 (245.67)	809 (246.58)	Coaly Mudstone	Mudstone, coaly chunks in it very dark grey			Mudstone may be partly bentonitic

	809 (246.58)	818 (249.33)	Sandstone	Sandstone	809 ft 1.50 GPM		Tight hole mud pushes in and
	818 (249.33)	832 (253.59)	Sandstone	Sandstone, very hard, light colored, fine grained with very minor calcite chips, coaly plant debris.			closes the hole off
	832 (253.59)	833 (253.90)	COAL	COAL			
	833 (253.90)	858 (261.52)	Sandstone	Sandstone, fine grained with very minor calcite chips At 837 (255.12) very thin carbonaceous mudstone, Coaly debris from plants throughout sandstone.			
	858 (261.52)	860 (262.13)	Mudstone/Sst	Sandstone and mudstone			
	860 (262.13)	863 263.04)	COAL	COAL good coal with froth on water black		120476	5 seam ?
	863 (263.04)	866 (263.96)	COAL	COAL good coal with froth on water black		120477	5 seam?
	866 (263.96)	869 (264.87)	COAL	COAL last foot has some hanging wall rock in it.		120478	5 seam?
	869 (264.87)	890 (271.27)	Sandstone	Sandstone with coaly plant debris throughout			
	890 (271.27)	893 (272.19)	COAL	COAL slightly brownish from floor rock		120479	6 seam ?
	893 (272.19)	896 (273.10)	COAL	COAL good black froth on water		120480	6 seam ?
	896 (273.10)	899 (274.02)	COAL	COAL good black froth on water		120481	7 seam ?
	899 (274.02)	902 (274.93)	COAL	COAL good black froth on water		120482	7 seam ?
	902 (274.93)	905 (275.84)	COAL	COAL brownish from mudstone partings		120483	7 seam ?
	905 (275.84)	908 (276.76)	COAL	COAL/Mudstone/Sandstone very dirty roof contact		120484	7 seam ?
	908 (276.76)	926 (282.24)	Sandstone	Sandstone			
	926 (282.24)	929 (283.16)	Mudstone	Mudstone medium hard medium grey			
	929 (283.16)	933 (284.38)	Sandstone	Sandstone			
	933 (284.38)	939 (286.21)	Mudstone	Mudstone			
	939 (286.21)	943 (287.43)	Sandstone	Sandstone			
	943 (287.43)	946 (288.34)	COAL	COAL dirty with high angle floor contact		120485	8 seam ?
	946 (288.34)	949 (289.26)	COAL	COAL brownish from mudstone within		120486	8 seam ?
	949 (289.26)	951 (289.86)	COAL	COAL, brownish with mudstone and sandstone roof		120487	8 seam ?
	951 (289.86)	1003 (305.71)	Sandstone	Sandstone			
	1003 (305.71)	1009 (307.54)	Coaly Mudstone	Mudstone coaly and silty			
	1009 (307.54)	1047 (319.13)	Sandstone	Sandstone, fine to medium grained, medium grey and abrupt contact with coal.			
	1047 (319.13)	1050 (320.04)	COAL	COAL, black very good frothy		120488	No. 10 Seam
	1050 (320.04)	1053 (320.95)	COAL	COAL, slightly brownish water, could be thin parting		120489	No. 10 Seam
	1053 (320.95)	1056 (321.87)	COAL	COAL, Good black coal with froth on water		120490	No. 10 Seam
	1056 (321.87)	1059 (322.78)	COAL	COAL, Good black coal with froth on water		120491	No. 10 Seam
	1059 (322.78)	1062 (323.70)	COAL	COAL, foamy with slightly brownish water		120492	No. 10 Seam
	1062 (323.70)	1065 (324.61)	COAL	COAL, foamy with slightly brownish water		120493	No. 10 Seam
	1065 (324.61)	1068 (325.53)	COAL	COAL, very soft with brownish water		120494	No. 10 Seam
	1068 (325.53)	1071 (326.44)	Coaly Mudstone	Coaly mudstone parting, very brown, some coal too		120495	Parting
	1071 (326.44)	1073 (327.05)	Muddy COAL	COALY mudstone going into Muddy coal, into COAL		120496	Parting
	1073 (327.05)	1075 (327.66)	COAL	COAL, good black coal with froth on water (2 ft sample)		120497 (2 ft)	No. 10R Seam
	1075 (327.66)	1078 (328.57)	COAL	COAL, good for 2 feet going into sandstone in last foot		120498	No. 10R Seam
	1078 (328.57)	1105 (336.80)	Sandstone	Sandstone, hard,fine to very fine grained and plant debris throughout causing black water at times	1078 ft 2.0 GPM		
	1105 (328.57)	1106 (337.11)	Mudstone	Mudstone, medium grey, medium hard			
	1106 (337.11)	1109 (338.02)	COAL	COAL, Good black coal with froth on water		120499	No. 10A Seam
	1109 (338.02)	1112 (338.93)	COAL	COAL, Good black coal with froth on water		120500	No. 10A Seam
	1112 (338.93)	1114 (339.55)	COAL	COAL, good black coal with froth on water (2 ft sample)		120501 (2 ft)	No. 10A Seam

	1114 (339.55)	1135 (345.95)	Sandstone	Sandstone, fine grainee, hard			Bingay sandstone
	1135 (345.95)	1135.5 (346.10)	COAL	COAL, very thin coal stringer			
	1135.5 (346.10)	1189 (361.19)	Sandstone	Sandstone			Bingay Sandstone
	1189 (361.19)	1198 (365.15)	Mudstone	Mudstone, medium grey, medium hard			
	1198 (365.15)	1201 (366.06)	COAL	COAL		120502	11 seam
	1201 (366.06)	1203 (366.67)	COAL	COAL quite muddy dirty coal		120503	11 seam
	1203 (366.67)	1210 (368.81)	Sandstone	Sandstone			
TRIP OUT AND CHANGE FROM HAMMER BIT TO TRI-CONE BIT FOR REMAINDER OF REVERSE CIRCULATION HOLE							
	1210 (368.81)	1219 (371.55)	Sandstoone	Sandstone			
	1219 (371.55)	1219.5 (371.70)	COAL	Coal very small stringer			
	1219.5(371.70)	1230 (374.90)	Sandstone	Sandstone			
	1230 (374.90)	1233 (375.82)	Mudstone	Mudstone, carbonaceous			
	1233 (375.82)	1236 (376.73)	COAL	COAL good black lots of froth couldn't help losing float		120504	12 seam
	1236 (376.73)	1239 (377.65)	COAL	COAL good black lots of froth couldn't help losing float		120505	12 seam
	1239 (377.65)	1242 (378.56)	COAL	COAL good black lots of froth couldn't help losing float		120506	12 seam
	1242 (378.56)	1245 (379.48)	COAL	COAL good black lots of froth couldn't help losing float		120507	12 seam
	1245 (379.48)	1248 (380.39)	COAL	COAL good black lots of froth couldn't help losing float		120508	12 seam
	1248 (380.30)	1251 (381.30)	COAL	COAL good black lots of froth couldn't help losing float		120509	12 seam
	1251 (381.30)	1254 (382.22)	COAL	COAL good but very small parting		120510	12R seam
	1254 (382.22)	1257 (383.13)	COAL	COAL good black frothy with hsmall hard parting		120511	12R seam
	1257 (383.13)	1260 (384.05)	COAL	COAL good black lots of froth couldn't help losing float		120512	12R seam
	1260 (384.05)	1262 (384.66)	COAL	COAL good black with small amount of roof rock		120513 (2 ft)	12R seam
	1262 (384.66)	1267 (386.18)	Mudstone	Mudstone			
	1267 (386.18)	1274 (388.32)	Sandstone	Sandstone			
	1274 (388.32)	1277 (389.23)	COAL	COAL (2 foot of coal and last foot sandstone very dirty)		120514	
	1277 (389.23)	1280 (390.14)	Sandstone	Sandstone			
	1280 (390.14)	1281 (390.45)	COAL	COAL			
	1281 (390.45)	1282 (390.75)	Sandstone	Sandstone			
	1282 (390.75)	1285 (391.67)	Mudstone	Mudstone			
	1285 (391.67)	1295 (394.72)	Sandstone	Sandstone			
	1295 (395.72)	1295.5 (394.87)	COAL	COAL stringer			
	1295.5 (394.87)	1298 (395.63)	Mudstone	Mudstone very minor calcite chips			
	1298 (395.63)	1313 (400.20)	Sandstone	Sandstone with a coal stringer at 1299 feet.			
	1313 (400.20)	1316 (401.12)	COAL	COAL black good coal		120515	11 seam
	1316 (401.12)	1318 (401.73)	Mudstone	Mudstone			
	1318 (401.73)	1335 (406.91)	Sandstone	Sandstone			
	1335 (406.91)	1338 (407.82)	Mudstone	Mudstone			
	1338 (407.82)	1342 (409.04)	Sandstone	Sandstone			
	1342 (409.04)	1342 (409.35)	Mudstone	Mudstone			
	1342 (409.35)	1345 (409.96)	Sandstone	Sandstone			
	1345 (409.96)	1348 (410.87)	COAL	COAL good coal black and frothy		120516	11 R seam
	1348 (410.87)	1351 (411.78)	COAL	COAL good coal black and frothy		120517	11R seam
	1351 (411.78)	1353 (412.39)	COAL	COAL good coal black and frothy		120518 (2 ft)	11 R seam
	1353 (412.39)	1355 (413.00)	Sandstone	Sandstone			
	1355 (413.00)	1358 (413.92)	COAL	COAL good black frothy with lots of float		120519	12 seam
	1358 (413.92)	1361 (414.83)	COAL	COAL good black frothy with lots of float		120520	12 seam
	1361 (414.83)	1364 (415.75)	COAL	COAL good black frothy with lots of float		120521	12 seam

	1364 (415.75)	1367 (416.66)	COAL	COAL good black frothy with lots of float			120522	12 seam
	1367 (416.66)	1370 (417.58)	COAL	COAL good black frothy with lots of float			120523	12 seam
	1370 (417.58)	1373 (418.49)	COAL	COAL good black frothy with lots of float			120524	12R seam
	1373 (418.49)	1376 (419.45)	COAL	COAL good black frothy with lots of float			120525	12 R seam
	1376 9419.45)	1379 (420.32)	COAL	COAL good black with small amount of roof rock			120526	12 R seam
	1379 (420.32)	1383 (421.54)	Silty mudstone	Silty mudstone				
	1383 (421.54)	1400 (426.72)	Sandstone	Sandstone				
				TOTAL DEPTH 1400 feet (426.72 meters)				

DRILL HOLE 2012-03Ra
Reverse Circulation (Hammer and tricone)
G.P.S. 644336 E 5563812N +/- 6 m
Orientation 125°/51°
Field Log from cuttings as per driller and geologist
Overburden thickness unknown
Casing shoe depth 159.88 m

	Depth	Depth			Water	Coal Quality	
Cased	**From feet (m)**	**To feet (m)**	**Lithology**	**Description**	**G/M -ft(m)**	**Sample Tag**	**Notes**
6 inch	0.0 (0.0)	25 (7.62)	Gravel/road fill	Gravel and shattered rock from road fill			
	25 (7.62)	60 (18.29)	Clay/mud/gravel	Soft clay gravel and mud mixed			
	60 (18.29)	159 (48.46)	Gravel/boulders	Gravel and boulders			
	159 (48.46)	166 (50.60)	Clay/gravel	Clay and gravel			Gravel could be an old stream or the old river
	166 (50.60)	169 (48.46)	Gravel	Gravel			channel. Sandstone could be vertical beds that
	169 (48.46)	237 (72.24)	Clay	Clay soft and difficult to hammer			broke off and fell into channel?
	237 (72.24)	378 (115.21)	Gravel	Gravel	10 GPM 237 (72.24)		
	378 (115.21)	383 (116.74)	Sandstone	Sandstone (piece of bedrock broken off?)			
	383 (116.74)	495 (159.88)	Gravel	Gravel composed of llight and dark chips and			
				larger rocks. Some are carbonaceous and some			
				siltstones and sandstones. Some have very fine			Hole could be continued but has to be cased to
				bedding laminations			bedrock and casing shoe is becoming very worn.
				T.D. 495 feet (159.88 meters)			

Exploration Hole 2012-04Da

Diamond Drill Core Rig — Pad: 19

Logged By: Spring MacAskill — Azimuth: 200^{o}

Hole Diameter: HQ — Dip: 51^{o}

Block-Block		Cumulative Core Recovery		Width (m)	Sub Width (m)	Core cut (m)	Lithology	Core Description	RQD %	Sample ID	Unit Lengths (m)
Core From (ft.)	Core To (ft.)	From (m)	To (m)								
0	14	0.00	4.27	0.82		0.00	NA	Rubble	0.00		
14	19	4.27	5.35	1.08		0.00	Mudstone	Highly broken	0.00		Mudstone: 7.194
19	25	5.35	7.26	1.91		0.25	Mudstone		12.83		
25	29	7.26	8.45	1.19		0.51	Mudstone	Iron oxide on fractured surfaces	42.47		
29	34	8.45	10.30	1.86		0.72	Mudstone		38.76		
34	38	10.30	11.46	1.16		0.60	Mudstone		51.72		
38	42	11.46	12.51	1.05		0.85	Bingay SST	Vf-fine SST	81.72		Bingay: 13.682
42	47	12.51	14.17	1.66		1.32	Bingay SST		79.52		
47	52	14.17	15.73	1.56		0.49	Bingay SST	Vf SST w/iron on fractures (Iron stone)	31.09		
52	56.5	15.73	17.21	1.48		0.43	Bingay SST		28.72		
56.5	62	17.21	18.85	1.64		1.19	Bingay SST		72.56		
62	67	18.85	20.53	1.68		1.09	Bingay SST		64.58		
67	72	20.53	22.17	1.64		1.06	Bingay SST	Vf-f SST	64.63		
72	77	22.17	23.64	1.47		0.62	Bingay SST		42.12		
77	82	23.64	25.14	1.51		1.19	Bingay SST		79.07		
82	87	25.14	25.90	0.76		0.00	Mudstone	Very broken	0.00		Mudstone: 8.168
87	92	25.90	27.79	1.89		0.29	Mudstone		15.19		
92	95	27.79	28.61	0.82		0.64	Mudstone		77.95		
95	100	28.61	30.12	1.51		0.72	Mudstone		47.35		
100	105	30.12	31.86	1.73		0.85	Mudstone		48.79		
105	108.5	31.86	33.00	1.15		0.12	Mudstone		10.48		
108.5	115	33.00	33.31	0.31		0.00	Mudstone		0.00	120201	
115	120	33.31	34.22	0.91		0.00	10 Coal	Seam 10	0.00	120202	10 Coal: 1.567
120	125	34.22	34.22	0.00		0.00	10 Coal	Seam 10	0.00	120203, 120206	
125	131	34.22	34.22	0.00		0.00	10 Coal	Seam 10	0.00	120207	
131	132.5	34.22	34.50	0.28		0.00	10 Coal	Seam 10	0.00	120204	
132.5	139	34.50	34.88	0.38		0.00	10 Coal	Seam 10	0.00		
139	142	34.88	35.54	0.67		0.00	Mudstone	Polished surfaces on fractures	0.00		Mudstone: 1.417
142	146.5	35.54	36.30	0.75		0.00	Mudstone		0.00		
		36.30	36.93	0.63		0.00	10R Coal	10R	0.00	120208	10R Coal: 2.629
146.5	150.5	36.93	38.18	1.26		0.00	10R Coal	10R	0.00		
150.5	153.5	38.18	39.07	0.89	0.74	0.00	10R Coal	10R	0.00		
					0.15	0.00	Mudstone				Mudstone: 2.849
153.5	157	39.07	40.26	1.19		0.37	Mudstone		31.09		
157	162	40.26	41.77	1.51		0.00	Mudstone	Highly fractured mudstone	0.00		
162	166.5	41.77	43.24	1.47		0.92	Silty Sandstone	Vf SST	62.59		Silty Sandstone: 11.382
166.5	171.5	43.24	44.52	1.28		0.65	Silty Sandstone	Vf SST	50.82		

171.5	175.5	44.52	46.34	1.81		0.36	Silty Sandstone	Vf SST	20.02		
175.5	182	46.34	48.02	1.68		0.29	Silty Sandstone	Vf SST	17.26		
182	187	48.02	49.78	1.76		0.61	Silty Sandstone	Vf SST	34.77		
187	192	49.78	51.47	1.69		0.56	Silty Sandstone	Vf SST	33.14		
192	197	51.47	53.16	1.69		1.28	Silty Sandstone	Vf SST	75.86		
197	202	53.16	54.79	1.63	0.80	0.38	Mudstone	Interbedded coal	23.31		Mudstone: 0.797
					0.83		8/7/6 or 5 Coal	Coal			8/7/6 or 5: 0.973
202	207	54.79	55.80	1.01	0.14	0.10	8/7/6 or 5 Coal	Coal	9.98		
					0.55		Mudstone	Mudstone			Mudstone: 0.5491
					0.33		7/6 or 5 Coal	Coal			7/6 or 5 Coal: 0.33
207	212	55.80	56.81	1.02		0.00	Mudstone	Mudstone	0.00		Mudstone: 11.63
212	217	56.81	58.43	1.62		0.37	Mudstone	Mudstone	22.96		
217	222	58.43	60.00	1.57		0.78	Mudstone	Mudstone	49.68		
222	227	60.00	61.55	1.55		0.51	Mudstone	Mudstone	33.01		
227	232	61.55	63.01	1.46		0.47	Mudstone	Mudstone	32.19		
232	237	63.01	64.58	1.58		0.97	Mudstone	Mudstone	61.59		
237	242	64.58	65.86	1.28		1.02	Mudstone	Mudstone	80.00		
242	247	65.86	67.43	1.57		1.39	Mudstone	Mudstone	88.66		
247	252	67.43	68.80	1.37		0.36	Sandy Siltstone	Vf SST	26.38		Sandy siltstone: 11.294
252	257	68.80	70.75	1.96		0.13	Sandy Siltstone		6.70		
257	262	70.75	72.34	1.58		0.10	Sandy Siltstone		6.38		
262	267	72.34	74.13	1.79		0.40	Sandy Siltstone		22.46		
267	272	74.13	75.68	1.55		0.42	Sandy Siltstone		27.10		
272	277	75.68	77.42	1.75		0.25	Sandy Siltstone		14.33		
277	282	77.42	78.99	1.57	1.30	0.00	Sandy Siltstone		0.00		
					0.27		4 Coal				4 Coal: 2.41
282	286.5	78.99	80.42	1.43		0.00	4 Coal		0.00	120209, 120210	
286.5	288	80.42	81.85	1.43	0.71	0.00	4 Coal		0.00		
					0.72		Mudstone	Polished fractured surfaces			Mudstone: 5.542
288	292	81.85	83.23	1.38		0.00	Mudstone		0.00		
292	297	83.23	85.13	1.90		0.00	Mudstone		0.00		
297	302	85.13	86.67	1.55		0.70	Mudstone		45.31		
302	307	86.67	88.30	1.63		0.96	Sandstone	Vf SST w/ calcite	58.90		Sandstone: 16.705
307	312	88.30	89.75	1.44		1.19	Sandstone		82.45		
312	317	89.75	91.20	1.46		1.21	Sandstone		83.16		
317	322	91.20	92.73	1.53		1.39	Sandstone	Polished surfaces	90.93		
322	327	92.73	94.11	1.38		1.38	Sandstone	White bands of calcite	100.00		
327	332	94.11	95.78	1.67		0.37	Sandstone		22.10		
332	337	95.78	97.36	1.59		0.89	Sandstone	Fine SST	55.96		
337	342	97.36	98.81	1.45		1.37	Sandstone		94.48		
342	347	98.81	100.31	1.49		1.39	Sandstone		93.30		
347	352	100.31	101.84	1.53		1.53	Sandstone		100.00		
352	357	101.84	103.38	1.54		1.22	Sandstone		79.22		
357	362	103.38	104.80	1.42	0.93	0.00		Mudstone	0.00		Mudstone: 0.97
					0.49		3 Coal	Coal			3 Coal: 0.485
362	367	104.80	105.77	0.97		0.28	Mudstone		28.35		Mudstone: 2.59
367	372	105.77	107.39	1.62	0.15	0.76	Mudstone		47.04		

					0.55		2 Coal				2 Coal: 0.55
					0.93		Mudstone				Mudstone: 3.535
372	377	107.39	108.61	1.22		0.42	Mudstone		34.43		
377	381	108.61	110.00	1.39	0.85	0.14	Mudstone		10.07		
					0.54		3 or 2 Coal				3 or 2 Coal: .54
381	386	110.00	110.47	0.47		0.16	Mudstone		34.04		Mudstone: 8.172
386	391	110.47	111.70	1.23		0.44	Mudstone		35.71		
391	396	111.70	113.32	1.62		1.25	Mudstone		76.82		
396	401.5	113.32	114.95	1.63		1.23	Mudstone	White mineral (no reaction w/ HCL)	75.49		
401.5	407	114.95	116.54	1.59		0.60	Mudstone	Interbedded shale?	37.42		
407	412	116.54	118.17	1.63		1.32	Mudstone	Polished surfaces, slickensides	80.67		125.66
TOTAL LENGTHS (m):				**114.72**	**118.99**						

EOH 2012-04Da

Key: SST : Sandstone vf : Very fine HCL: Hydrochloric acid w/ : With

Note: Apx. Coal recovery 9.484

Exploration Hole 2012-05Da

Diamond Drill Rig — Pad: 18

Logged by: Spring MacAskill — Azimuth: 200°

Hole Diameter: HQ — Dip: 51°

Block-Block		Block-Block		Cumulative Core Recovery				Sub Width (m)	Recovery (m)	RQD %	Lithology	Core Description	Sample ID	Unit Lengths
Core From (ft.)	Core To (ft.)	From (m)	To (m)	Width (m)	From (m)	To (m)	Width (m)							
0	5	0	1.52	1.52	0.00	1.52	1.52		0	0.00	NA	Casing		
5	7	1.52	2.13	0.61	1.52	1.84	0.31		0.00	0.00	NA	Rubble		
7	12	2.13	3.66	1.52	1.84	3.48	1.65		1.01	61.09	Shenfield			Sheinfield: 9.519
12	18	3.66	5.36	1.71	3.48	5.04	1.56		1.35	86.43	Shenfield			
18	23	5.36	7.01	1.65	5.04	6.65	1.61		1.34	83.18	Shenfield			
23	28	7.01	8.53	1.52	6.65	8.20	1.55		1.18	76.00	Shenfield			
28	33	8.53	10.06	1.52	8.20	9.59	1.39		0.58	41.94	Shenfield			
33	38	10.06	11.58	1.52	9.59	11.23	1.65		1.07	65.05	Shenfield			
38	41	11.58	12.50	0.91	11.23	12.28	1.05		0.18	17.14	Shenfield			
41	43	12.50	13.11	0.61	12.28	12.96	0.68		0.42	61.47	Shenfield			
43	48	13.11	14.63	1.52	12.96	14.50	1.54		0.50	32.47	Shenfield			
48	53	14.63	16.15	1.52	14.50	16.13	1.63		0.60	36.81	Shenfield			
53	58	16.15	17.68	1.52	16.13	17.84	1.71	1.30	0.00	0.00	Shenfield			
								0.22			Coal Seam 13B			Coal seam 13B: 0.215
								0.19			Anderson Marine Shale			Anderson Marine Shale: 38.508
58	61	17.68	18.59	0.91	17.84	18.57	0.74		0.00	0.00	Anderson Marine Shale			
61	65	18.59	19.81	1.22	18.57	19.86	1.29		0.14	10.47	Anderson Marine Shale			
65	69	19.81	21.03	1.22	19.86	21.18	1.32		0.26	19.70	Anderson Marine Shale			
69	73	21.03	22.25	1.22	21.18	22.01	0.83		0.22	26.67	Anderson Marine Shale			
73	78	22.25	23.77	1.52	22.01	23.49	1.48		0.38	25.34	Anderson Marine Shale			
78	83	23.77	25.30	1.52	23.49	25.17	1.69		0.00	0.00	Anderson Marine Shale			
83	88	25.30	26.82	1.52	25.17	26.40	1.23		0.25	20.41	Anderson Marine Shale			
88	93	26.82	28.35	1.52	26.40	28.05	1.65		0.00	0.00	Anderson Marine Shale			
93	97	28.35	29.57	1.22	28.05	29.12	1.08		0.13	12.09	Anderson Marine Shale			
97	100	29.57	30.48	0.91	29.12	30.77	1.64		0.00	0.00	Anderson Marine Shale			
100	103	30.48	31.39	0.91	30.77	31.75	0.99		0.60	60.41	Anderson Marine Shale			
103	108	31.39	32.92	1.52	31.75	33.26	1.51		0.83	54.64	Anderson Marine Shale			
108	113	32.92	34.44	1.52	33.26	34.86	1.60		1.07	67.06	Anderson Marine Shale			
113	118	34.44	35.97	1.52	34.86	36.34	1.48		1.48	100.00	Anderson Marine Shale			
118	123	35.97	37.49	1.52	36.34	37.84	1.50		1.24	82.61	Anderson Marine Shale			
123	128	37.49	39.01	1.52	37.84	39.30	1.47		0.97	65.87	Anderson Marine Shale			
128	133	39.01	40.54	1.52	39.30	40.83	1.53		1.41	92.16	Anderson Marine Shale			
133	138	40.54	42.06	1.52	40.83	42.39	1.56		1.14	72.76	Anderson Marine Shale			
138	143	42.06	43.59	1.52	42.39	43.86	1.47		1.44	98.29	Anderson Marine Shale			
143	148	43.59	45.11	1.52	43.86	45.36	1.50		1.43	95.34	Anderson Marine Shale			
148	153	45.11	46.63	1.52	45.36	46.90	1.54		1.47	95.13	Anderson Marine Shale			
153	158	46.63	48.16	1.52	46.90	48.51	1.61		1.18	73.20	Anderson Marine Shale			
158	163	48.16	49.68	1.52	48.51	50.05	1.54		1.30	84.42	Anderson Marine Shale			
163	168	49.68	51.21	1.52	50.05	51.55	1.50		0.98	65.55	Anderson Marine Shale			
168	173	51.21	52.73	1.52	51.55	53.10	1.55		1.15	73.87	Anderson Marine Shale			
173	178	52.73	54.25	1.52	53.10	54.46	1.36		0.74	54.41	Anderson Marine Shale			
178	183	54.25	55.78	1.52	54.46	55.86	1.40		0.62	44.29	Anderson Marine Shale			
183	188	55.78	57.30	1.52	55.86	56.16	0.30		0.00	0.00	Anderson Marine Shale			
					56.16	57.54	1.38		0.00	0.00	12T Coal	Coal		Coal 12T Seam: 6.275
188	193	57.30	58.83	1.52	57.54	59.15	1.62		0.00	0.00	12T Coal	Coal		

193	198	58.83	60.35	1.52	59.15	61.03	1.88		0.00	0.00	12T Coal	Coal		
198	203	60.35	61.87	1.52	61.03	62.43	1.40		0.00	0.00	12T Coal	Coal		
203	208	61.87	63.40	1.52	62.43	63.33	0.90	0.75	0.00	0.00	Mudstone	Parting		Mudstone: 0.75
								0.15			12 Coal	Coal		Coal 12 Seam: 6.23
208	213	63.40	64.92	1.52	63.33	64.33	1.00		0.00	0.00	12 Coal	Coal		
213	215	64.92	65.53	0.61	64.33	64.97	0.64		0.00	0.00	12 Coal	Coal		
215	218	65.53	66.45	0.91	64.97	66.13	1.16		0.00	0.00	12 Coal	Coal		
218	222	66.45	67.67	1.22	66.13	67.30	1.17		0.00	0.00	12 Coal	Coal		
222	226	67.67	68.88	1.22	67.30	68.56	1.26		0.00	0.00	12 Coal	Coal		
226	229	68.88	69.65	0.76	68.56	69.41	0.86		0.00	0.00	12 Coal	Coal		
229	230	69.65	70.10	0.46	69.41	69.79	0.38		0.00	0.00	Mudstone	Mudstone		Mudstone: 6.542
230	232	70.10	70.71	0.61	69.79	70.46	0.67		0.00	0.00	Mudstone	Mudstone w/interbedded coal		
232	237	70.71	72.24	1.52	70.46	72.18	1.72		0.11	6.12	Mudstone	Mudstone		
237	241	72.24	73.46	1.22	72.18	73.14	0.96		0.65	68.02	Mudstone			
241	246	73.46	74.98	1.52	73.14	74.54	1.40		0.37	26.64	Mudstone			
246	251	74.98	76.50	1.52	74.54	75.09	0.55		0.00	0.00	Mudstone			
251	254	76.50	77.42	0.91	75.09	75.95	0.87		0.61	70.06	Mudstone			
254	259	77.42	78.94	1.52	75.95	77.49	1.54		1.15	74.68	Bingay SST	Siltstone		Bignay SST: 49.347
259	263	78.94	80.16	1.22	77.49	78.69	1.19		1.14	95.73	Bingay SST	Silty SST		
263	268	80.16	81.69	1.52	78.69	80.10	1.41		1.34	95.04	Bingay SST	Vf SST		
268	273	81.69	83.21	1.52	80.10	81.79	1.69		0.78	46.15	Bingay SST	Dark grey vf SST, minor carbonate		
273	278	83.21	84.73	1.52	81.79	83.41	1.62		1.20	74.07	Bingay SST	Med-dark grey fine-vf SST		
278	283	84.73	86.26	1.52	83.41	84.97	1.56		1.38	88.54	Bingay SST	Med-dark grey fine-vf SST		
283	288	86.26	87.78	1.52	84.97	86.45	1.48		0.94	63.13	Bingay SST	Fine SST w/interbedded shale, coarsening downwards		
288	293	87.78	89.31	1.52	86.45	88.02	1.57		1.16	73.71	Bingay SST			
293	298	89.31	90.83	1.52	88.02	89.66	1.65		0.00	0.00	Bingay SST			
298	303	90.83	92.35	1.52	89.66	91.42	1.76		0.51	29.03	Bingay SST			
303	308	92.35	93.88	1.52	91.42	93.04	1.62		1.30	80.20	Bingay SST			
308	313	93.88	95.40	1.52	93.04	94.60	1.56		1.28	82.18	Bingay SST			
313	318	95.40	96.93	1.52	94.60	96.02	1.42		1.19	83.71	Bingay SST			
318	323	96.93	98.45	1.52	96.02	97.67	1.64		0.85	51.83	Bingay SST			
323	328	98.45	99.97	1.52	97.67	99.15	1.49		1.25	83.99	Bingay SST			
328	333	99.97	101.50	1.52	99.15	100.72	1.56		1.38	88.35	Bingay SST			
333	338	101.50	103.02	1.52	100.72	102.28	1.56		1.44	92.31	Bingay SST			
338	343	103.02	104.55	1.52	102.28	103.82	1.54		1.54	99.68	Bingay SST	Fine med grey SST		
343	348	104.55	106.07	1.52	103.82	105.33	1.52		1.52	100.00	Bingay SST	Fine SST w/ conglomeratic pieces interbedded		
348	353	106.07	107.59	1.52	105.33	106.74	1.41		1.03	73.33	Bingay SST	Fine SST w/ conglomeratic pieces interbedded		
353	358	107.59	109.12	1.52	106.74	108.27	1.53		1.53	100.00	Bingay SST	Med grey SST		
358	363	109.12	110.64	1.52	108.27	109.84	1.57		1.45	92.65	Bingay SST			
363	368	110.64	112.17	1.52	109.84	111.40	1.56		0.92	58.90	Bingay SST			
368	373	112.17	113.69	1.52	111.40	112.99	1.59		1.15	72.14	Bingay SST	SST w/ conglomeratic pieces interbedded		
373	378	113.69	115.21	1.52	112.99	114.52	1.53		1.06	69.37	Bingay SST			
378	383	115.21	116.74	1.52	114.52	116.06	1.54		0.92	59.74	Bingay SST	Med SST w/ coal fragments coarsening upward from vf SST/siltstone		
383	388	116.74	118.26	1.52	116.06	117.59	1.53		1.27	83.01	Bingay SST	Pyrite on fractured surface of SST		
388	393	118.26	119.79	1.52	117.59	119.04	1.45		1.06	73.10	Bingay SST	Vf-fine SST		

393	398	119.79	121.31	1.52	119.04	120.54	1.50		0.97	64.33	Bingay SST	Vf-fine SST		
398	403	121.31	122.83	1.52	120.54	122.10	1.57		0.33	21.09	Bingay SST	Vf SST		
403	408	122.83	124.36	1.52	122.10	123.67	1.57		1.32	84.08	Bingay SST	Vf SST		
408	413	124.36	125.88	1.52	123.67	125.30	1.63		0.88	53.68	Bingay SST	Vf SST		
413	418	125.88	127.41	1.52	125.30	126.77	1.47		1.00	68.03	Mudstone	Very broken silty mudstone		Mudstone: 35.05
418	423	127.41	128.93	1.52	126.77	128.65	1.88		0.00	0.00	Mudstone	Silty mudstone		
423	428	128.93	130.45	1.52	128.65	130.18	1.54		0.00	0.00	Mudstone	Silty mudstone		
428	433	130.45	131.98	1.52	130.18	131.40	1.22		0.54	44.03	Mudstone	Silty mudstone		
433	438	131.98	133.50	1.52	131.40	132.78	1.39		0.00	0.00	Mudstone	Silty mudstone		
438	443	133.50	135.03	1.52	132.78	134.22	1.44		1.14	79.58	Mudstone	Silty mudstone		
443	448	135.03	136.55	1.52	134.22	135.63	1.41		1.15	81.23	Mudstone	Silty mudstone		
448	453	136.55	138.07	1.52	135.63	137.26	1.63		1.00	61.48	Mudstone	Silty mudstone		
453	458	138.07	139.60	1.52	137.26	138.89	1.63		1.36	83.44	Mudstone	Silty mudstone		
458	463	139.60	141.12	1.52	138.89	140.44	1.55		1.47	94.82	Mudstone	Silty mudstone		
463	468	141.12	142.65	1.52	140.44	141.97	1.53		1.33	86.60	Mudstone	Silty mudstone		
468	473	142.65	144.17	1.52	141.97	143.53	1.56		1.64	105.13	Mudstone	Silty mudstone		
473	478	144.17	145.69	1.52	143.53	144.93	1.40		1.21	86.07	Mudstone	Silty mudstone		
478	483	145.69	147.22	1.52	144.93	146.58	1.66		0.96	58.01	Mudstone	Silty mudstone		
483	488	147.22	148.74	1.52	146.58	148.25	1.67		0.80	47.90	Mudstone	Silty mudstone		
488	493	148.74	150.27	1.52	148.25	149.90	1.65		1.18	71.85	Mudstone	Silty mudstone		
493	498	150.27	151.79	1.52	149.90	151.37	1.48		1.41	95.46	Mudstone	Silty mudstone		
498	503	151.79	153.31	1.52	151.37	152.93	1.56		1.12	71.70	Mudstone	Mudstone		
503	508	153.31	154.84	1.52	152.93	154.48	1.55		1.02	66.00	Mudstone	Mudstone		
508	513	154.84	156.36	1.52	154.48	156.01	1.53		1.09	71.37	Mudstone	Mudstone		
513	518	156.36	157.89	1.52	156.01	157.54	1.53		1.04	67.71	Mudstone	Mudstone		
518	523	157.89	159.41	1.52	157.54	159.10	1.56		0.97	62.12	Mudstone	Mudstone		
523	528	159.41	160.93	1.52	159.10	160.35	1.26	0.07	0.00	0.00	Mudstone	Mudstone		
								1.19			10 Coal	Coal sample 120301	120301	Coal seam 10: 11.067
528	533	160.93	162.46	1.52	160.35	162.15	1.80		0.00	0.00	10 Coal	Coal sample 120302	120302	
533	538	162.46	163.98	1.52	162.15	163.80	1.65		0.00	0.00	10 Coal	Coal sample 120303	120303	
538	543	163.98	165.51	1.52	163.80	165.45	1.65		0.00	0.00	10 Coal	Coal sample 120304	120304	
543	548	165.51	167.03	1.52	165.45	166.93	1.48		0.00	0.00	10 Coal	Coal sample 120305	120305	
548	553	167.03	168.55	1.52	166.93	168.68	1.74		0.00	0.00	10 Coal	Coal sample 120306	120306	
553	557.5	168.55	169.93	1.37	168.68	170.23	1.56		0.00	0.00	10 Coal	Coal sample 120307	120307	
557.5	563	169.93	171.60	1.68	170.23	171.52	1.29		0.00	0.00	Mudstone	124cm Mudstone then 46cm of coal (not sampled)		Mudstone: 1.29
563	568	171.60	173.13	1.52	171.52	172.39	0.87		0.00	0.00	10R Coal	Coal sample 120309 (Note:120308 was incorrectly labeled and discarded)	120309	Coal seam 10R: 1.963
568	571.5	173.13	174.19	1.07	172.39	173.49	1.09		0.00	0.00	10R Coal	Coal sample 120310	120310	
571.5	574	174.19	174.96	0.76	173.49	174.31	0.83		0.74	89.59	Mudstone	Mudstone		Mudstone: 6.553
574	579	174.96	176.48	1.52	174.31	175.77	1.45		1.30	89.55	Mudstone			
579	583	176.48	177.70	1.22	175.77	176.99	1.22		1.10	90.33	Mudstone			
583	588	177.70	179.22	1.52	176.99	178.47	1.48		0.96	64.62	Mudstone	Smooth, shiny fractures, interbedded shale		
588	593	179.22	180.75	1.52	178.47	180.04	1.57		1.25	79.20	Mudstone			
593	598	180.75	182.27	1.52	180.04	181.48	1.44		1.08	74.90	Silty Sandstone	Vf SST		Silty sandstone: 10.411
598	603	182.27	183.79	1.52	181.48	183.05	1.57		1.51	96.06	Silty Sandstone	Vf SST		
603	608	183.79	185.32	1.52	183.05	184.63	1.58		1.29	81.33	Silty Sandstone	Vf SST		
608	613	185.32	186.84	1.52	184.63	186.13	1.50		1.35	90.12	Silty Sandstone	Vf SST		
613	618	186.84	188.37	1.52	186.13	187.65	1.52		1.26	83.11	Silty Sandstone	Vf SST		
618	623	188.37	189.89	1.52	187.65	189.10	1.45		1.37	94.36	Silty Sandstone	Vf SST		

623	627	189.89	191.11	1.22	189.10	190.45	1.35		0.79	58.71	Silty Sandstone	Siltstone		
627	632.5	191.11	192.79	1.68	190.45	192.04	1.59		1.06	66.77	Mudstone	Small .03m band of coal in mudstone		Mudstone: 1.842
632.5	638	192.79	194.46	1.68	192.04	193.69	1.65	0.25	0.00	0.00	Mudstone	Silty mudstone		
								1.40			8/7/6 or 5 Coal	Coal, Sample 120311	120311	**Perhaps Coal seam 8/7/6/5 Not 4 as recorded in Sample ID
638	639	194.46	194.77	0.30	193.69	194.06	0.37		0.00	0.00	8/7/6 or 5 Coal	Coal		Coal seam 8/7/6 or 5 : 1.765
639	643	194.77	195.99	1.22	194.06	195.24	1.19		0.88	74.43	Mudstone	Mudstone		
643	648	195.99	197.51	1.52	195.24	196.79	1.55		1.33	86.05	Mudstone	Mudstone		Mudstone: 3.732
648	651	197.51	198.42	0.91	196.79	197.79	1.00		0.78	78.08	Mudstone	Mudstone		Siltstone: 9.313
651	657	198.42	200.25	1.83	197.79	199.16	1.37		1.13	82.70	Siltstone	Siltstone		
657	662	200.25	201.78	1.52	199.16	200.75	1.59		1.02	63.76	Siltstone	Siltstone		
662	667	201.78	203.30	1.52	200.75	202.26	1.51		1.03	68.41	Siltstone	Siltstone		
667	672.5	203.30	204.98	1.68	202.26	203.78	1.52		0.82	53.95	Siltstone	Siltstone		
672.5	678	204.98	206.65	1.68	203.78	205.40	1.62		1.07	66.05	Siltstone	Siltstone		
678	683	206.65	208.18	1.52	205.40	207.10	1.70		1.00	58.79	Siltstone	Siltstone		
683	688	208.18	209.70	1.52	207.10	208.57	1.47		1.29	87.36	Mudstone	Mudstone		Mudstone:1.471
688	693	209.70	211.23	1.52	208.57	210.09	1.52	1.28	1.38	90.64	4 Coal	Coal 4 Sample 120312	120312	Coal seam 4: 1.282
								0.24			Mudstone	Mudstone		
693	700	211.23	213.36	2.13	210.09	210.85	0.76	0.02	0.00	0.00	Mudstone	Mudstone		Mudstone: 0.255
								0.27			4R Coal	Coal		Coal Seam 4R: 0.27
								0.47			Mudstone	Mudstone		
700	702	213.36	213.97	0.61	210.85	211.49	0.64		0.32	49.53	Mudstone	Mudstone, with a small 2.5cm band of coal		Mudstone: 3.809
702	705	213.97	214.88	0.91	211.49	212.29	0.81		0.35	43.35	Mudstone	Mudstone w/interbedded coal		
705	707.5	214.88	215.65	0.76	212.29	213.02	0.73		0.48	65.48	Mudstone	Mudstone		
707.5	713	215.65	217.32	1.68	213.02	214.66	1.64	0.15	0.40	24.46	Mudstone	Mudstone		
								0.25			3 Coal	Coal		Coal Seam 3 .245
								0.33			Mudstone	Mudstone		
								0.26			2 Coal	Coal		Coal Seam 2: 0.255
								0.66			Mudstone	Mudstone		
713	718	217.32	218.85	1.52	214.66	216.14	1.48		0.00	0.00	Mudstone	Mudstone with interbedded coal bands		Mudstone: 2.135

EOH 2012-05Da

Key: SST: Sandstone Vf: Very Fine Med: Medium w/ : With

Exploration Hole 2012-06Da

Diamond Drill Rig

Logged by: Spring MacAskill

Hole Diameter: HQ

Pad: 20

Azimuth: 135°

Dip: 51°

Block-Block		Block-Block		Cumulative Core Recovery			Sub Width (m)	RQD	Lithology	Core Description	Sample ID	Unit Lengths
Core From (ft.)	Core To (ft.)	From (m)	To (m)	From (m)	To (m)	Width (m)		> 10cm				
0	20	0.00	6.10	0.00	6.10	6.10		0.00	Casing	70ft casing, inferred		Casing: 6.10 metres
20	93	6.10	28.35	6.10	28.35			0.00	Rubble	Rubble; rounded gravel		Rubble Length (Not including missing sections, used tricone bit): 2.86
93	98	28.35	29.87	28.35	28.71	0.36		0.36	Mudstone	Silty mudstone; sub-rounded on both ends, w/oxidation in fractures		2.96
98	102	29.87	31.09	28.71	29.92	1.21	0.21	0.00	Rubble	Sub-rounded gravel (6cm in diameter)		
			0.00				1.01	0.98	Mudstone	Mudstone w/iron oxide in fractures		
102	107	31.09	32.61	29.92	31.25	1.33	1.15	0.81	Mudstone	Mudstone w/interbedded shale, coarsening downward from med-fine gr SST, contains carbonate (fizzes w/HCL)		
			0.00				0.18	0.00	SST/Mudstone	Layered SST (light grey)/mudstone(dark grey) w/ oxide in fractures; sub-rounded end of SST unit		
107	112	32.61	34.14	31.25	32.77	Missing (1.52)			**Missing core; inferred**			
112	139	34.14	42.37	32.77	32.83	0.06		0.00	Rubble	Tricone bit – no core recovered		
139	143	42.37	43.59						10A Coal	Tricone bit – no core recovered		10A Length: 0.45
143	144.5	43.59	44.04	32.83	33.28	0.45		0.00	10A Coal	10A coal seam?		0.45
144.5	150	44.04	45.72	33.28	34.74	1.47	0.08	0.00	Mudstone	Highly broken		
							1.39	0.00	10R Coal	Sample 120313 (145'-150')	120313	Seam 10R length:
150	151.5	45.72	46.18	34.74	35.20	Missing (0.46)		0.00	**Missing core**			Missing Length: 0.46
151.5	157	46.18	47.85	35.20	36.71	1.51	0.63	0.00	Mudstone	Mudstone w/interbedded coal		Mudstone: 0.63
							0.88	0.25	10 Coal	10 Coal seam?		Seam 10: 2.81
157	162	47.85	49.38	36.71	38.35	1.64		0.35	10 Coal	Coal w/interbedded mudstone; sample 120314	120314	
162	164	49.38	49.99	38.35	38.64	0.30		0.00	10 Coal			
164	168.5	49.99	51.36	38.64	39.75	1.11		0.43	Mudstone	Mudstone w/interbedded coal, potential fault (2 bombs sent down drill), highly broken with slickensides		
168.5	172	51.36	52.43	39.75	40.74	0.99		0.12	Mudstone	Mudstone w/interbedded coal		Mudstone: 2.1
172	177	52.43	53.95	40.74	42.08	1.34	0.77		SST	Fine-med SST w/ quartz participated in fracture and slickensides		Sandstone: 0.77
							0.06		9 Coal	9 Coal seam?		Seam 9? 0.06
							0.10		Mudstone	Slickensides present on fractured surface		Mudstone: 0.1
							0.41		SST	Med SST		SST: 4.9
177	182	53.95	55.47	42.08	43.73	1.65		1.20	SST	Fine-Med SST, plant fragments present (Stems) on fractures surfaces- coal and oxides		
				43.73	45.40	1.67			Siltstone	Vf siltstone/mudstone w/plant fragments to fine/med gr SST, calcite stringers (fizzes with HCL) on fracture surface and slickensides		
182	186	55.47	56.69	45.40	46.56	1.16	1.15		SST	Fine-med gr SST, calcite in fractures, polished fracture surfaces		
							0.01		Clay			Clay 0.01
186	191	56.69	58.22	46.56	48.22	1.66	1.58	0.44	SST	Fine-vf SST/siltstone, oxidized in fracture surfaces		SST: 1.58
							0.08		8 Coal	8 Coal seam?		Seam 8: 0.08
191	195	58.22	59.44	48.22	49.42	1.20		93.40	Mudstone	Black, dark mudstone		Mudstone: 4.12

195	199.5	59.44	60.81	49.42	50.74	1.32		1.18	Mudstone	Black, dark mudstone		
199.5	204	60.81	62.18	50.74	52.34	1.60		1.44	Mudstone	Black, dark mudstone to fine SST		
204	209	62.18	63.70	52.34	53.95	1.61		1.41	Silty sandstone	VF SST, calcite in fractures (major fizz with HCL)		Silty SST: 3.0
209	214.5	63.70	65.38	53.95	55.34	1.39		0.81	Silty sandstone	Vf SST-siltstone		
214.5	216.5	65.38	65.99	55.34	56.20	0.87		0.00	7 Coal	7 Coal seam?		Seam 7?: 0.87
216.5	220	65.99	67.06	56.20	57.19	0.99	0.25	0.00	Mudstone	Mudstone		Mudstone: 1.0
220	222	67.06	67.67				0.74	0.00	6 Coal	6 Coal seam?		Seam 6?: 0.74
222	227	67.67	69.19	57.19	57.73	0.54		0.12	Mudstone	Mudstone w/interbedded coal, 50° slickensides		Mudstone: 5.09
				57.73	59.18	1.45		0.65	Mudstone	Siltstone/vf SST w/interbedded mudstone 30° slickensides		
227	232	69.19	70.71	59.18	60.73	1.56		0.69	Mudstone	Mudstone w/interbedded coal, polished surface 60° slickensides		
232	237	70.71	72.24	60.73	62.28	1.55		0.53	Mudstone	Mudstone w/ interbedded coal		
237	242	72.24	73.76	62.28	63.75	1.47		1.47	Sandstone	Fine-vf SST light grey, with white qtz in fracture surfaces (no fizz w/HCL)		Sandstone: 11.24
242	247	73.76	75.29	63.75	65.52	1.78		0.79	Sandstone	Fine gr SST light-med grey		Lost return- bombed the hole
247	250.5	75.29	76.35	65.52	65.95	0.43		0.46	Sandstone	Fine-vf SST med grey		
250.5	255.5	76.35	77.88	65.95	67.49	1.55		0.29	Sandstone	Highly fractured, polished surfaces, fine SST w/ white calcite stringers		
255.5	260.5	77.88	79.40	67.49	68.74	1.25		0.53	Sandstone	Vf-fine SST, fractured polished surfaces, interbedded coal		
260.5	266	79.40	81.08	68.74	70.17	1.43		0.00	Sandstone	vf -fine SST, 55°		
266	269	81.08	81.99	70.17	71.38	1.21		0.72	Sandstone	Fine-med SST w/ int coal, polished surfaces		
269	274	81.99	83.52	71.38	72.63	1.25		0.70	Sandstone			
274	276	83.52	84.12	72.63	73.52	0.89		0.60	Sandstone	Vf-fine SST w/int coal		
276	280	84.12	85.34	73.52	73.86	0.34		0.00	10 A Coal	10A Coal seam?		Seam 10? 0.44
280	286.5	85.34	87.33	73.86	75.07	1.21	0.10	0.56	10 A Coal	10A Coal seam?		
							1.11		Sandstone	vf SST w/int coal		Sandstone: 2.63
286.5	291.5	87.33	88.85	75.07	76.59	1.52		0.99	Sandstone	vf SST w/int coal		
291.5	297	88.85	90.53	76.59	78.27	1.68	0.94	0.24	Mudstone	Mudstone w/ interbedded coal		Mudstone: 0.94
							0.53	0.00	10 R Coal	10R Coal seam?		Seam 9, 10R? 0.53
							0.21	0.00	Mudstone	Mudstone w/interbedded coal		Mudstone: 0.83
297	302	90.53	92.05	78.27	79.50	1.23	0.62	0.52	Mudstone	Mudstone w/ interbedded coal		
							0.61	0.00	10 Coal	10 Coal seam?		Seam 10? 0.71
302	304	92.05	92.66	79.50	79.60	0.10		0.00	10 Coal	10 Coal seam?		
304	307	92.66	93.57	79.60	80.21	0.61		0.00	Mudstone	Mudstone w/ interbedded coal		Mudstone: 0.83
307	307.5	93.57	93.73	80.21	80.43	0.22		0.00	Mudstone	Mudstone w/int coal		
307.5	310	93.73	94.49	80.43	81.35	0.92		0.00	Silty sandstone	Vf SST- med grey		Silty SST: 6.62
310	315	94.49	96.01	81.35	82.89	1.54		1.32	Silty sandstone	Vf SST- med grey		
315	320	96.01	97.54	82.89	84.10	1.22		0.88	Silty sandstone	Vf SST- med grey		
320	325	97.54	99.06	84.10	85.61	1.51		1.25	Silty sandstone	Vf SST- med grey w/ pyrite		
325	330	99.06	100.58	85.61	87.05	1.44	1.24	0.00	8 Coal	8 Coal seam?		Coal 8? 1.24
							0.20		Silty sandstone	Vf SST		
330	332	100.58	101.19	87.05	87.67	0.62		0.47	Silty sandstone	Vf SST		SST: 2.26
332	337	101.19	102.72	87.67	89.11	1.44		1.11	Silty sandstone	Vf SST w/ plant fragments		
337	342	102.72	104.24	89.11	89.47	0.37		0.00	Mudstone	Mudstone w/int coal		Mudstone: 0.37
342	348.5	104.24	106.22	89.47	90.13	0.66		0.00	7 Coal	7 Coal seam?		Coal 7? 0.66
348.5	349	106.22	106.38	90.13	90.29	Missing (0.15)				**Missing**		
349	352	106.38	107.29	90.29	91.18	0.89		0.58	Sandstone	vf SST w/coal fragments Med-light grey		SST: 10.19
352	357	107.29	108.81	91.18	92.81	1.64		0.73	Sandstone	Med- light grey vf SST, highly fractured near the end		
357	359.5	108.81	109.58	92.81	93.49	0.68		0.31	Sandstone			
359.5	362	109.58	110.34	93.49	94.36	0.87		0.59	Sandstone			
362	367	110.34	111.86	94.36	95.87	1.51		1.03	Sandstone			

367	372	111.86	113.39	95.87	97.27	1.40		1.18	Sandstone			
372	377	113.39	114.91	97.27	98.89	1.62		0.86	Sandstone			
377	382	114.91	116.43	98.89	100.47	1.58	0.59	0.17	Sandstone	Highly fractured fine SST		
							0.75		6 Coal	6 coal seam?		Coal 6: 0.75
							0.24		Sandstone			SST: 1.75
382	387	116.43	117.96	100.47	101.98	1.51		0.82	Sandstone			
387	392	117.96	119.48					0.89	Sandstone			
392	397	119.48	121.01					1.09	Sandstone			
397	402	121.01	122.53	101.98	103.18	1.20	0.09	0.88	Mudstone			Mudstone: 0.09
							0.21	0.00	5 Coal	5 Coal seam?		Coal 5: 0.21
							0.90	0.00	Sandstone	Vf SST med grey		SST: 30.6
402	407	122.53	124.05	103.18	104.76	1.58		1.36	Sandstone	Vf SST med grey		
407	413	124.05	125.88	104.76	106.47	1.71		1.38	Sandstone	Vf SST w/ calcite in fractures		
413	418.5	125.88	127.56	106.47	108.00	1.53		1.21	Sandstone	Vf SST-silt-mudstone w/interbedded coal		
418.5	422	127.56	128.63	108.00	109.05	1.05		0.29	Sandstone	Mudstone w/ interbedded coal to siltstone w/calcite in fractures		
422	428	128.63	130.45	109.05	110.90	1.85		1.43	Sandstone	Siltstone w/calcite		
428	432	130.45	131.67	110.90	112.23	1.33		1.17	Sandstone			
432	437	131.67	133.20	112.23	113.66	1.44		1.44	Sandstone	Vf SST med-light grey		
437	442	133.20	134.72	113.66	115.29	1.63		1.38	Sandstone	Siltstone/mudstone light-med grey		
442	447	134.72	136.25	115.29	116.85	1.56		0.59	Sandstone	Siltstone/mudstone light-med grey		
447	452	136.25	137.77	116.85	118.69	1.84		0.25	Sandstone	Siltstone/mudstone light-med grey w/ white ppt (non fizzing w/HCL, very soft)		
452	457	137.77	139.29	118.69	120.56	1.87		0.14	Sandstone	Vf siltstone/mudstone broken with white mineral		
457	462	139.29	140.82	120.56	122.26	1.70	1.25	0.00	Sandstone	Vf SST		
							0.15	0.00	Sandstone	Vf siltstone/mudstone w/conglomeritic pieces in situ		
							0.30	0.00	Sandstone	Fine gr SST		
462	467	140.82	142.34	122.26	123.99	1.74	0.84	0.34	Sandstone	Fine-med gr SST w/ small 1cm bands of coal		
							0.90	0.00	Sandstone	Vf SST/siltstone w/ polished surfaces		
467	472	142.34	143.87	123.99	125.14	1.15		0.71	Sandstone	Fine-med SST med-light grey		
472	477	143.87	145.39	125.14	126.67	1.53		0.94	Sandstone	Fine-med SST med-light grey		
477	482	145.39	146.91	126.67	128.24	1.57		0.31	Sandstone	Fine SST w/white mineral to vf SST to fine SST (layering) coal/plant fragments in vf SST		
482	487	146.91	148.44	128.24	129.82	1.58		0.90	Sandstone	Vf SST w/coal fragments		
487	492	148.44	149.96	129.82	131.30	1.49		0.85	Sandstone	Vf SST		
492	497	149.96	151.49	131.30	132.87	1.57		0.46	SST	Vf SST w/ coal interbedded (1cm bands)		
497	502	151.49	153.01	132.87	134.12	1.25	0.50	0.00	4 Coal			Seam 4? 3.08
							0.75	0.00	4 Coal		120351	
502	506	153.01	154.23	134.12	135.55	1.43		0.00	4 Coal		120352	
506	507	154.23	154.53	135.55	135.95	0.40		0.00	4 Coal			
507	507.5	154.53	154.69	135.95	136.10	Missing (0.15)		0.00	Missing			Missing
507.5	512	154.69	156.06	136.10	137.33	1.24	0.38	0.00	Mudstone			Mudstone: 0.38
							0.86	0.00	4R Coal			Seam 4R? 0.86
512	517	156.06	157.58	137.33	138.82	1.49			Sandstone	Vf SST		SST: 11.36
517	522	157.58	159.11	138.82	140.48	1.66			Sandstone	Vf SST light/med grey		
522	527	159.11	160.63	140.48	142.07	1.59			Sandstone	Vf SST		
527	532	160.63	162.15	142.07	143.53	1.46			Sandstone	Vf-fine SST light/med grey		
532	537	162.15	163.68	143.53	145.01	1.48			Sandstone	Vf-fine SST light/med grey		
537	542	163.68	165.20	145.01	146.61	1.60			Sandstone	Vf-fine SST light/med grey		
542	547	165.20	166.73	146.61	148.29	1.68			Sandstone	Vf SST to siltstone/mudstone (highly broken)		
547	552	166.73	168.25	148.29	149.37	1.08	0.40		Sandstone	Vf SST		
							0.16		3 Coal			Seam 3? 0.16
							0.34		Mudstone			Mudstone: 0.34

							0.18		2 Coal			Seam 2: 4.08
552	553	168.25	168.55	149.37	149.71	0.35		0.00	Mudstone	Broken mudstone		Mudstone: 4.08
553	558	168.55	170.08	149.71	151.38	1.67		0.37	Mudstone	Broken mudstone		
558	562	170.08	171.30	151.38	152.69	1.31		0.28	Mudstone			
562	567	171.30	172.82	152.69	154.56	1.88	0.76	0.24	Mudstone			
							0.34	0.40	Sandstone	Med SST salt and pepper		SST: 0.34
							0.78	0.00	1 Coal			Seam 1: 1.105
567	572	172.82	174.35	154.56	155.89	1.33	0.33	0.00	1 Coal			
							1.06	1.06	Moose Mountain	Med SST salt and pepper		Moose Mountain: 12.35
572	577	174.35	175.87	155.89	157.45	1.56		1.48	Moose Mountain	Med SST salt and pepper		
577	582	175.87	177.39	157.45	158.98	1.53		1.31	Moose Mountain	Med SST salt and pepper		
582	587	177.39	178.92	158.98	160.54	1.56		1.27	Moose Mountain	Med SST salt and pepper		
587	592	178.92	180.44	160.54	162.12	1.58		1.51	Moose Mountain	Med SST salt and pepper		
592	597	180.44	181.97	162.12	163.62	1.50		1.47	Moose Mountain	Med SST salt and pepper		
597	602	181.97	183.49	163.62	165.16	1.55		1.10	Moose Mountain	Med-fine SST		
602	607	183.49	185.01	165.16	166.71	1.54		1.37	Moose Mountain	Bands of mudstone/shale with polished surfaces		
607	612	185.01	186.54	166.71	168.27	1.56		1.37	Moose Mountain	Med-fine SST		
612	617	186.54	188.06	168.27	169.82	1.55		1.41	Weary Ridge sandstone/siltstone	Fine SST		Weary Ridge: 28.66
617	622	188.06	189.59	169.82	171.31	1.49		1.43	Weary Ridge sandstone/siltstone	Fine SST		
622	627	189.59	191.11	171.31	172.83	1.52		1.29	Weary Ridge sandstone/siltstone	Fine SST		
627	632	191.11	192.63	172.83	174.39	1.57		1.48	Weary Ridge sandstone/siltstone	Fine SST		
632	637	192.63	194.16	174.39	176.01	1.62		1.53	Weary Ridge sandstone/siltstone	Fine SST		
637	642	194.16	195.68	176.01	177.50	1.49		1.15	Weary Ridge sandstone/siltstone	Fine SST		
642	647	195.68	197.21	177.50	179.18	1.69		1.09	Weary Ridge sandstone/siltstone	Fine SST		
647	651.5	197.21	198.58	179.18	180.47	1.29		1.01	Weary Ridge sandstone/siltstone	Fine SST		
651.5	656.5	198.58	200.10	180.47	182.00	1.53		1.32	Weary Ridge sandstone/siltstone	Fine SST		
656.5	662	200.10	201.78	182.00	183.66	1.66		1.42	Weary Ridge sandstone/siltstone	Fine SST		
662	667	201.78	203.30	183.66	185.18	1.53		1.53	Weary Ridge sandstone/siltstone	Fine SST		
667	672	203.30	204.83	185.18	186.79	1.61		1.61	Weary Ridge sandstone/siltstone	Fine SST		
672	677	204.83	206.35	186.79	188.32	1.53		1.53	Weary Ridge sandstone/siltstone	Fine SST		
677	682	206.35	207.87	188.32	189.80	1.48		1.41	Weary Ridge sandstone/siltstone	Fine SST		
682	687	207.87	209.40	189.80	191.34	1.55		1.55	Weary Ridge sandstone/siltstone	Fine SST		
687	692	209.40	210.92	191.34	192.75	1.41		1.41	Weary Ridge sandstone/siltstone	Fine SST		
692	697	210.92	212.45	192.75	194.29	1.54		1.46	Weary Ridge sandstone/siltstone	Fine SST		
697	702	212.45	213.97	194.29	195.79	1.50		1.42	Weary Ridge sandstone/siltstone	Fine SST		

702	706	213.97	215.19	195.79	196.93	1.14		1.07	Weary Ridge sandstone/siltstone	Fine SST, last cm has pyrite		
706	711	215.19	216.71	196.93	198.61	1.68	0.15	0.60	Fernie Fm?	Vf SST with mud layers, carbonate (fizzes with HCL)		Fernie: 83.82
							1.53		Fernie Fm?	Vf SST med grey with carbonate (fizz)		
711	716	216.71	218.24	198.61	200.16	1.56		1.55	Fernie Fm?	Vf SST med grey with carbonate (fizz)		
716	721.5	218.24	219.91	200.16	201.79	1.63		1.39	Fernie Fm?	Vf SST med grey with carbonate (fizz)		
721.5	726.5	219.91	221.44	201.79	203.40	1.61		1.11	Fernie Fm?	Vf SST med grey, shearing at 75 degrees		
726.5	731.5	221.44	222.96	203.40	205.05	1.66	0.10	1.39	Fernie Fm?	Vf SST med grey		
							0.17		Fernie Fm?	Fine Mudstone laminations		
							1.39		Fernie Fm?	VF SST med grey		
731.5	737	222.96	224.64	205.05	206.65	1.60		0.34	Fernie Fm?	VF SST fine		
737	742	224.64	226.16	206.65	208.33	1.68	0.88	0.60	Fernie Fm?	VF -Fine SST - soft areas shearing 75 degrees		
							0.80		Fernie Fm?	SST w/mudstone laminations		
742	747	226.16	227.69	208.33	209.81	1.48		1.29	Fernie Fm?	Fine-vf SST w/ lots mudstone laminations		
747	752	227.69	229.21	209.81	211.40	1.58		1.12	Fernie Fm?	Calcite stringers in shearing direction, polished surfaced, bioturbation 70° fractures		
752	757	229.21	230.73	211.40	213.01	1.61		1.26	Fernie Fm?	Vf-fine SST -mudstone w/bioturbation, dark brown/black		
757	762	230.73	232.26	213.01	214.56	1.55		1.49	Fernie Fm?	Vf SST -fewer laminations some bioturbation (light grey)		
762	767	232.26	233.78	214.56	216.16	1.60		1.33	Fernie Fm?	Vf SST med grey		
767	772	233.78	235.31	216.16	217.67	1.52		1.35	Fernie Fm?	Vf SST med grey, thin beds of coal, and laminations		
772	777	235.31	236.83	217.67	219.30	1.63		1.34	Fernie Fm?	Vf SST med grey		
777	782	236.83	238.35	219.30	220.76	1.46		1.46	Fernie Fm?	Vf SST med grey		
782	787	238.35	239.88	220.76	222.26	1.50		1.50	Fernie Fm?	Vf SST med grey		
787	792	239.88	241.40	222.26	223.77	1.51		1.34	Fernie Fm?	Vf SST med grey		
792	797	241.40	242.93	223.77	225.34	1.57		1.57	Fernie Fm?	Vf SST med grey		
797	802	242.93	244.45	225.34	226.76	1.43		1.39	Fernie Fm?	Vf SST med grey		
802	807	244.45	245.97	226.76	228.32	1.56	1.35	1.31	Fernie Fm?	Vf SST med grey		
							0.12		Fernie Fm?			
							0.10		Fernie Fm?			
807	812	245.97	247.50	228.32	229.82	1.50		1.50	Fernie Fm?	Limey vf-fine sandstone, with calcite in bedding fractures		
812	817	247.50	249.02	229.82	231.36	1.54		1.43	Fernie Fm?	Darker- brown/black with calcite (fizzes profusely)		
817	822	249.02	250.55	231.36	232.83	1.47		1.40	Fernie Fm?	highly hard, pyrite bands		
822	827	250.55	252.07	232.83	234.38	1.55		1.43	Fernie Fm?	Oil spots in SST		
827	832	252.07	253.59	234.38	235.89	1.51		1.33	Fernie Fm?	Vf SST/ dark grey		
832	842	253.59	256.64	235.89	237.45	1.56		1.47	Fernie Fm?	Vf SST/ dark grey		
842	847	256.64	258.17	237.45	239.02	1.57		1.51	Fernie Fm?	Vf SST/ dark grey		
847	852	258.17	259.69	239.02	240.46	1.45		1.40	Fernie Fm?	Vf SST/ dark grey with laminations		
852	857	259.69	261.21	240.46	242.02	1.56		1.50	Fernie Fm?	Vf SST/ dark grey with light grey coarser SST laminations		
857	862	261.21	262.74	242.02	243.49	1.48		1.39	Fernie Fm?	Vf SST/ dark grey with light grey coarser SST laminations		
862	867	262.74	264.26	243.49	244.99	1.50		1.29	Fernie Fm?	Vf SST/ dark grey , calcite band		
867	872	264.26	265.79	244.99	246.57	1.58		1.58	Fernie Fm?	Vf SST/ dark grey		
872	877	265.79	267.31	246.57	248.14	1.57		1.42	Fernie Fm?	Vf SST/ dark grey		
877	882	267.31	268.83	248.14	249.70	1.56		1.51	Fernie Fm?	Vf SST/ dark grey		
882	887	268.83	270.36	249.70	251.31	1.61		1.47	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
887	892	270.36	271.88	251.31	252.75	1.44		1.04	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
892	897	271.88	273.41	252.75	254.33	1.58		1.02	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
897	902	273.41	274.93	254.33	255.91	1.58		1.00	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
902	907	274.93	276.45	255.91	257.42	1.51		1.33	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		

907	912	276.45	277.98	257.42	259.07	1.65		0.62	Fernie Fm?	Limey (carbonate) vf SST/ dark grey, highly broken		
912	917	277.98	279.50	259.07	260.76	1.69		0.77	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
917	922	279.50	281.03	260.76	262.27	1.51		1.00	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
922	927	281.03	282.55	262.27	263.87	1.60		1.20	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
927	932	282.55	284.07	263.87	265.45	1.58		1.25	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
932	937	284.07	285.60	265.45	267.06	1.61		1.49	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
937	942	285.60	287.12	267.06	268.48	1.42		1.13	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
942	947	287.12	288.65	268.48	270.11	1.63		1.47	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
947	952	288.65	290.17	270.11	271.60	1.49		1.09	Fernie Fm?	Limey (carbonate) vf SST/ dark grey		
952	957	290.17	291.69	271.60	273.26	1.66		0.28	Fernie Fm?	Darker- black vf SST with polished surfaces, lots of calcite stringers		
957	962	291.69	293.22	273.26	274.77	1.51		1.33	Fernie Fm?	Darker- black vf SST, lots of calcite stringers		
962	967	293.22	294.74	274.77	276.26	1.49		1.28	Fernie Fm?	Darker- black, lots of calcite stringers		
967	972	294.74	296.27	276.26	277.81	1.55		1.55	Fernie Fm?	Darker- black surfaces, lots of calcite stringers		
972	977	296.27	297.79	277.81	279.19	1.38		1.38	Fernie Fm?	Darker- black with polished surfaces, lots of calcite stringers		
977	982	297.79	299.31	279.19	280.75	1.56		1.29	Fernie Fm?	Darker- black with polished surfaces, lots of calcite stringers		
EOH=299.31m, 2012-06Da												
Key: SST: Sandstone			Vf: Very fine qtz: Quartz		int: Interbedded		w/ : With		ppt: Precipitate	Fm: Formation	Med: Medium	

Exploration Hole 2012-7Da

Diamond Drill — Pad 12

Logged By: Spring MacAskill — Azimuth 135°

Hole Diameter: HQ — Dip 51°

Block-Block		Block-Block		Cumulative Core Recovery			Sub Width (m)	Recovery Core cut >10cm	Lithology	Core Description	RQD %	Sample ID	Unit Length	
Core From (ft)	Core To (ft)	From (m)	To (m)	From (m)	To (m)	Width (m)								
0	24	0.00	7.32	0.00	7.32				NA	Casing			Overburden	2.10
24	28.5	7.32	8.69	7.32	8.88	1.57		0.00	NA	Highly broken muddy SST	0			
28.5	29	8.69	8.84	8.88	9.41	0.53		0.00	NA	Mud	0			
29	32	8.84	9.75	9.41	10.28	0.87	0.34	0.00	SST	SST	0		SST	0.34
							0.53		Coal	Coal			Coal	0.53
32	35	9.75	10.67	10.28	11.36	1.08		0.10	SST	Vf SST w/int coal, and non reactive to HCL white mineral	9.35		SST	11.58
35	39	10.67	11.89	11.36	12.84	1.48		0.00	SST		0			
39	42	11.89	12.80	12.84	13.71	0.87		0.00	SST	SST w/int coal, 70° fractures/sheering	0			
42	47	12.80	14.33	13.71	15.31	1.60		0.37	SST	SST w/ coal int	23.13			
47	53	14.33	16.15	15.31	17.04	1.73		0.44	SST	Highly broken, 69° fractures, polished surfaces	25.43			
53	57	16.15	17.37	17.04	18.80	1.76		0.38	SST	SST w/ coal int	21.59			
57	62	17.37	18.90	18.80	20.27	1.47		0.38	SST	SST w/ coal int	25.85			
62	67	18.90	20.42	20.27	21.85	1.59	0.69	0.22	SST	Fine SST -grey w/ white non reactive to HCL soft mineral	13.82			
							0.17		coal	Coal			Coal	0.17
							0.73		SST	SST- dark brown/black			SST	0.73
67	72	20.42	21.95	21.85	23.27	1.42		0.24	Mudstone	Mudstone w/int coal	16.90		Mudstone	3.00
72	77	21.95	23.47	23.27	24.85	1.58	0.50	0.00	Mudstone	Mudstone w/int coal	0			
							1.08		Coal	Coal			Coal	1.58
77	80	23.47	24.38	24.85	25.35	0.50		0.00	Coal	Coal	0			
80	82	24.38	24.99	25.35	25.69	0.34		0.00	Mudstone	Mudstone w/int coal	0		Mudstone	0.34
82	87	24.99	26.52	25.69	27.02	1.67		0.00	SST	Vf SST- dark grey	0		SST	10.61
87	92	26.52	28.04	27.02	27.15	1.46		0.00	SST	Grey SST	0			
92	97	28.04	29.57	27.15	28.62	1.60		0.00	SST	Grey SST	0			
97	102	29.57	31.09	28.62	28.78	1.63		0.23	SST	Light-med grey fine SST w/int mudstone	13.85			
102	107	31.09	32.61	28.78	30.04	1.42		0.60	SST	Fine gr SST	42.25			
107	112	32.61	34.14	30.04	30.34	1.57		1.22	SST	Fine gr SST	77.86			
112	117	34.14	35.66	30.34	31.52	1.48	1.27	0.78	SST	Fine gr SST	52.70			
							0.21		Coal	Coal			Coal	19.69
117	122	35.66	37.19	31.52	32.08	0.56		0.00	Coal	Coal	0			
122	127	37.19	38.71	32.08	32.78	0.70		0.00	Coal	Coal	0			
127	129	38.71	39.32	32.78	33.16	0.38		0.00	Coal	Coal	0			
129	132	39.32	40.23	33.16	33.99	0.83		0.00	Coal	Coal	0			
132	137	40.23	41.76			**Missing - Wash from ~ 135 feet. Problem with drilling; hole caved for a bit and the drill was stuck**						120356		
137	138	41.76	42.06			Missing								
138	142	42.06	43.28	33.99	35.02	1.03		0	Coal	Coal	0			
142	144	43.28	43.89	35.02	35.29	0.28		0	Coal	Coal	0			

144	146	43.89	44.50	35.29	36.01	0.72		0	Coal	Coal	0			
146	149	44.50	45.42	36.01	36.77	0.76		0	Coal	Coal	0			
149	152	45.42	46.33	36.77	36.98	0.22		0	Coal	Coal	0			
152	156	46.33	47.55	36.98	38.48	1.50		0	Coal	Coal	0			
156	161	47.55	49.07	38.48	39.89	1.41		0	Coal	Coal	0			
161	166.5	49.07	50.75	39.89	40.59	0.70		0	Coal	Coal	0			
166.5	171.5	50.75	52.27	40.59	40.65	0.06		0	Coal	Coal	0			
171.5	172	52.27	52.43	40.65	40.77	0.13		0	Coal	Coal	0			
172	175	52.43	53.34	40.77	40.81	0.04		0	Coal	Coal	0			
175	176	53.34	53.64	40.81	40.86	0.05		0	Coal	Coal	0			
176	181	53.64	55.17	40.86	40.92	0.06		0	Coal	Coal	0			
181	185.5	55.17	56.54	40.92	41.37	0.45		0	Coal	Coal	0			
185.5	187	56.54	57.00	41.37	41.56	0.20		0	Coal	Coal	0			
187	189	57.00	57.61	41.56	41.76	0.20		0	Coal	Coal	0			
189	192	57.61	58.52	41.76	41.99	0.23		0	Coal	Coal	0			
192	194	58.52	59.13	41.99	42.19	0.20		0	Coal	Coal	0			
194	195	59.13	59.44			**Missing**								
195	200.5	59.44	61.11	42.19	43.15	0.96		0.00	Coal	Coal	0.00			
200.5	205.5	61.11	62.64	43.15	44.38	1.23		0.00	Coal	Coal	0.00			
205.5	210.5	62.64	64.16	44.38	46.35	1.97		0.00	Coal	Coal	0.00			
210.5	216.5	64.16	65.99	46.35	48.22	1.87		0.00	Coal	Coal	0.00			
216.5	218	65.99	66.45	48.22	48.72	0.50		0.00	Coal	Coal	0.00			
218	222	66.45	67.67	48.72	50.06	1.34		0.00	Coal	Coal	0.00			
222	226	67.67	68.88	50.06	51.22	1.17	0.94	0.00	Coal	Coal	0.00			
							0.23	0.00	SST	Vf SST dark grey			SST	3.42
226	231	68.88	70.41	51.22	52.78	1.56	0.53	1.09	SST	Vf SST dark grey 75° contact	69.46			
							1.03		SST	Med-fine SST w/ light grey laminations, calcite in fractures (fizzes w/HCL) 60° fractures				
231	236	70.41	71.93	52.78	54.41	1.63		1.04	SST	Dark grey-black vf SST w/light grey fine SST int	63.50			
236	241	71.93	73.46	54.41	56.07	1.66		1.20	Mudstone	Silty mudstone	72.51		Mudstone	15.41
241	246	73.46	74.98	56.07	57.50	1.43		0.66	Mudstone	Silty mudstone	46.11			
246	250.5	74.98	76.35	57.50	58.70	1.20		1.20	Mudstone	Silty mudstone	100.00			
250.5	254.5	76.35	77.57	58.70	59.93	1.23		1.23	Mudstone	Silty mudstone	100.00			
254.5	259.5	77.57	79.10	59.93	61.48	1.56		1.29	Mudstone	Silty mudstone	82.96			
259.5	264.5	79.10	80.62	61.48	62.92	1.44		1.20	Mudstone	Silty mudstone	83.33			
264.5	269.5	80.62	82.14	62.92	64.49	1.57		1.40	Mudstone	Silty mudstone	89.17			
269.5	274.5	82.14	83.67	64.49	66.07	1.58		1.33	Mudstone	Silty mudstone	84.44			
274.5	279.5	83.67	85.19	66.07	67.47	1.41		0.95	Mudstone	Silty mudstone	67.45			
279.5	282	85.19	85.95	67.47	68.26	0.79		0.28	Mudstone	Silty mudstone	35.44			
282	287	85.95	87.48	68.26	69.82	1.56		0.49	Mudstone	Calcite/carbonate in fractures (fizzes with HCL)	31.41			
287	292	87.48	89.00	69.82	71.41	1.59	0.78	0.00	SST	Vf sandy siltstone (dark grey) int w/fine SST(light grey)	0.00		SST	8.75

							0.81		SST	Light grey limey fine-med gr SST w/ lamminations				
292	297	89.00	90.53	71.41	73.06	1.65		0.87	SST	Light grey limey fine-med gr SST w/ lamminations	52.97			
297	302	90.53	92.05	73.06	74.59	1.53		0.59	SST	Light grey limey fine-med gr SST w/ lamminations	38.49			
302	307	92.05	93.57	74.59	75.29	0.70		0.16	SST	Light grey limey fine-med gr SST w/ lamminations	22.86			
307	312	93.57	95.10	75.29	76.83	1.54		1.44	SST	Vf sandy siltstone w/polished surfaces	93.51			
312	317	95.10	96.62	76.83	78.57	1.74	0.44	0.27	SST	Vf silty sandstone	15.52			
							1.30	0.00	Coal	Coal			Coal L:	2.20
317	322	96.62	98.15	78.57	80.24	1.67	0.90	0.87	Coal	Coal	52.10			
							0.77		Mudstone	Mudstone w/int coal, polished surfaces			Mudstone	0.77
322	327	98.15	99.67	80.24	81.72	1.48		1.05	Siltstone	Siltstone dark grey	70.95		Siltstone	15.15
327	332	99.67	101.19	81.72	83.18	1.46		1.05	Siltstone	Siltstone dark grey	72.02			
332	337	101.19	102.72	83.18	84.84	1.66	1.41	1.40	Siltstone	Siltstone dark grey	84.34			
							0.26		Siltstone	Siltstone dark grey w/coal int				
337	339	102.72	103.33	84.84	85.34	0.50		0.17	Siltstone	Siltstone dark grey w/coal int 75 ° fractures/slickenslides present	34.00			
339	342	103.33	104.24	85.34	86.31	0.97		0.86	Siltstone	Siltstone dark grey	88.35			
342	347	104.24	105.77	86.31	87.77	1.46		1.16	Siltstone	Siltstone dark grey	79.45			
347	352	105.77	107.29	87.77	89.30	1.53		1.53	Siltstone	Siltstone dark grey	100.00			
352	357	107.29	108.81	89.30	90.76	1.46		1.37	Siltstone	Siltstone dark grey	94.04			
357	362	108.81	110.34	90.76	92.30	1.54		1.37	Siltstone	Siltstone dark grey	88.96			
362	367	110.34	111.86	92.30	93.81	1.51		0.55	Siltstone	Siltstone dark grey	36.36			
367	372	111.86	113.39	93.81	95.39	1.58		0.93	Siltstone	Siltstone dark grey w/int coal	58.86			
372	374.5	113.39	114.15	95.39	97.55	2.16	0.44	0.00	Coal	Coal	0.00		Coal	0.44
							0.20	0.00	SST	Silty sandstone			SST	1.85
							0.13	0.00	SST	Silty sandstone				
374.5	379.5	114.15	115.67	97.55	99.15	1.60	1.52	0.87	SST	Silty sandstone w/slickenslides (Box 25)*	54.38			
							0.08	0.00	Coal	Coal			Coal	0.91
379.5	380	115.67	115.82	99.15	99.15	0.00		0.00		Missing				
380	382	115.82	116.43	99.15	99.72	0.57		0.00	Coal/mudstone	Coal w/int mudstone	0.00			
382	383.5	116.43	116.89	99.72	99.98	0.26		0.00	Coal	Coal	0.00			
383.5	385.5	116.89	117.50	99.98	100.59	0.61		0.00	Mudstone	Mudstone w/int coal	0.00		Mudstone	3.74
385.5	390.5	117.50	119.02	100.59	102.36	1.77		0.00	Mudstone	Highly fractured/brocken up mudstone	0.00			
390.5	392.5	119.02	119.63	102.36	102.76	0.40		0.00	Mudstone	Highly fractured/brocken up mudstone w/coal int	0.00			
392.5	398	119.63	121.31	102.76	103.75	0.99	0.96	0.00	Mudstone	Mudstone w/int coal	0.00			
							0.03		Coal	Coal			Coal	0.30
398	402	121.31	122.53	103.75	104.49	0.75	0.27		Coal/mudstone	Mostly coal w/minor mudstone	0.00			
							0.48	0.42	SST	vfSST med grey			SST	8.64
402	407	122.53	124.05	104.49	105.99	1.50		1.50	SST	vfSST med grey, calcite (fizzes w/HCL)	100.00			
407	412	124.05	125.58	105.99	107.43	1.44		1.44	SST	vfSST med grey, calcite (fizzes w/HCL)	100.00			

412	417	125.58	127.10	107.43	109.04	1.61		1.61	SST	vfSST med grey, calcite (fizzes w/HCL)	100.00			
417	422	127.10	128.63	109.04	110.48	1.44		1.44	SST	vfSST med grey, calcite (fizzes w/HCL)	100.00			
422	427	128.63	130.15	110.48	111.93	1.45		1.16	SST	vfSST med grey, calcite (fizzes w/HCL)	80.00			
427	432	130.15	131.67	111.93	113.64	1.71	0.72	1.19	SST	vf sandy siltstone dark grey	69.59			
							0.16		Coal	Coal			Coal	0.16
							0.84		Siltstone	Vf sandy siltstone dark grey w/calcite veins			Siltstone	25.04
432	437	131.67	133.20	113.64	115.04	1.40		1.13	Siltstone	Vf sandy siltstone dark grey w/calcite veins	80.71			
437	442	133.20	134.72	115.04	116.59	1.55		1.30	Siltstone	Vf sandy siltstone dark grey w/calcite veins	84.14			
442	447	134.72	136.25	116.59	118.08	1.49		0.97	Siltstone	Vf sandy siltstone dark grey w/calcite veins	65.10			
447	452	136.25	137.77	118.08	119.63	1.55		1.55	Siltstone	Vf sandy siltstone dark grey w/calcite veins	100.00			
452	457	137.77	139.29	119.63	121.20	1.58		1.58	Siltstone	Med grey siltstone w/calcite stringers	100.00			
457	462	139.29	140.82	121.20	122.84	1.64		1.12	Siltstone	Med grey siltstone w/calcite stringers	68.29			
462	467	140.82	142.34	122.84	124.27	1.43		1.43	Siltstone	Med grey siltstone w/calcite stringers and coal interbeded	100.00			
467	472	142.34	143.87	124.27	125.92	1.65		1.14	Siltstone	Med grey siltstone w/calcite stringers	69.42			
472	477	143.87	145.39	125.92	127.43	1.51		1.40	Siltstone	Med grey siltstone	92.72			
477	482	145.39	146.91	127.43	128.84	1.42		1.42	Siltstone	Med grey siltstone w/ coal interbeded	100.00			
482	487	146.91	148.44	128.84	130.39	1.55		1.55	Siltstone	Med grey siltstone w/calcite	100.00			
487	492	148.44	149.96	130.39	131.81	1.42		1.42	Siltstone	Med grey siltstone w/calcite and coal interbeded	100.00			
492	497	149.96	151.49	131.81	133.38	1.57		0.94	Siltstone	Med grey siltstone w/calcite, last .19m changes to vf SST	59.87			
497	502	151.49	153.01	133.38	134.88	1.50		1.50	Siltstone	Vf sandy siltstone dark grey w/calcite veinsf SST-sandy siltstone med grey	100.00			
502	507	153.01	154.53	134.88	136.42	1.54		1.41	Siltstone	Fine SST, cross bedding, calcite, polished surfaces	91.56			
507	512	154.53	156.06	136.42	137.84	1.42		1.02	Siltstone	Vf sandy siltstone w/ coal int	72.04			
512	517	156.06	157.58	137.84	139.37	1.53		1.30	SST	Vf SST w/ calcite interbeded	85.23		SST	4.58
517	522	157.58	159.11	139.37	140.90	1.53		1.45	SST	Vf-fine SST w/ perhaps bioturbation?	94.44			
522	527	159.11	160.63	140.90	142.42	1.52		1.52	SST	Vf-fine SST w/ coal int	100.00			
527	532	160.63	162.15	142.42	143.90	1.48		1.30	Siltstone	Siltstone w/lamminations	88.08		Siltstone	16.70
532	533.5	162.15	162.61	143.90	144.65	0.75		0.75	Siltstone	Siltstone w/coal int	100.00			
533.5	539.5	162.61	164.44	144.65	146.27	1.62		1.26	Siltstone	Siltstone w/coal int	77.47			
539.5	545	164.44	166.12	146.27	147.85	1.58		1.39	Siltstone	Siltstone w/coal int	87.86			
545	549	166.12	167.34	147.85	149.04	1.19		1.03	Siltstone	Siltstone w/coal int	86.72			
549	552	167.34	168.25	149.04	150.00	0.96		0.96	Siltstone	Siltstone w/coal int	100.00			
552	557	168.25	169.77	150.00	151.54	1.54		1.01	Siltstone	Siltstone w/coal int	65.58			
557	562	169.77	171.30	151.54	153.11	1.57		0.83	Siltstone	Siltstone-vf SST w/coal int	52.87			
562	567	171.30	172.82	153.11	154.60	1.49		1.30	Siltstone	Siltstone-vf SST w/calcite int	87.56			
567	572	172.82	174.35	154.60	156.05	1.45		1.45	Siltstone	Siltstone-vf SST w/coal int	100.00			
572	577	174.35	175.87	156.05	157.61	1.56		1.56	Siltstone	Siltstone-vf SST w/coal int	100.00			
577	582	175.87	177.39	157.61	159.12	1.51	1.43	1.43	Siltstone	Sandy siltstone w/ calcite	94.70			
							0.08	0.00	Coal	Coal			Coal	0.80
582	587	177.39	178.92	159.12	160.84	1.72	0.72	0.00	Coal	Coal	0.00			

							1.05		Mudstone	Mudstone w/int coal			Mudstone	3.83
587	591	178.92	180.14	160.84	162.18	1.34		0.37	Mudstone	Mudstone w/int coal	27.59			
591	593	180.14	180.75	162.18	163.52	1.34		0.00	Mudstone	Mudstone w/int coal	0.00			
593	598	180.75	182.27	163.52	164.57	1.06	0.06	0.00	Mudstone	Mudstone w/int coal	0.00			
							0.04		Mudstone	Coal in wedge shape				
							0.96		SST	Fine SST w/int coal			SST	52.14
598	602	182.27	183.49	164.57	165.97	1.40		1.11	SST	Fine SST w/int coal	79.00			
602	607	183.49	185.01	165.97	167.51	1.54		1.24	SST	Fine SST w/int coal	80.65			
607	612	185.01	186.54	167.51	168.91	1.40		1.08	SST	Fine SST w/int coal	76.79			
612	617	186.54	188.06	168.91	170.48	1.57		1.38	SST	Fine SST w/int coal	87.90			
617	622	188.06	189.59	170.48	172.10	1.62		1.27	SST	Fine-med SST w/coal int	78.40			
622	627	189.59	191.11	172.10	173.68	1.58		1.23	SST	Fine SST w/int coal	77.53			
627	632	191.11	192.63	173.68	175.27	1.59		1.11	SST	Fine SST w/int coal	69.81			
632	637	192.63	194.16	175.27	176.74	1.46		1.45	SST	Vf-fine-med SST int (med grey)	99.11			
637	642	194.16	195.68	176.74	178.26	1.52		0.85	SST	Vf-fine-med SST w/mud int (med grey)	55.78			
642	647	195.68	197.21	178.26	179.79	1.53	0.92	0.48	SST	Vf-fine-med SST w/mud int (med grey)	31.05			
							0.61		SST	Subangular broken up SST and clay w/coal int, very soft gravel/clay combination				
647	652	197.21	198.73	179.79	181.09	1.30	0.67	0.48	SST	Subangular grains .05m in diameter; gravel/mud, dark brown/black	37.15			
							0.53		SST	Silty sandstone w/coal int				
652	657	198.73	200.25	181.09	182.68	1.60	0.62	0.32	SST	Vf silty sandstone med grey	20.06			
							0.08		SST	Coal w/ SST int				
							0.90		SST	Fine-med SST				
657	662	200.25	201.78	182.68	184.18	1.49		0.57	SST	Fine SST, Highly fractured w/some rubble	38.20			
662	667	201.78	203.30	184.18	185.78	1.61		0.44	SST	Rubble w/broken SST, then vf SST	27.41			
667	672	203.30	204.83	185.78	187.46	1.68		0.00	SST	Highly fractured vf-fine SST	0.00			
672	677	204.83	206.35	187.46	189.18	1.72		0.83	SST	Polished surfaces w/slickenslides (48 °s) on SST	48.14			
677	682	206.35	207.87	189.18	190.98	1.80		0.00	SST	Highly fractured, slight fizz on white minteral (not profusley)	0.00			
682	687	207.87	209.40	190.98	192.49	1.52		0.52	SST	Broken up w/mud and sm rock fragments <0.2cm	34.32			
687	692	209.40	210.92	192.49	194.14	1.65		0.56	SST	Vf SST	33.64			
692	697	210.92	212.45	194.14	195.61	1.47		0.43	SST	Vf SST	29.18			
697	702	212.45	213.97	195.61	197.29	1.68		0.70	SST	Vf SST med grey	41.49			
702	707	213.97	215.49	197.29	198.78	1.49		1.32	SST	Vf-fine SST	88.55			
707	712	215.49	217.02	198.78	200.29	1.51		1.51	SST	Vf-fine SST med-dark grey	100.00			
712	717	217.02	218.54	200.29	201.73	1.45		1.43	SST	Vf SST med-dark grey	98.55			
717	722	218.54	220.07	201.73	203.29	1.56		0.90	SST	Vf-fine SST med-dark grey	57.50			
722	727	220.07	221.59	203.29	204.83	1.54		1.50	SST	Vf-fine SST med-dark grey	97.47			
727	732	221.59	223.11	204.83	206.40	1.57		1.29	SST	Vf-fine SST med-dark grey	81.96			
732	737	223.11	224.64	206.40	207.90	1.50	0.94	1.26	SST	Vf-fine SST med-dark grey	83.86			
							0.56		SST	Vf SST/mudstone contact (brown/black)				

737	742	224.64	226.16	207.90	209.39	1.49		1.20	SST	Vf SST med-dark grey w/coal and mudstone int	80.43			
742	747	226.16	227.69	209.39	210.98	1.58		0.00	SST	Highly fractured/brocken vf SST med-dark grey w/coal and mudstone int	0.00			
747	752	227.69	229.21	210.98	212.48	1.50		0.88	SST	Vf SST med grey w/white stringers (slight fizz w/HCL)	58.72			
752	757	229.21	230.73	212.48	214.17	1.70		0.81	SST	Siltstone -vf- med SST- vf SST all int w/calcite stringers (slight fizz w/HCL)	47.91			
757	762	230.73	232.26	214.17	215.53	1.36		0.77	SST/siltstone	Vf SST/siltstone combination	56.97		SST/Silt	2.57
762	767	232.26	233.78	215.53	217.22	1.70		0.28	SST/siltstone	Siltstone-vf SST med-dark grey	16.50			
767	772	233.78	235.31	217.22	218.82	1.60		1.52	SST/siltstone	Siltstone-vf SST med-dark grey w/white mineral (slight fizz w/HCL)	95.00			

EOH 2012-07Da

Key: SST: Sandstone vf: Very fine Med: Medium w/: With sm: Small - : To int: Interbedded

Exploration Hole 2012-08Da

Logged by: Spring MacAskill | Pad: MW11-5D

Diamond Drill | Azimuth: 290°

Core Size: HQ | Dip: 47°

Block-Block		Block-Block			Measured		Core			
Core From (ft.)	Core To (ft.)	From (m)	To (m)	Width (m)	From (m)	To (m)	Recovery (m)	Lithology	Sample ID	Notes
0	86	0.00	26.21	26.21	0.00	26.21	0.00	Rubble		Rubble
86	88	26.21	26.82	0.61	26.21	26.56	0.35	Rubble		Rubble with coal
88	89	26.82	27.13	0.30	26.56	26.56	0.00			**Missing**
89	93	27.13	28.35	1.22	26.56	27.71	1.15	coal		10 Coal *Mud added
93	96	28.35	29.26	0.91	27.71	28.85	1.13	coal	120357	10 Coal *Mud added
96	101	29.26	30.78	1.52	28.85	30.39	1.55	coal		10 Coal *Mud added
101	106	30.78	32.31	1.52	30.39	32.18	1.79	coal	120358	10 Coal *Mud added
106	111	32.31	33.83	1.52	32.18	33.64	1.46	coal	120360	10 Coal *Mud added (sample ID 120359 does not exist)
111	116	33.83	35.36	1.52	33.64	35.16	1.52	coal	120361	10 Coal *Mud added
116	120	35.36	36.58	1.22	35.16	36.67	1.50	coal	120362	10 Coal *Mud added
120	126	36.58	38.40	1.83	36.67	38.57	1.91	coal	120363	10 Coal *Mud added
126	131	38.40	39.93	1.52	38.57	40.39	1.81	coal	120364	10 Coal *Mud added
131	136	39.93	41.45	1.52	40.39	42.28	1.89	coal	120365	10 Coal *Mud added
136	141	41.45	42.98	1.52	42.28	44.12	1.84	coal	120366	10 Coal *Mud added
141	147	42.98	44.81	1.83	44.12	45.32	1.20	coal		10 Coal *Mud added
147	153	44.81	46.63	1.83	45.32	47.23	1.91	coal	120367	10 Coal *Mud added
153	158	46.63	48.16	1.52	47.23	49.12	1.89	coal	120368	10 Coal *No Bentonite used - Replaced with Penetrol: non-ionic wetting agent, Ez-mud Gold: clay/shale stabilizer, Quik-Trol Gold LV: Low viscosity highly dispersible Filtration, 550X Drilling polymer Additive.
158	163	48.16	49.68	1.52	49.12	50.77	1.66	coal	120369	10 Coal *No Bentonite used (No Mud)
163	168	49.68	51.21	1.52	50.77	52.31	1.54	coal	120370	10 Coal *No Bentonite used (No Mud)
168	173	51.21	52.73	1.52	52.31	54.18	1.87	coal	120371	10 Coal *No Bentonite used (No Mud)
173	178	52.73	54.25	1.52	54.18	55.49	1.31	coal	120372	10 Coal *No Bentonite used (No Mud)
178	183	54.25	55.78	1.52	55.49	55.49	0.00			**Missing**
183	186	55.78	56.69	0.91	55.49	56.64	1.15	coal	120373	10 Coal *No Bentonite used (No Mud)
186	190	56.69	57.91	1.22	56.64	57.83	1.19	coal	120374	10 Coal *No Bentonite used (No Mud)
190	193	57.91	58.83	0.91	57.83	58.88	1.05	coal	120375	10 Coal *No Bentonite used (No Mud)
193	197	58.83	60.05	1.22	58.88	60.27	1.39	coal	120376	10 Coal *No Bentonite used (No Mud)
197	201	60.05	61.26	1.22	60.27	61.64	1.37	coal	120377	10 Coal *No Bentonite used (No Mud)
201	206	61.26	62.79	1.52	61.64	63.50	1.87	coal	120378	10 Coal *No Bentonite used (No Mud)
206	211	62.79	64.31	1.52	63.50	65.20	1.70	coal	120379	10 Coal *No Bentonite used (No Mud)
211	213	64.31	64.92	0.61	65.20	65.73	0.54	coal		10 Coal *No Bentonite used (No Mud)
213	218	64.92	66.45	1.52	65.73	67.40	1.67	coal	120380	10 Coal *No Bentonite used (No Mud)
218	223	66.45	67.97	1.52	67.40	69.29	1.89	coal	120381	10 Coal *No Bentonite used (No Mud)
223	229	67.97	69.80	1.83	69.29	70.33	1.04	coal		10 Coal *No Bentonite used (No Mud)
229	232	69.80	70.71	0.91	70.33	71.21	0.88	coal		10 Coal *No Bentonite used (No Mud)
232	236	70.71	71.93	1.22	71.21	72.55	1.34	coal	120382	10 Coal *No Bentonite used (No Mud)

236	239	71.93	72.85	0.91	72.55	73.97	1.42	coal		10 Coal *Mud added
239	243	72.85	74.07	1.22	73.97	74.54	0.57	coal		10 Coal *Mud added
243	255	74.07	77.72	3.66	74.54	74.54	0.00			**Missing**
255	257	77.72	78.33	0.61	74.54	74.69	0.16	muddy coal		Muddy coal (sludge) *Mud added
257	262	78.33	79.86	1.52	74.69	74.69	0.00			**Missing**
262	266	79.86	81.08	1.22	74.69	76.25	1.56	coal		Highly broken 10 coal with mud *Mud added
266	272	81.08	82.91	1.83	76.25	78.02	1.77	coal	120383	Very soft coal *Mud added
272	273	82.91	83.21	0.30	78.02	78.41	0.39	coal		10 Coal *Mud added
273	278	83.21	84.73	1.52	78.41	79.77	1.36	coal	120384	10 Coal *Mud added
278	282	84.73	85.95	1.22	79.77	80.84	1.07	muddy coal		Muddy coal (sludge) *Mud added
282	288	85.95	87.78	1.83	80.84	82.49	1.65	muddy coal		Muddy coal (sludge) *Mud added
						Total Coal:	55.93			

EOH 2012-08Da

2012 BOREHOLE LOG

Boring or Well No.: BH 12-1a	**Drilling Contractor: JR Waterwell Drilling, Cranbrook, BC**
Project: Bingay	**Drilling Equipment: Dual air rotary**
Location: Adj to MW11-1S and 1D	**Prepared By: Daniel Watterson**
Elevation: 1419.50m	**Borehole Complete: 10/10/12**
Borehole Start: 10/6/12	

Time	Depth (ft)	Depth (m)	Sample Description	Comments
14:50	0	0.00	overburden	angle hole 70 deg to south
	33	10.07	no cuttings	+/- 2 gpm
	40	12.20		+/- 20 gpm
	50	15.25	c oal w/water	fast drilling
	52	15.86	bedrock, soft	poor returns
	55	16.78		less water
	61	18.61	coaly siltstone, soft	poor returns
	67	20.44	bedrock, possibly mudstone	harder drilling
	69	21.05	coal	fast drilling
	73	22.27	bedrock	set casing at 73 ft
10/7/12	80	24.40	silty sandstone, med to dk gray, hard, dry	DTW MW11-1D 13.38 m btoc
	89	27.15	coal with fine brown mudstone?	
	96	29.28	sandstone, gray, hard, fn grn, dry	slower drilling
	105	32.03	sandstone, hard, fn to md grn, dry	few cuttings, mostly rock dust,
	110	33.55	as above, md gray, dry	
10:10	115	35.08	as above, md grn, dry	
	120	36.60	as above	GW @ 120 ft, producing about 1/4 gpm
	125	38.13	as above, incr grain size	harder drilling
	130	39.65	as above	hole plugging - start injecting +/- 2 gpm water
	135	41.18	poor sample	contam with uphole cuttings
	140	42.70	sandstone, md gry, fn to cs grn	
13:15	145	44.23	as above	
	150	45.75	as above	
	160	48.80	as above	
	165	50.33	As above - trace white fracture fill	
	170	51.85	As above	faster drilling
	175	53.38	As above	smaller cuttings
	180	54.90	As above	slower drilling
	185	56.43	As above	
14:25	195	59.48	As above	Stopped drilling -compressor broken
10/8/12	200	61.00	As above	Injecting slightly more water to maintain circulation
	205	62.53	Sandstone, med gray, hard, med to fn grain	GW production about 1/4 gpm
	210	64.05	Sandstone, med to dk gry, fine grain, hard	
8:15	215	65.58	As above	Possible sli increased GW prod
	220	67.10	As above, trace white frac fill	
	225	68.63	Sandstone, gray, fn grain, poss trace silt, minor wt frac fill	
	230	70.15	As above, poss more silt	faster drilling
	235	71.68	As above, poss sli greenish color	finer cuttings
	240	73.20	Silty sandstone, med gray, med hard	Poor samples, frequent lost circ for 15 ft
	245	74.73	As above, sand fn to vfn	
9:30	250	76.25	Sandstone, fn to vfn, mod hard, trace silt, minor wt min	
	255	77.78	As above, darker gray	
	260	79.30	As above, med gray	fine cuttings, sli harder drilling, better samples
	265	80.83	Sandstone, med gray, fn	bigger chips
	270	82.35	As above	
	275	83.88	As above	
	280	85.40	As above, incr wt min	smaller chips
	285	86.93	Sandstone, fn to vfn, hard	
	290	88.45	As above	
	295	89.98	As above	
	300	91.50	As above	
12:10	305	93.03	As above	
	310	94.55	As above	
	315	96.08	Silty mudstone, black, mod hard	faster drilling, GW flow +/- 0.5 gpm
	320	97.60	Sandstone, med gray, hard, poss cherty	slower drilling
	332	101.26		soft, fast drilling
	335	102.18	siltstone/mudstone, dk gray, w/ vfn sand, trace wt min	
	340	103.70	Sandstone, gray, hard, poss cherty	gw flow +/- 0.5 gpm
	350	106.75	Silty sandstone, gray, v hard, poss cherty	slow drilling
	355	108.28	As above	
14:10	360	109.80	As above	
	365	111.33	cherty siltstone?, dk gray, vfn grain, v hard, trace vfn sd	
	370	112.85	As above	
	375	114.38	Silty Sandstone, med to dk gray, incr wt min	faster drilling
	380	115.90	As above, increased chert, hard	slower drilling
	385	117.43	As above	
	390	118.95	As above	
	392	119.56	Poss thin coal seam	coal dust in produced water
	395	120.48	Sandy Siltstone, gray, trace wt frac fill	not as hard
15:35	400	122.00	Silty sandstone / Sandy siltstone, gray, hard, fn to vfn grn	
	405	123.53	As above	faster drilling
	410	125.05	Sandy mudstone, poss darker gray, wt minerals	poss plant frag
	415	126.58	Sandy siltstone, gray, hard, trace coal	smaller cuttings, slower drilling
	420	128.10	As Above	
	425	129.63	Muddy sandstone, dk gry, hard	smaller cuttings, slower drilling

	430	131.15	Sandy mudstone, dk gray, softer	sli faster drilling
	435	132.68	Mudstone with trace vfn sand, softer	small cuttings
16:00	440	134.20	As above	
	445	135.73	Mudy sandstone, sd vfn, hard	small cuttings
	450	137.25	As above	
	455	138.78	As above	
	460	140.30	Mudstone, blk to dk gy, tr vfn sd, softer, few wt min	
	465	141.83	Mudstone, blk to dk gy, few wt min	faster drilling
	470	143.35	As above	
	472	143.96		Slower drilling
	475	144.88	As above	
	480	146.40	Sandy mudstone, dk gy to blk, sd vfn, hard	small cuttings
	485	147.93	As above	
	487	148.54		Poss incr GW flow
	490	149.45	Mudstone, blk to dark gray	softer drilling
	495	150.98	As above	v small cuttings
09/10/2012				Flushed water from hole; GW prod +/- 3-4 gpm
	500	152.50	As above	
	505	154.03	No sample	Fast driling, poor circulation
	510	155.55	Mudstone, black, incr wt and brown calcerous min	
	515	157.08	As above	
	520	158.60	Mudstone, dk gray to blk, less frac fill	fast drilling
	525	160.13	As above	
	530	161.65	As above	
	535	163.18	As above	
	540	164.70	As above	
	545	166.23	As above, few frag of greenish rock, sli calc	fast drilling
10:25	555	169.28	Mudstone, black	
	560	170.80	As above, sli brownish color	
	565	172.33	As above	
	570	173.85	As abpve	
	575	175.38	As above, less white min	larger cuttings
	580	176.90	As above	
	585	178.43	Mudstone, blk, v hard or cherty, some concoidal cuttings	
	590	179.95	As above	
11:40	595	181.48	As above, incr wt calc min	larger cutings
	600	183.00	As above	
	605	184.53	As above, less wht frac fill	
	610	186.05	As above, poss cherty	
12:14	615	187.58	As above, few pieces with poss slickensides	
	620	189.10	As above	smaller cuttings
	625	190.63	As abve	
	630	192.15	As above, sli incr calc frac fill	
12:50	635	193.68	Mudstone, blk, mod hard to hard	
	640	195.20	As above, less wt frac fill	
	645	196.73	As above	
	650	198.25	As above, sli incr calc frac fill	increased chip size
13:40	655	199.78	As above, less wt frac fill	slower drilling
	660	201.30	As above	
	665	202.83	As above	
	670	204.35	As above	
14:25	675	205.88	As above, incr wt calc frac fill	
	680	207.40	As above, dk gray to black	
	685	208.93	As above	
15:10	690	210.45	As above, poss cherty, carbonate 4 mm frac fill	larger cuttings
	695	211.98	As above, less wt frac fill	smaller cuttings, faster drilling
	700	213.50	As above	
	705	215.03	As above, poss sli silty	
	710	216.55	As above	smaller cuttings
15:40	715	218.08	As above	
	720	219.60	As above, incr wt calc frac fill	
	725	221.13	As above, less wt frac fill	
	730	222.65	As above	
16:30	735	224.18	As above, sli incr calc frac fill	
	740	225.70	As above, sli harder	Slower drilling
	745	227.23	As above	Very fine cuttings - coarse grain sized
	750	228.75	Mudstone, blk, hard, poss sli cherty, minor wt min frac fill	large cuttings
17:25	755	230.28	As above	smaller cuttings
	760	231.80	Mudstone, blk, mod hard, minor wt calc frac fill	
	765	233.33	As above, more calcerous	
	770	234.85	As above	smaller cuttings
	775	236.38	As above, sli harder, incr calcerous w/depth	
10/10/2012				GW flow +- 4 gpm
	780	237.90	Mudstone, blk,hard, no calc frac fill, poss sli cherty	slow drilling, large cuttings
	785	239.43	As above, few pieces wt min frac fill	
	790	240.95	As above, incr wt calc frac fill	
9:10	795	242.48	As above, softer	Faster drilling, smaller cuttings
	800	244.00	As above	
	805	245.53	Silty mudstone, med hard	
	810	247.05	As above, few frac fill cuttings	
10:00	815	248.58	As above, sli harder	
	820	250.10	No sample	Poor circulation
	825	251.63	As above	Poor sample recovery
	830	253.15	As above	Faster drilling

11:00	835	254.68	As above	Smaller cuttings
	840	256.20	Mudstone, trace silt, minor wt calc frac fill	larger cuttings
	845	257.73	As above	smaller cuttings
	850	259.25	No sample	Circulation stopped
11:45	855	260.78	As above	
	860	262.30	As above	
	865	263.83	As above, incr wt calc frac fill	
	870	265.35	As above	
	875	266.88	As above	slower drilling
	880	268.40	As above	poor circulation
	885	269.93	As above	v fine cuttings
	890	271.45	Mudstone, blk, hard; few pieces gray siltstone /	poor sample, poss slough?
			very fine sandstone, trace wt frac fill	increased cutting size
14:30	895	272.98	Silty mudstone, blk, hard	improved circ
	900	274.50	As above	poor circ, poor recovery
	905	276.03	As above	
	910	277.55	As above, 4 mm wt calc frac fill	905 to 915 cuttings commingled, poor circ
				larger cutting with rounded edges
				insufficient water in hole - no hydrostatic head
15:00	915	279.08	As above	
			END HOLE @ 915 FT	GW prod +/- 4 gpm
10/14/012				DTW 19.7 m bgs

2012 BOREHOLE LOG

Boring or Well No.:BH 12-2a	**Drilling Contrator: JR Waterwell Drilling, Cranbrook, BC**
Project: Bingay	**Drilling Equipment: Dual air rotary, reverse circulation**
Location: Elkford, BC 0644456N, 5562789E	**Prepared By: Daniel Watterson**
Elevation: 1390 m	**Borehole Complete: 10/15/12**
Borehole Start: 10/14/12	

Time	Depth (ft)	Depth (m)	Sample Description	Comments
	0	0.00	Overburden, trace sand and gravel	69 deg to ESE
	13	3.97	trace moisture	
	15	4.58	Bedrock	Casing set at 26'
	40	12.20	sandstone, grey, very fine-grained, hard mudstone, drk grey to black, hard, dry	small cuttings, fast drilling
	50	15.25	coaly mudstone, black, med hard	small cuttings, fast drilling
	55	16.78	silty/muddy sandstone, black to dark grey, sand very fine-grained	small cuttings, fast drilling
	60	18.30	sandy mudstone, black to dark grey, sand, very fine grained, possibly silty, dry	
15:30	65	19.83	as above, dark grey, dry	fast drilling
	70	21.35	as above, less sand, few weakly pieces calcerous white fracture fill	
	75	22.88	siltstone, grey, hard, possible trace of very fine sand, dry	"
15:50	80	24.40	as above, possibly slight mud, dry	"
	85	25.93	silty mudstone, black to dark grey, hard	
	90	27.45	silty sandstone/sandy siltstone, sand very fine grained dry, hard, dark to med grey	
	95	28.98	silty sandstone, med grey, sand very fine grained cuttings slightly damp	no water produced
	100	30.50	siltstone, dark grey, hard, possibly mudstone layers	slower drilling
	105	32.03	muddy siltstone incr. coaly @ 107'	
	110	33.55	mudstone, black, coaly	softer, finer cuttings
16:50	115	35.08	silty mudstone, dark grey	
	118	35.99	incr. coaly	fast drilling
	125	38.13	coal/coaly mudstone	
	130	39.65	Coal/coaly mudstone	
	131	39.96	coaly mudstone	lighter cuttings
	135	41.18	as above	
	140	42.70	Coal/coaly mudstone	small cuttings
	145	44.23	as above	GW produced, 1.5 to 2 gpm
	150	45.75	as above	
17:40	155	47.28	siltstone with fine sand, with calcerous frac fill	small cuttings
	158	48.19	thin coal seam	
	160	48.80	coaly mudstone, black, as above	
	165	50.33	Interbedded fine silty sandstone with coaly mudstone	
	170	51.85	coaly mudstone, as above	
	175	53.38	as above	finer cuttings
Oct-15	180	54.90	coal/coaly mudstone, black	
	185	56.43	silty mudstone, coaly, black	
	190	57.95	silty mudstone, dark grey, trace coal	
8:25	195	59.48	as above	
	200	61.00	silty sandstone/sandy siltstone, grey sand very fine, few pieces with frac fill	larger cuttings
	205	62.53	as above	
	210	64.05	silty mudstone, dark grey to black	finer cuttings
9:00	215	65.58	as above	
	220	67.10	as above, black	
	225	68.63	muddy siltstone, dark grey	
	230	70.15	siltstone, dark grey, hard	larger cuttings
	232	70.76		possibly GW
9:35	235	71.68	as above	
	240	73.20	as above, trace very fine sand	
	245	74.73	incr. coaly, silty sandstone/sandy siltstone, sand very fine, slightly hard	
	250	76.25	muddy siltstone, dark grey to black	finer cuttings
9:55	255	77.78	silty mudstone, dark grey to black, hard	GW prod +/- 5 gpm
	260	79.30	coaly mudstone, black, hard	softer drilling
	265	80.83	coal, no sample	very fast drilling
	270	82.35	coal, no sample	
10:45	275	83.88	coal with coaly mudstone	
	280	85.40	coal, no sample	
	285	86.93	thin rock layer, still in coal	harder does not equal 0.5 ft
	290	88.45	coal with thin rock layer	harder does not equal 0.5 ft
	295	89.98	coal with mudstone	
	296	90.28	out of coal	
	300	91.50	coal	
	305	93.03	coal	
	310	94.55	out of coal?	
	312-313	95.16-95.47	thin coal seam	
	315	96.08	muddy siltstone, dark grey to black	
	320	97.60	coal	no returns, bit plugged
	335	102.18	hole terminated @335 ft	
			move 70 ft east, try again	

2012 BOREHOLE LOG

Boring or Well No. BH 12-3a	**Drilling Contrator: JR Waterwell Drilling, Cranbrook, BC**
Project: Bingay	**Drilling Equipment: Dual air rotary**
Location: 0644470 N, 5562776 E UTM 11, aprox 25 m E of BH12-2a	**Prepared By: Daniel Watterson**
Elevation: 1395 m	**Borehole End: 10/27/12**
Borehole Start: 10/15/12	

Date /Time	Depth (ft)	Depth (m)	Sample Description	Comments
10/15/12	0-14	0-4.27	overburden	Borehole inclined at 59.5 degrees
	31	9.46	casing set at 31'	
10/16/12				
10:00	55	16.78	per borehole BH12-2a	fast drilling
	70	21.35	silty mudstone	"
	75	22.88	coaly mudstone	"
	80	24.40	Interbedded thin coal	"
	95	28.98	and coaly siltstone/mudstone layers, dry	"
	100	30.50	silty mudstone, med to drk grey, hard, dry	slower drilling
	105	32.03	as above, trace very fine sand, dry, hard	
	110	33.55	silty sandstone, dark to med grey, hard, dry	
11:30	115	35.08	sandy siltstone, hard, dry, med grey	
	120	36.60	as above	
	125	38.13	silty mudstone, dark grey, hard, dry	few pieces of damp cuttings
	130	39.65	as above	few damp cuttings
	135	41.18	as above	
	140	42.70	as above	
	144	43.92		Groundwater, trickle, -start
	145	44.23	as above	injecting water +/- 2 gpm
	150	45.75	as above, possibly coaly	
13:10	155	47.28		
	160	48.80	silty mudstone, dark grey to black	faster drilling, slightly larger cuttings
	170	51.85	silty mudstone, as above	
	175	53.38	as above	
	180	54.90	as above, possibly v. fusd	finer cuttings
	183	55.82		
	185	56.43	as above, few pieces with frac fill, calcitic	larger cuttings
				inner barrel plugged, prod. significant GW
	192	58.56	mudstone, slightly coaly, black, few calcitic frac fill	
	195	59.48		20+ gpm based on airlift
	220	67.10	fine-grained sandstone with silt, med grey	coaly
	225	68.63	siltstone, trace sand, med grey	"
	230	70.15	silty mudstone, hard	"
	234	71.37	coal	soft
	240	73.20	coal with possibly thin mudstone layers	
	250	76.25	coal	
				swivel head broke, drillers fixing,
18/10/2012				down for the day and all of Oct 17
9:48	258	78.69	coal	back into rock at 258 ft
	260	79.30	sandstone, some silt, light grey, med hard	light hydrocarbon odour
	265	80.83	as above, hard to scratch	as above
	270	82.35	silty sandstone, med grey, med hard	as above
10:25	275	83.88	siltstone, med grey, med soft	as above
10:52	281	85.71	mudstone / siltstone, coaly, soft, dark grey	softer
	285	86.93	silty sandstone, med hard, med grey	
11:05	290	88.45	siltstone, some sand, med soft, dark grey	
	295	89.98	as above	
	300	91.50	med-grained sandstone, med grey, hard	small chips
	305	93.03	fine to med grained sandstone, trace silt, med grey, hard	
	310	94.55	brown, grey sandy siltstone, hard	white veining of soft mineral
	315	96.08	fine to med grained sandstone, some silt, med grey	
	320	97.60	as above	
	323	98.52	coaly siltstone, trace sand, soft, black	less than 1 foot thick, fast drilling
	325	99.13	siltstone, dark grey, trace sand, med soft	
	330	100.65	sandy siltstone, med hard, dark grey	
12:47	335	102.18	as above	
	340	103.70	as above, grey-brown	white veining
	345	105.23	as above	
	350	106.75	mudstone/siltstone, dark grey, med soft	
13:40	355	108.28	muddy siltsone, med soft, dark grey	
	360	109.80	mudstone, medium hard, grey-brown	fine cuttings, muddy return water
	365	111.33	coaly mudstone, light in weight, soft	mustone and coal interbeds, coal starts at 365'
	370	112.85	coal, light, soft, black	
	375	114.38	coaly mudstone, light in weight, soft	
	380	115.90	coal, light, soft, black	
	385	117.43	coal, light, soft, black	
	390	118.95	coal and coaly mudstone, black	coal interbeds end at 389'
	395	120.48	coaly mudstone, light in weight, med soft	
	400	122.00	muddy coal, black	very fine chips, coal from 401-403
	405	123.53	mudstone / siltstone, grey, med soft	
	410	125.05	as above	
15:30	415	126.58	as above	
	420	128.10	as above	
	425	129.63	coal, light, soft, black	coal from 424' to 435'
	430	131.15	muddy coal, black	
	435	132.68	coaly mudstone	
	440	134.20	coaly mudstone, light in weight, med soft	muddy coal from 441' to 442

	445	135.73	coaly mudstone < 1ft thick	
	450	137.25	mudstone, med soft, grey-brown	
	455	138.78	coaly mudstone, brown, med soft	
	460	140.30	coaly mudstone, med soft	458-460 coal
	465	141.83	muddy siltstone, dark grey, med soft	
17:15	470	143.35	mudstone with coal, med soft	small sandstone layer at 468
17:21	475	144.88	coaly mudstone, med soft	soft rock starts just at 475', 476 '- 478' coal
	480	146.40	coal (also dry sample at 482)	
	485	147.93	coaly mudstone, med hard, black	roc 486-487
	486	148.23	undetermined rock	
	490	149.45	coal	
17:58	495	150.98	coal	
	498	151.89	out of coal	
10/19/12				
8:28	500	152.50	silty sandstone, hard, med grey	slower drilling/harder rock
8:42	505	154.03	coaly mudstone	
	510	155.55	siltstone, med soft, med grey	flow rate +/-30 US gpm
9:18	515	157.08	as above	
	520	158.60	sandy siltstone, med grey, med soft	about 50/50 sand and silt
	525	160.13	as above	as above
	530	161.65	as above	as above
10:38	535	163.18	as above	as above
	540	164.70	silty sandstone, med hard, med grey	
	546	166.53	as above	
	550	167.75	muddy siltstone, med soft, grey-brown	white veining
	555	169.28	muddy siltstone, dark grey-brown	
11:49				GW flow rate +/- 18 gpm
12:11	560	170.80	siltstone/mudstone, tr to some coal, md soft, dk gy	
	565	172.33	as above	
	570	173.85	as above	
	575	175.38	as above, slightly less coal	
	580	176.90	sandy siltstone, med grey, med hard	about 30-40% sand
	585	178.43	silty sandstone , med grey, med hard	
	590	179.95	as above	easier drilling
	593	180.87	coaly mudstone	
13:55	595	181.48	coal / coaly mudstone	
	600	183.00	coal, black	
	605	184.53	coal / coaly mudstone, brownish-black	end of coal at 606
	610	186.05	muddy siltstone, med soft, med grey	
	615	187.58	as above	
	620	189.10	coal, and interbeds of silty mudstone	coal seam 619 - 621
	625	190.63	coal	coal 625-626, then rock again
15:35	630	192.15	muddy siltstone, med hard, grey-brown	
	635	193.68	as above	minor white veining
	640	195.20	as above	
	645	196.73	as above	
	648	197.64	coaly siltsone	
	650	198.25	coaly siltstone	
	652	198.86	coal	
16:45	655	199.78	coal, black, light in weight	
17:18	660	201.30	muddy siltstone	
	665	202.83	silty mudstone	poss water-bearing fracture at 665
	670	204.35	muddy siltstone, med hard	
18:17	675	205.88	as above	flow rate +/- 25 gpm
				driller thinks borehole is inclination has changed
				to shallower angle
23/10/2012				air on
17:45	680	207.40	coaly mudstone, blk, poss sli silt	small cuttings, mod drilling - about 2min/ft
	685	208.93	as above	
	690	210.45	as above	
	695	211.98	coal, coaly mudstone	start drlg 17:15 using reverse circ air tricone
	703	214.42	coal	
	705	215.03	coal	faster drilling, poor returns
	710	216.55	coal / coaly mudstone	
	715	218.08	coaly mudstone / hard coal	v poor returns
	718	218.99	coal	
	720	219.60	as above	
18:15	725	221.13	sandstone, gray, hard, fn grn, "S&P"	slow drilling, small cuttings
24/10/2012	730	222.65	as above, fn to vfn grn, dk grey	slow drilling
	735	224.18	sandstone,dk gy, vfn, poss trace silt	
	740	225.70	sandstone, fn gn, hard, "S&P"	slow drilling, larger cuttings
	745	227.23	as above	
	750	228.75	sandstone, vfn gn, dk gry, poss silty	
	755	230.28	as above	
	760	231.80	silty sandstone, vfn to fn gn, dk dry	
	765	233.33	as above	
	770	234.85	as above	
11:10	775	236.38	as above	
	780	237.90	sandstone, gray, hard, few pieces tan frac fill	
13:05	785	239.43	as above	
	790	240.95	as above	
14:00:00	795	242.48	as above	
14:50	800	244.00	sandstone, gray, vfn to fn, "S & P" poss slightly silty	
	805	245.53	as above	
	810	247.05	as above	
15:45	815	248.58	as above	

	816	248.88	coal	poss incr gw flow, brief rough drilling, poss fault?
	820	250.10	coal	
16:00	825	251.63	coal with coaly mudstone	vfn cuttings, faster drilling
	830	253.15	no sample, coal	
	835	254.68	coal/coaly mudstone	
	837	255.29	out of coal	slower drilling
	840	256.20	coaly mudstone, incr coal	v fn cuttings
	842	256.81	coal	
	844	257.42	out of coal	slower drilling
17:00	845	257.73	sandstone, grey, v hard, trace whit frac fill	v slow drilling
17:35	850	259.25	silty sandstone, gray to dk gray, hard, some whit frac fill	slow drilling, fn cuttings, v porr returns
	855	260.78	silty ss, dk gray to black, fn grn, hard	
25/10/2012				
9:00				GW flow +/- 5 gal in 6-7 sec, +/- 43 gpm
	860	262.30	silty sandstone, dk gy to blk, ft S&P, fn grn	fine cuttings, poor returns
	865	263.83	as above, poss less silt	
	870	265.35		
	875	266.88	ssandstone, dk gy to blk, ft S&P, fn grn	larger cuttings
	880	268.40	as above, fn to vfn grn	v slow drilling
	885	269.93	as above	
	890	271.45	as above, lighter gray	
	895	272.98	as above, few pieces white fracture fill	
13:40	900	274.50	as above	poss slightly faster drilling
	905	276.03	as above	more returns, better samples
	910	277.55	sandstone, dk to med gray, fn grn, S&P, poss sli silty	
	915	279.08	as above, poss sli silty	
	920	280.60	as above, fn to vfn grn	gw flow +/- 5 gal in 7 sec, +/- 43 gpm
	925	282.13	as above	
	930	283.65	as above	finer cuttings
17:05	935	285.18	as above	
17:45	940	286.70	as above	
18:05	945	288.23	as above	
	950	289.75	as above	
	955	291.28	as above, finer grn, poss silty, lighter gray	
	960	292.80	as above	
	965	294.33	as above	
	970	295.85	as above, few pieces gray frac fill	
26/10/2012				DTW +/- 18 m bgs at 59 deg dip
	975	297.38	as above, fn to vfn grn	v slow drilling
	980	298.90	as above	poss sli faster drilling
	985	300.43	as above, sli darker gray	
	990	301.95	silty sandstone, dk gray, hard, vfn grn	larger cuttings
	995	303.48	sandstone, dk gray	finer cuttings
	1000	305.00	as above	
			END OF HOLE	
27/10/2012				DTW 18.30 m bgs

2012 BOREHOLE LOG

Boring or Well No.: MW12-1D	**Drilling Contrator: JR Waterwell Drilling, Cranbrook, BC**
Project: Bingay	**Drilling Equipment: Dual air rotary, reverse circulation**
Location: Elkford, BC 0644405N, 5562369E	**Prepared By: Daniel Watterson**
Elevation: 1403m	**Borehole Complete: 10/4/12**
Borehole Start: 10/2/12	

Time	Depth (ft)	Depth (m)	Sample Description	Comments
15:30	0	0.00	Silty gravelly sand/sandy silt, brn, dry, poorly sorted, incr	
			cobbles with depth, dense	
16:00	10	3.05	as above	
	13	3.97	gravelly sand with cobbles, gray, losse, moist, sd fn	
			mod sorted	
	15	4.58		softer drilling
16:12	16	4.88	clay, soft, damp to wet, dk gy to blk	
16:40	20	6.10	incr moisture with depth	fast drlg, no returns
	22	6.71	silt, dk gray to black, firm, moist, scat pebbles	
	23	7.02	bedrock, dry, abnt silt, possibly silty clay with abnt cobbles	
16:50	27	8.24	sandstone, hard, dk gray, possibly muddy	set casing at 27 ft
17:30	34	10.37		
	38	11.59	silty sand/sandy silt, moist fim	
	40	12.20	siltstone, dk gy	trace groundwater
	45	13.73	as above	harder drilling
	48	14.64		6-in fracture, bit dropped, enc gw
18:15	60	18.30	coaly silt, dk gy, soft	fast drilling
03/10/2012				DTW 39 ft bgs
8:30	65	19.83	coaly siltstone, soft, dk gy	approx gw flow +/- 2 gpm
				fast drilling
	82	25.01	coaly siltstone, soft, dk gy	
10:20	100	30.50	as above, poss trace vfn sand	
10:40	120	36.60	as above	
	157	47.89	as above, poss incr vfn sand	GW prod +/- 6 gpm
11:40	170	51.85	sandy siltstone/silty sandstone, dk gw to gray, harder	sli slower drilling
			poss incr sand, wt frac fill, poss grading to gy-brn	
			as above, trace coal	
12:00	180	54.90	silty sandstone, dk gry, harder	
	190	57.95	as above, incr wt frac fill	faster drilling
	240	73.20	sandy siltstone, dk to med gray, less coal	
13:50	260	79.30	as above	
14:15	280	85.40	as above	GW prod +/- 6 gpm
	300	91.50	as above	faster drilling
15:20	320	97.60	as above	
15:55	340	103.70	as above	
16:10	353	107.67	as above	
			Hole total depth	
04/10/2012				
7:45				Well development - air lift for approx 1 hr
				DTW +/- 25.67 m btoc
				install 40 ft 4-in pvc screen, remainder 4-in bpc blank
				set packer at 30 ft bfs, install 2 bags coated bentonite
				chips, hydrated with 10 gals water
				bentonite to 12 ft bgs
05/10/2012				DTW 15.60 m bgs

2012 BOREHOLE LOG

Boring or Well No.:MW12-2D	**Drilling Contrator: JR Waterwell Drilling, Cranbrook, BC**
Project: Bingay	**Drilling Equipment: Dual air rotary, reverse circulation**
Location: Elkford, BC 0644456 N, 5562790E	**Prepared By: Daniel Watterson**
Elevation: 1395 m	**Borehole Complete: 10/5/12**
Borehole Start: 10/4/12	

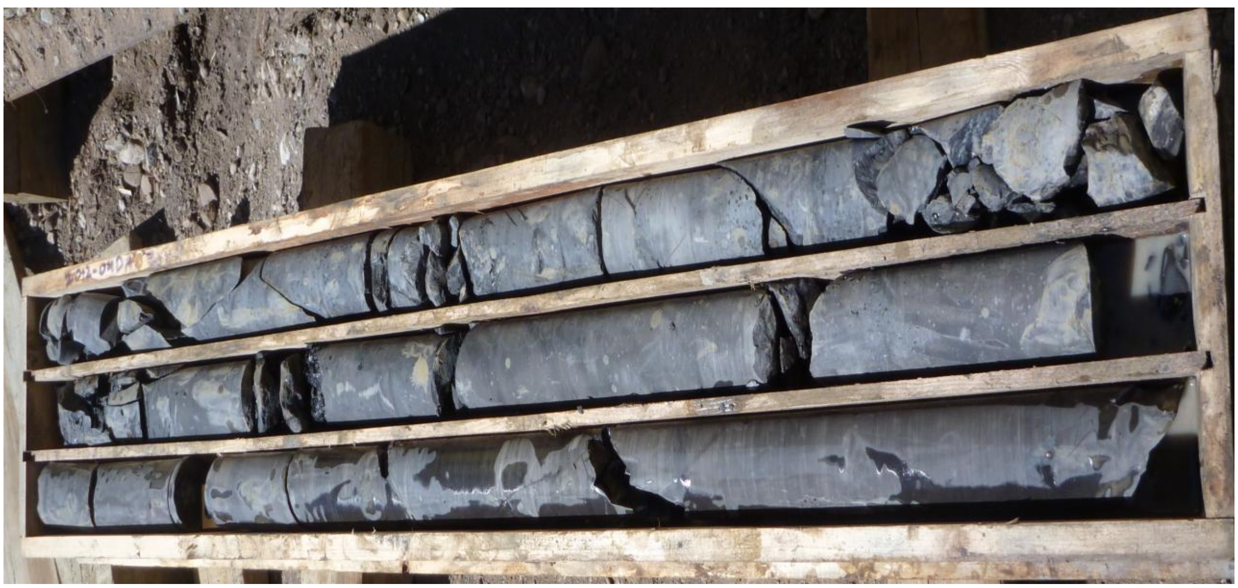
Time	Depth (m)	Depth (ft)	Sample Description	Comments
15:00	0	0.00	topsoil, silty sand w/ abnt cobbles silty sand with gravel, dry to v sli damp, loose	
15:45	16	4.88	silty mudstone, dry, dark to med gray, mod hard	
	20	6.10	darker gray with depth	set surface casing
16:48	36	10.98	coal, approx 1' seam	trace perched gw above coal
	40	12.20	siltstone w/ vfn sd, mod hard, med gray, poss coaly, dry	softer drilling
17:25	60	18.30	silty sandstone, gray to dark gray, dry, hard	harder drilling
	70	21.35	as above	
17:50	80	24.40	as above, possibly coaly	
18:05	100	30.50	coaly siltstone? Dk gray, soft, dry	fine cutrtings, faster drilling
15/10/2012				
7:30				GW flow < 1/4 gpm
8:15	120	36.60	coaly siltstone w/ vfn sand, dk gray, mod hard, dry to sli damp, incr coal compared to above	less dust
8:40	140	42.70	as above, damp to dry	
	160	48.80	as above, incr coaly	sli incr gw
9:20	175	53.38	coal	sli incr water prod
	180	54.90	no sample, possibly grading to silty coal	no returns, hole plugging, v sli water produced
				stopped drilling to rig water injection
11:00	195	59.48	poss silty coal	retart drlg, inj +/- 2 gpm, fast drilling
11:30	205	62.53	coaly siltstone, dk gray, decr coal with depth	poor returns
	213	64.97	possibly v fn sand	rough drilling
11:55	220	67.10	silty sandstone, md gray, less coal	slower drilling
12:30	240	73.20	silty sandstone, med gray, mod hard	faster drilling, poss sli increased gw flow, +/- 1 gpm
	270	82.35	poss increased coal with depth	
13:30	280	85.40	as above	slower drilling
	295	89.98	as above	faster drilling
	300	91.50	siltstone, poss trace vfn sand, dk to md gray, hard	slower drilling
	320	97.60	as above	
14:55	340	103.70	silt/mudstone, dk gray, mod hard, no disc grains, smooth, concodial chips, poss cherty	
	350	106.75	poss increasing coal with depth	
	355	108.28	hole total depth	Gw flow < 0.5 gpm
				Install 20 ft 4-in pvc screen, blank 4-in pvc casing
06/10/2012			DTW 15.65 BTOC	to surface
				Set packer at +/- 25 ft bgs
				Installed 2 bags coated bentonite chips
				hydrated with 10 gals water
				Top of bentonite +/- 12 ft bgs

2012-04Da Core Box Photos:

PIC 1: Box 1

Pic 2: Box 2

Pic 3: Box 3



Pic 4: Box 4

Pic 5: Box 5

Pic 6: Box 6

Pic 7: Box 7

Pic 8: Box 8 (No.10 Coal Seam)

Pic 9: Box 9 (No.10 Coal Seam)


Pic 10: Box 10 (No.10R Core Seam)

Pic 11: Box 11


Pic 12: Box 12


Pic 13: Box 13


Pic 14: Box 14 (No.8 Coal Seam)


Pic 15: Box 15


Pic 16: Box 16

Pic 17: Box 17

Pic 18: Box 18

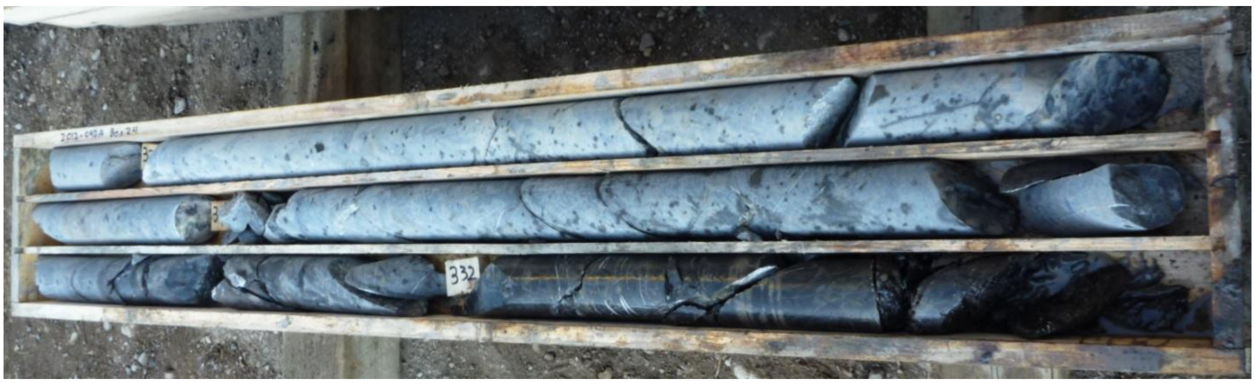
Pic 19: Box 19

Pic 20: Box 20 (No.7 Coal Seam)

Pic 21: Box 21

Pic 22: Box 22


Pic 23: Box 23


Pic 24: Box 24


Pic 25: Box 25


Pic 26: Box 26


Pic 27: Box 27 (No.5 and No.4 Coal Seam)


Pic 28: Box 28 (No.5 or No.4 Coal Seam)

Pic 30: Box 30

Appendix III

2012 Bingay Main Coal Borehole Geophysical Log

Century WIRELINE SERVICES

GAMMA - CALIPER COMPENSATED DENSITY 2012-01RA

COMPANY	: CENTERMOUNT COAL
WELL	: 2012-01RA
FIELD	: N/A
COUNTRY	: CANADA
PROVINCE	: BRITISH COLUMBIA

OTHER SERVICES:
9067
9058D

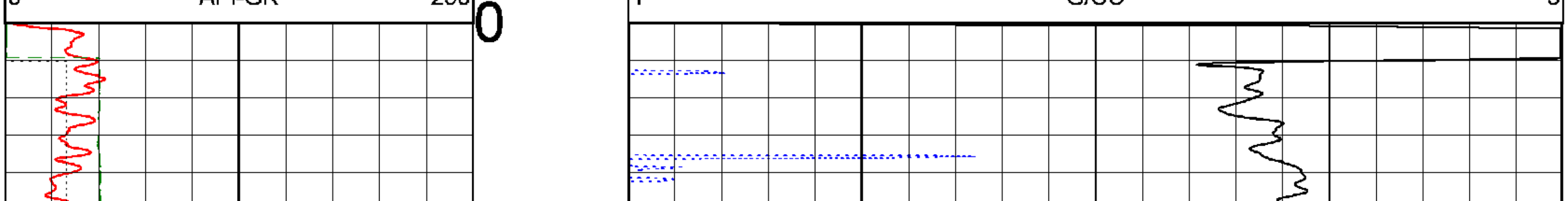
LSD	:		
SECTION	: N/A		
TOWNSHIP	: N/A		
RANGE	: N/A		
LICENSE NO.	: N/A		
UNIQUE WELL ID.	: N/A		
PERMANENT DATUM	: GL	ELEVATION KB	: N/A
LOG MEASURED FROM: GL		ELEVATION DF	: N/A
DRL MEASURED FROM: GL		ELEVATION GL	: N/A
DATE	: 05/28/12	RIG NUMBER	: JR
DEPTH DRILLER	: 350	LOGGER TD	: 308.81
BIT SIZE	: 139.70	ARRIVAL TIME	: 10:00
LOG TOP	: -1.32	DEPARTURE TIME	: 19:00
LOG BOTTOM	: 308.69	CIRC STOPPED	: N/A
CASING LOGGER	: 64		
CASING DRILLER	: 64		
CASING TYPE	: STEEL		
BOREHOLE FLUID	: WATER		
RM TEMPERATURE	: N/A		
MUD RES	: N/A		
MUD WEIGHT	: 1.0		
WITNESSED BY	: RON SWAREN		
RECORDED BY	: E.LINFORD		
REMARKS 1	: 45 DEGREE ANGLE HOLE		
REMARKS 2	: DENSITY TOOL BRIDGED AT 308M		

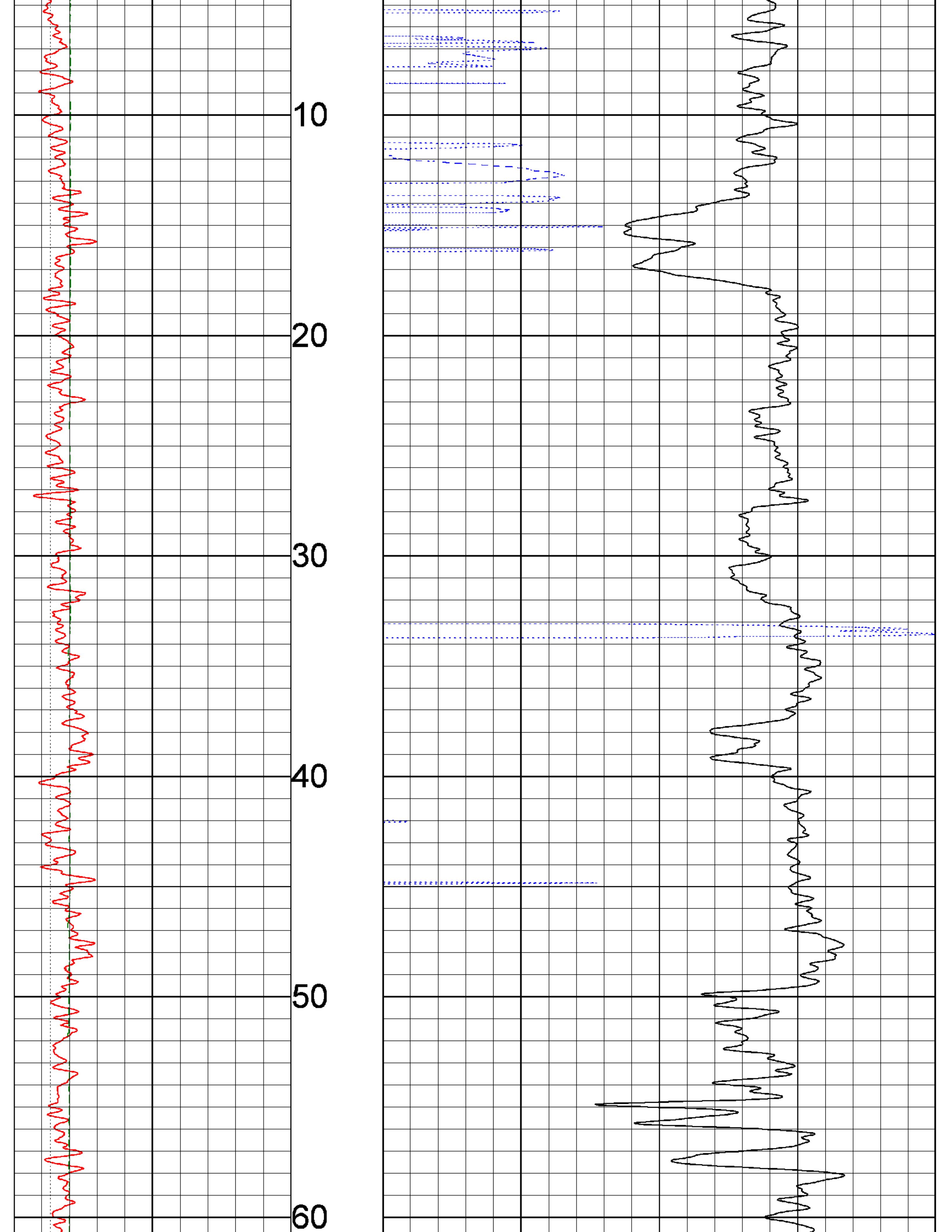
1:200 DENSITY 2012-01RA 05/28/12

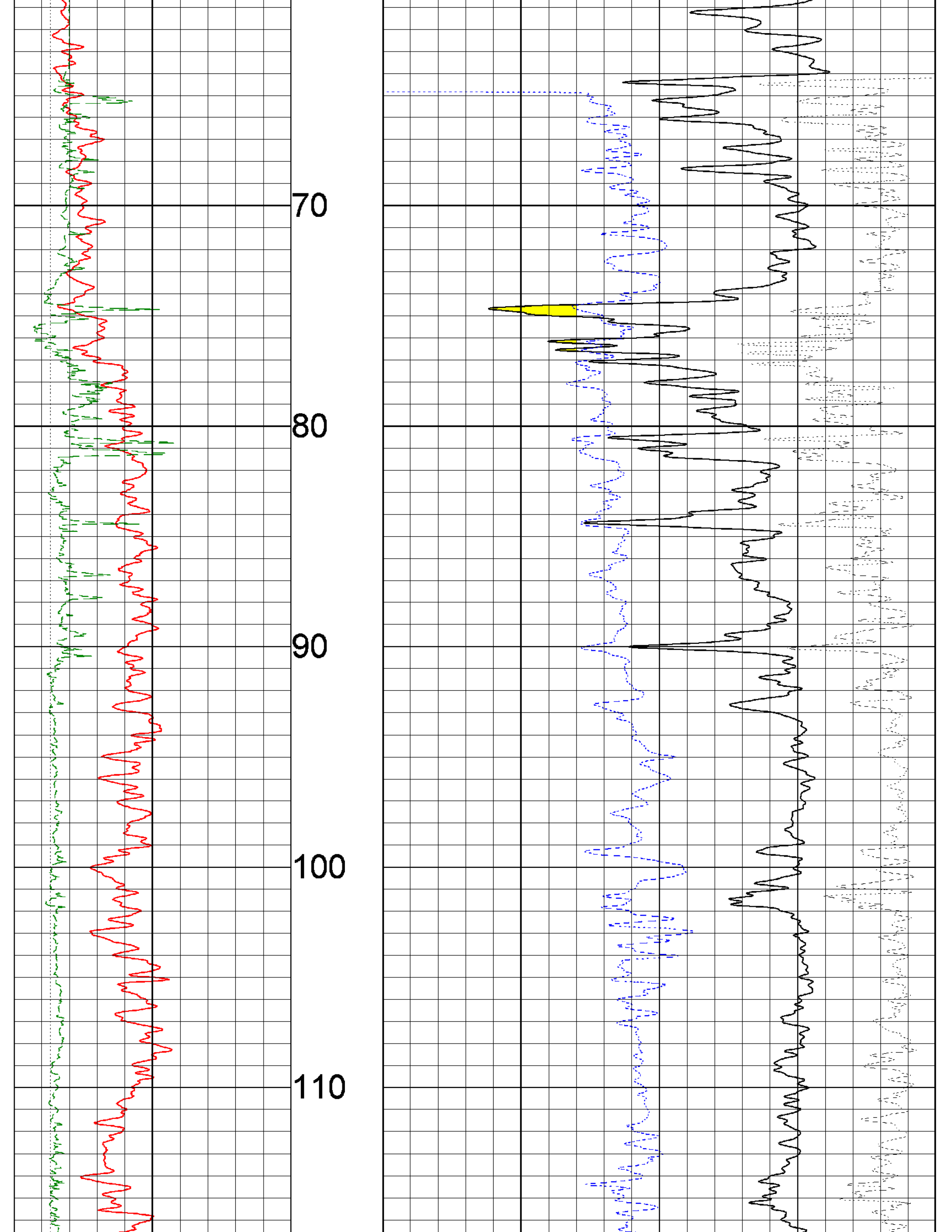
LOG PARAMETERS

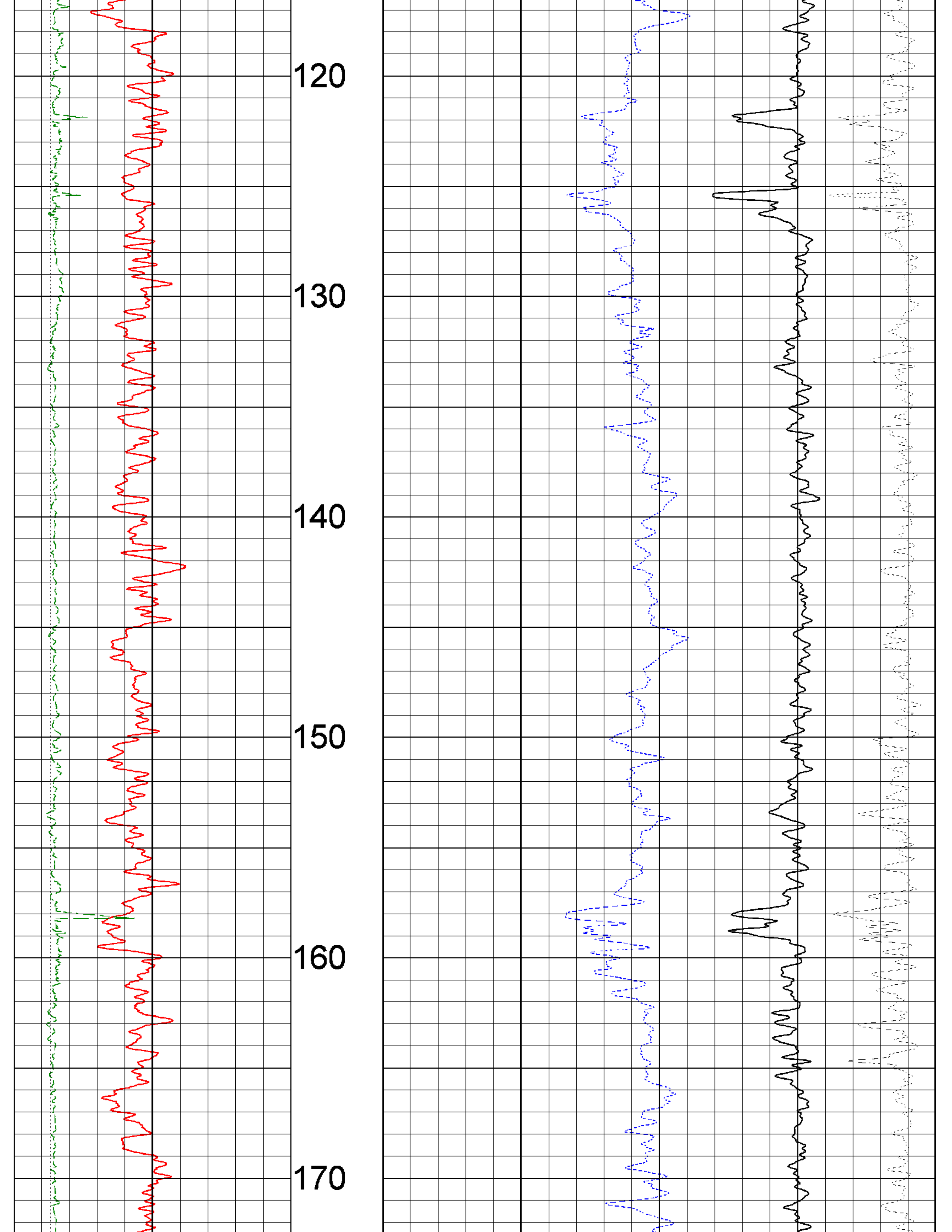
MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.2 ELECT. CUTOFF : 99000 BIT SIZE : 139.70
PRESENTATION NAME/DATE = 9239C1-TECK-GH_DENSITY.0 06/22/2011 VERSION = 3.64KC

BIT SIZE 100 MM 400	METERS		COMP 0.45 G/CC -0.05
CALIPERL 100 MM 400		RES(SG) 4 OHM-M 40000	
GAMMA 0 API-GR 250		DEN(CDL) 1 G/CC 3	

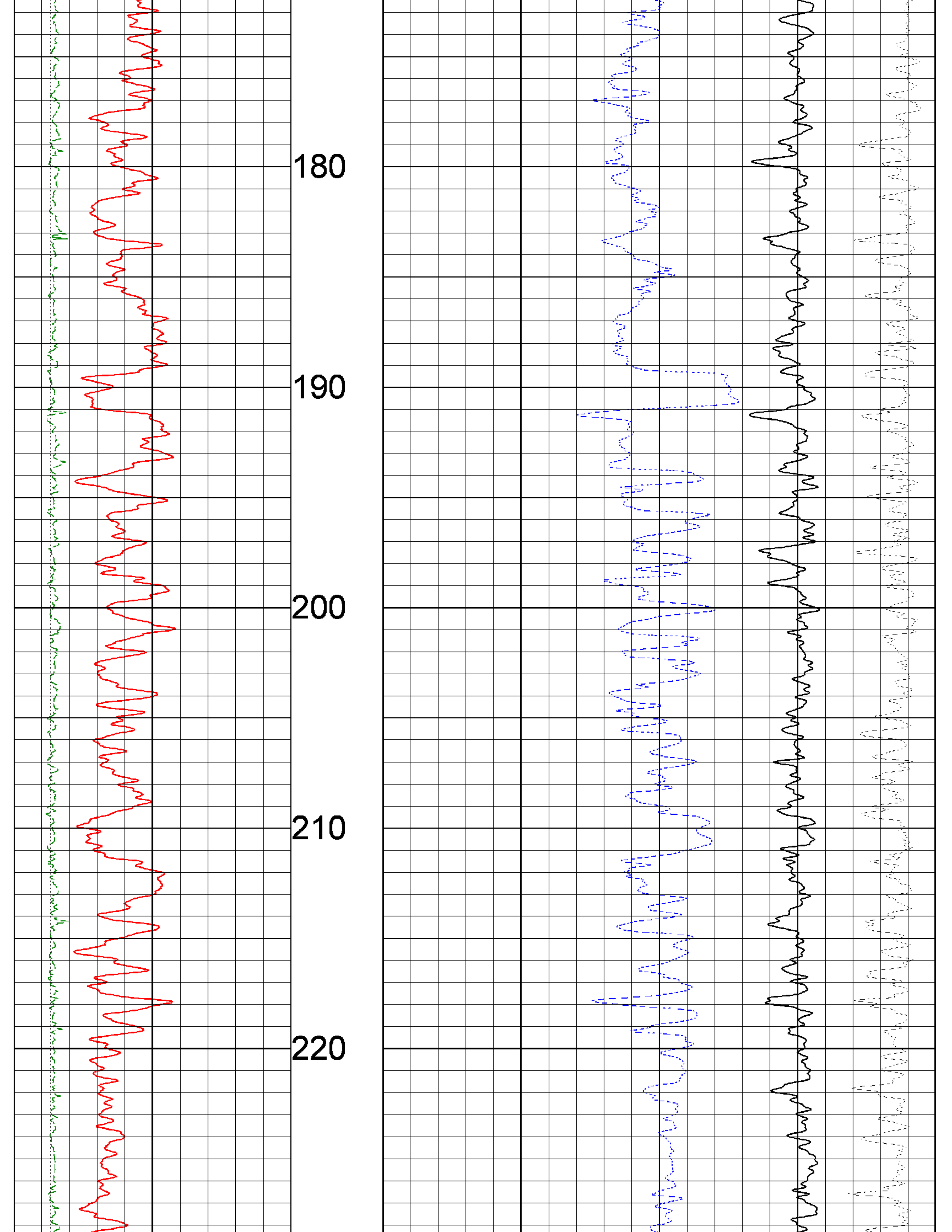


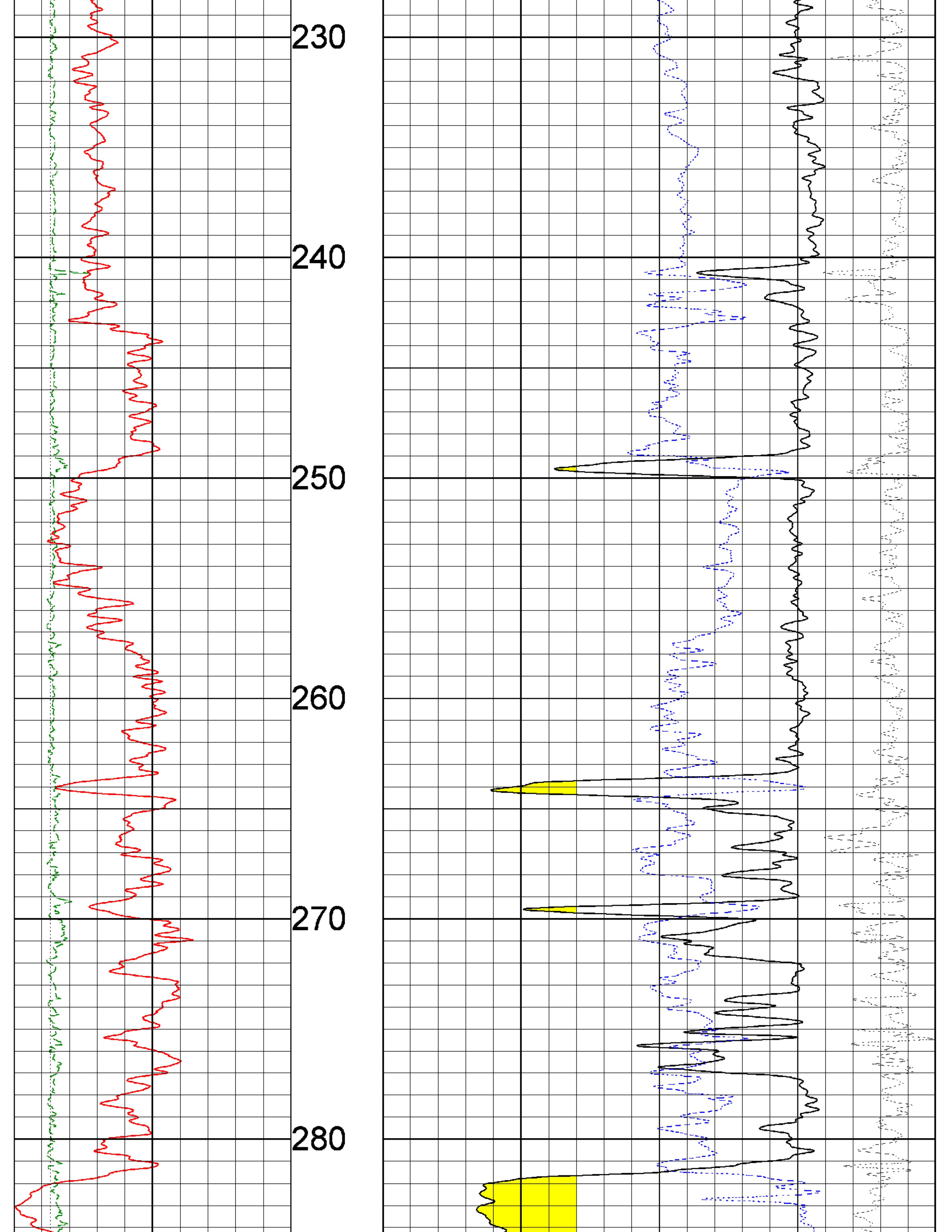

10
20
30
40
50
60


70
80
90
100
110

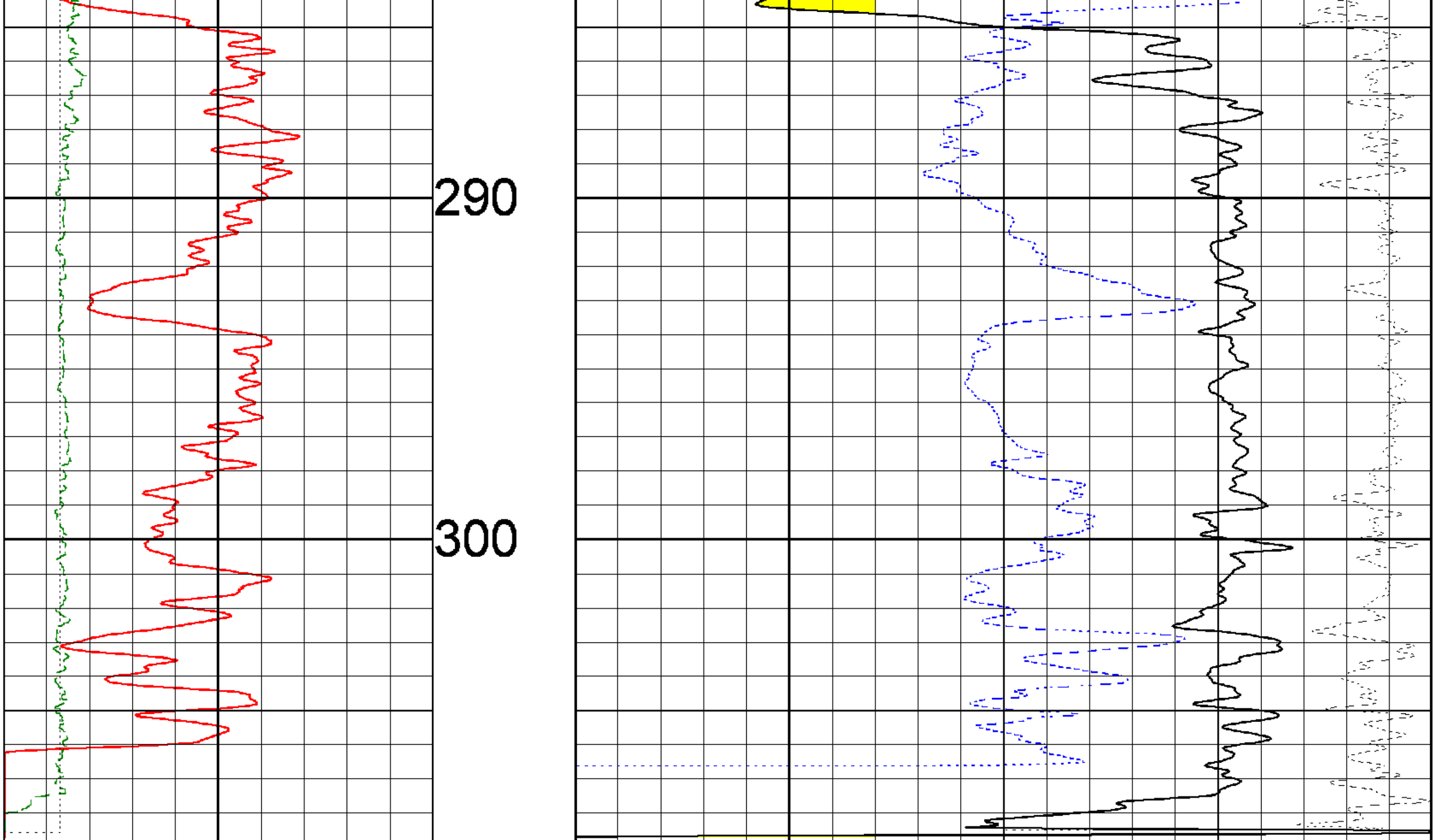


120
130
140
150
160
170


180
190
200
210
220



230
240
250
260
270
280



0 API-GR 250		1 G/CC 3	
GAMMA		DEN(CDL)	
100 MM 400		4 OHM-M 40000	
CALIPERL		RES(SG)	
100 MM 400			0.45 G/CC -0.05
BIT SIZE	METERS		COMP

1:200 DENSITY 2012-01RA 05/28/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177

MAGNETIC DECL : 15.2 ELECT. CUTOFF : 99000 BIT SIZE : 139.70

PRESENTATION NAME/DATE = 9239C1-TECK-GH_DENSITY.0 06/22/2011 VERSION = 3.64KC

TOOL CALIBRATION 2012-01RA 05/28/12 06:17
TOOL 9239C1 TM VERSION 2023
SERIAL NUMBER 2404

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	May15,12	13:26:56	GAMMA	0.000	[API-GR]	4.000	[CPS]
	May15,12	13:26:56	GAMMA	545.000	[API-GR]	635.000	[CPS]
2	May15,12	13:38:23	VOLTAGE	26.000	[MV]	6777.000	[CPS]
	May15,12	13:38:23	VOLTAGE	228.200	[MV]	34015.000	[CPS]
3	Jul22,10	12:13:09	CALIPER	76.000	[INCH]	112020.000	[CPS]
	Jul22,10	12:13:09	CALIPER	178.000	[INCH]	339526.000	[CPS]
4	May15,12	14:03:39	DEN(LS)	1.620	[G/CC]	13852.000	[CPS]

	May15,12	14:03:39	DEN(LS)	2.612	[G/CC]	1895.000	[CPS]
5	May15,12	14:03:57	DEN(SS)	1.590	[G/CC]	45734.000	[CPS]
	May15,12	14:03:57	DEN(SS)	2.580	[G/CC]	18052.000	[CPS]
6	May15,12	13:45:26	CALIPERL	100.000	[INCH]	238544.000	[CPS]
	May15,12	13:45:26	CALIPERL	200.000	[INCH]	341169.000	[CPS]
7	May15,12	13:38:58	CURRENT	26.000	[UA]	2954.000	[CPS]
	May15,12	13:38:58	CURRENT	228.200	[UA]	19904.000	[CPS]
8	Jun15,10	07:54:27	F	Default	[CPS]		
9	Jun15,10	07:54:27	X	Default	[CPS]		

Century WIRELINE SERVICES

COMPENSATED DENSITY GAMMA-CALIPER-RES 2012-02RA

COMPANY	:CENTERMOUNT COAL
WELL	:2012-02RA
FIELD	:N/A
COUNTRY	:CANADA
PROVINCE	:BRITISH COLUMBIA
LSD	:N/A
SECTION	:N/A
TOWNSHIP	:N/A
RANGE	:N/A
LICENSE NO.	:N/A
UNIQUE WELL ID.	:N/A

OTHER SERVICES:
DIP
NEU

PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:06/11/12	RIG NUMBER	:AK 24
DEPTH DRILLER	:426.80	LOGGER TD	:242.75
BIT SIZE	:133.35	ARRIVAL TIME	:12:00
LOG TOP	:0.00	DEPARTURE TIME	:22:00
LOG BOTTOM	:242.51	CIRC STOPPED	:N/A
CASING LOGGER	:70.40		
CASING DRILLER	:72.85		
CASING TYPE	:SURFACE		
BOREHOLE FLUID	:WATER		
RM TEMPERATURE	:N/A		
MUD RES	:N/A		
MUD WEIGHT	:1.00		
WITNESSED BY	:R. SWAREN		
RECORDED BY	:M. LEBEDA		
REMARKS 1	:BRIDGED @ 242.75M		
REMARKS 2	:AZIMUTH: 137, INCLINATION 40		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

GAMMA DENSITY 1:200 2012-02RA 06/11/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.50 ELECT. CUTOFF : 99999 BIT SIZE : 133.35
PRESENTATION NAME/DATE = BULK DENSITY_CMC.0 06/11/2012 VERSION = 3.64KF

GAMMA DENSITY 1:200 2012-02RA 06/11/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.50 ELECT. CUTOFF : 99999 BIT SIZE : 133.35
PRESENTATION NAME/DATE = BULK DENSITY_CMC.0 06/11/2012 VERSION = 3.64KF

TOOL CALIBRATION 2012-02RA 06/11/12 19:48
TOOL 9239C1 TM VERSION 2025
SERIAL NUMBER 2404

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun02,12	16:01:05	GAMMA	0.000	[API-GR]	4.000	[CPS]
	Jun02,12	16:01:05	GAMMA	545.000	[API-GR]	635.000	[CPS]
2	Jun02,12	16:20:27	VOLTAGE	23.000	[MV]	6860.000	[CPS]
	Jun02,12	16:20:27	VOLTAGE	225.000	[MV]	34055.000	[CPS]
3	Jun02,12	16:00:49	CALIPER	Default	[CPS]	Default	[CPS]
	Jun02,12	16:00:49	CALIPER	Default	[CPS]	Default	[CPS]
4	Jun02,12	16:01:58	DEN(LS)	1.620	[G/CC]	13852.000	[CPS]
	Jun02,12	16:01:58	DEN(LS)	2.612	[G/CC]	1895.000	[CPS]
5	Jun02,12	16:02:26	DEN(SS)	1.590	[G/CC]	45738.000	[CPS]
	Jun02,12	16:02:26	DEN(SS)	2.580	[G/CC]	18052.000	[CPS]
6	Jun02,12	16:10:07	CALIPERL	100.000	[MM]	241070.000	[CPS]
	Jun02,12	16:10:07	CALIPERL	200.000	[MM]	344109.000	[CPS]
7	Jun02,12	16:20:44	CURRENT	23.000	[UA]	2925.000	[CPS]
	Jun02,12	16:20:44	CURRENT	225.000	[UA]	18770.000	[CPS]
8	Jun02,12	16:00:49	F	Default	[CPS]		

Century Wireline Services

GAMMA-DENSITY (CPS)
LOG THRU DRILL PIPE
2012-04DA

COMPANY	: CENTERMOUNT COAL		
WELL	: 2012-04DA		
FIELD	: N/A		
COUNTRY	: CANADA		
PROVINCE	: BRITISH COLUMBIA		
LSD	: N/A		
SECTION	: N/A		
TOWNSHIP	: N/A		
RANGE	: N/A		
LICENSE NO.	: N/A		
UNIQUE WELL ID.	: N/A		
PERMANENT DATUM	: GL	ELEVATION KB	: N/A
LOG MEASURED FROM	: GL	ELEVATION DF	: N/A
DRL MEASURED FROM	: GL	ELEVATION GL	: N/A
DATE	: 08/20/12	RIG NUMBER	: FB DRILLING
DEPTH DRILLER	: 125.5	LOGGER TD	: 124.63
BIT SIZE	: 95.25	ARRIVAL TIME	: 13:30
LOG TOP	: -2.78	DEPARTURE TIME	: 18:00
LOG BOTTOM	: 124.63	CIRC STOPPED	: N/A
CASING LOGGER	: 4.6		
CASING DRILLER	: 4.6		
CASING TYPE	: STEEL		
BOREHOLE FLUID	: WATER		
RM TEMPERATURE	: N/A		
MUD RES	: N/A		
MUD WEIGHT	: 1.0		
WITNESSED BY	: MIMI		
RECORDED BY	: E. LINFORD		
REMARKS 1	: 50 DEGREE ANGLE HOLE		
REMARKS 2	: DIPMETER BECAME STUCK AT ~ 75M		

OTHER SERVICES:
9058
9411

1:200 SLIM DENSITY 2012-04DA 08/20/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.2 ELECT. CUTOFF : 99000 BIT SIZE : 95.25
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/2IVERSION = 3.64KC

1:200 SLIM DENSITY 2012-04DA 08/20/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.2 ELECT. CUTOFF : 99000 BIT SIZE : 95.25
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/2IVERSION = 3.64KC

TOOL CALIBRATION 2012-04DA 08/20/12 15:13
TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun01,12	14:18:24	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Jun01,12	14:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

Century WIRELINE SERVICES

GAMMA-DENSITY (CPS)
LOG THRU DRILL PIPE
2012-05DA

COMPANY	:CENTERMOUNT COAL	OTHER SERVICES:	
WELL	:2012-05DA	DEN	
FIELD	:N/A	DEV	
COUNTRY	:CANADA		
PROVINCE	:BRITISH COLUMBIA		
LSD	:N/A		
SECTION	:N/A		
TOWNSHIP	:N/A		
RANGE	:N/A		
LICENSE NO.	:N/A		
UNIQUE WELL ID.	:N/A		
PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:08/28/12	RIG NUMBER	:BD
DEPTH DRILLER	:218.90	LOGGER TD	:218.30
BIT SIZE	:96.00	ARRIVAL TIME	:08:30
LOG TOP	:0.00	DEPARTURE TIME	:16:00
LOG BOTTOM	:217.92	CIRC STOPPED	:N/A
CASING LOGGER	:N/A		
CASING DRILLER	:2.21		
CASING TYPE	:SURFACE		
BOREHOLE FLUID	:WATER		
RM TEMPERATURE	:N/A		
MUD RES	:N/A		
MUD WEIGHT	:1.00		
WITNESSED BY	:R. SWAREN		
RECORDED BY	:M. LEBEDA		
REMARKS 1	:AZIMUTH: 200, ANGLE: 39		
REMARKS 2	:PIPE SET @ 218.0M		

GAMMA DENSITY TP 1:200 2012-05DA 08/28/12

LOG PARAMETERS

MATRIX DENSITY : 2.65	NEUTRON MATRIX : SANDSTONE	MATRIX DELTA T : 177
MAGNETIC DECL : 15.50	ELECT. CUTOFF : 99999	BIT SIZE : 96.00
PRESENTATION NAME/DATE = 9068A.0 08/28/2012		VERSION = 3.64KF

GAMMA DENSITY TP 1:200 2012-05DA 08/28/12

LOG PARAMETERS

MATRIX DENSITY : 2.65	NEUTRON MATRIX : SANDSTONE	MATRIX DELTA T : 177
MAGNETIC DECL : 15.50	ELECT. CUTOFF : 99999	BIT SIZE : 96.00
PRESENTATION NAME/DATE = 9068A.0 08/28/2012		VERSION = 3.64KF

TOOL CALIBRATION 2012-05DA 08/28/12 11:34
TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun01,12	13:18:24	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Jun01,12	13:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

Century WIRELINE SERVICES

GAMMA-DENSITY (CPS) LOG THRU DRILL PIPE 2012-06DA

COMPANY	: CENTERMOUNT COAL
WELL	: 2012-06DA
FIELD	:
COUNTRY	: CANADA
PROVINCE	: BRITISH COLUMBIA
LSD	:
SECTION	: N/A
TOWNSHIP	: N/A
RANGE	: N/A
LICENSE NO.	: N/A
UNIQUE WELL ID.	: N/A

OTHER SERVICES:
9058N
9058D

PERMANENT DATUM	: GL	ELEVATION KB	: N/A
LOG MEASURED FROM:	GL	ELEVATION DF	: N/A
DRL MEASURED FROM:	GL	ELEVATION GL	: N/A
DATE	: 09/07/12	RIG NUMBER	: FB DRILLING
DEPTH DRILLER	: 299.3	LOGGER TD	: 297.19
BIT SIZE	: 95	ARRIVAL TIME	: 11:00
LOG TOP	: -2.28	DEPARTURE TIME:	18:30
LOG BOTTOM	: 297.19	CIRC STOPPED	: N/A
CASING LOGGER	: 21.3		
CASING DRILLER	: 21.3		
CASING TYPE	: STEEL		
BOREHOLE FLUID	: WATER		
RM TEMPERATURE	: N/A		
MUD RES	: N/A		
MUD WEIGHT	: 1.0		
WITNESSED BY	: FB DRILLING		
RECORDED BY	: E.LINFORD		
REMARKS 1	: 50 DEGREE ANGLE HOLE		
REMARKS 2	: HOLE BRIDGED AT ~ 35 M		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

1:200 SLIM DENSITY THRU PIPE 2012-06DA 09/07/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 95
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/2:VERSION = 3.64KC

1:200 SLIM DENSITY THRU PIPE 2012-06DA 09/07/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 95
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/2:VERSION = 3.64KC

TOOL CALIBRATION 2012-06DA 09/07/12 14:03
TOOL 9068A TM VERSION 1
SERIAL NUMBER 640

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Dec12,11	18:47:30	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Dec12,11	18:47:30	GAMMA	545.000	[API-GR]	182.000	[CPS]

Century WIRELINE SERVICES

GAMMA-DENSITY (CPS) LOG THRU DRILL PIPE 2012-07DA

COMPANY	:CENTERMOUNT COAL
WELL	:2012-07DA
FIELD	:
COUNTRY	:CANADA
PROVINCE	:BRITISH COLUMBIA
LSD	:
SECTION	:N/A
TOWNSHIP	:N/A
RANGE	:N/A
LICENSE NO.	:N/A
UNIQUE WELL ID.	:N/A

OTHER SERVICES:
9058
9058D

PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:09/14/12	RIG NUMBER	:FB DRILLING
DEPTH DRILLER	:235.30	LOGGER TD	:235.00
BIT SIZE	:95	ARRIVAL TIME	:11:30
LOG TOP	:0.00	DEPARTURE TIME	:19:00
LOG BOTTOM	:234.60	CIRC STOPPED	:N/A
CASING LOGGER	:41.14		
CASING DRILLER	:41.14		
CASING TYPE	:STEEL		
BOREHOLE FLUID	:WATER		
RM TEMPERATURE	:N/A		
MUD RES	:N/A		
MUD WEIGHT	:1.0		
WITNESSED BY	:FB DRILLING		
RECORDED BY	:B.HILL		
REMARKS 1	:50 DEGREE ANGLE HOLE		
REMARKS 2	:		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

GAMMA DENSITY TP 1:100 2012-07DA 09/14/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 95
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/29/2011VERSION = 3.64KF

GAMMA DENSITY TP 1:100 2012-07DA 09/14/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 95
PRESENTATION NAME/DATE = 9068A-CENTERMOUNT_SLIM-DENSITY.0 09/29/2011VERSION = 3.64KF

TOOL CALIBRATION 2012-07DA 09/14/12 13:16
TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun01,12	13:18:24	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Jun01,12	13:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

GAMMA - DENSITY (THROUGH RODS) 2012-08DA

Century WIRELINE SERVICES

COMPANY	:CENTERMOUNT COAL	OTHER SERVICES:	9058, 9058D
WELL	:2012-08DA		
FIELD	:		
COUNTRY	:CANADA		
PROVINCE	:BRITISH COLUMBIA		
LSD	:		
SECTION	:N/A		
TOWNSHIP	:N/A		
RANGE	:N/A		
LICENSE NO.	:N/A		
UNIQUE WELL ID.	:N/A		
PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:09/17/12	RIG NUMBER	:FB DRILLING
DEPTH DRILLER	:87.78	LOGGER TD	:75.45
BIT SIZE	:95	ARRIVAL TIME	:16:30
LOG TOP	:0.00	DEPARTURE TIME	:19:30
LOG BOTTOM	:75.06	CIRC STOPPED	:N/A
CASING LOGGER	:29.90		
CASING DRILLER	:25.90		
CASING TYPE	:STEEL		
BOREHOLE FLUID	:WATER		
RM TEMPERATURE	:N/A		
MUD RES	:N/A		
MUD WEIGHT	:1.0		
WITNESSED BY	:FB DRILLING		
RECORDED BY	:B.HILL		
REMARKS 1	:47 DEGREE ANGLE HOLE		
REMARKS 2	:310 AZMUTH		

GAMMA DENSITY 1:100 2012-08DA 09/17/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.20 ELECT. CUTOFF : 99000 BIT SIZE 95
PRESENTATION NAME/DATE = 9068A.0 05/06/2011 VERSION = 3.64KF

GAMMA DENSITY 1:100 2012-08DA 09/17/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.20 ELECT. CUTOFF : 99000 BIT SIZE 95
PRESENTATION NAME/DATE = 9068A.0 05/06/2011 VERSION = 3.64KF

TOOL CALIBRATION 2012-08DA 09/17/12 18:07
TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun01,12	13:18:24	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Jun01,12	13:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

Century WIRELINE SERVICES

GAMMA - DENSITY (THROUGH RODS) BH12-1A

OTHER SERVICES:
NEU

COMPANY	:CENTERMOUNT COAL		
WELL	:BH12-1A		
FIELD	:		
COUNTRY	:CANADA		
PROVINCE	:BRITISH COLUMBIA		
LSD	:		
SECTION	:N/A		
TOWNSHIP	:N/A		
RANGE	:N/A		
LICENSE NO.	:N/A		
UNIQUE WELL ID.	:N/A		
PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:10/10/12	RIG NUMBER	:JR DRILLING
DEPTH DRILLER	:279.00	LOGGER TD	:191.89
BIT SIZE	:146.05	ARRIVAL TIME	:17:30
LOG TOP	:0.00	DEPARTURE TIME	:20:00
LOG BOTTOM	:191.50	CIRC STOPPED	:N/A
CASING LOGGER	:22.25		
CASING DRILLER	:22.25		
CASING TYPE	:STEEL		
BOREHOLE FLUID	:WATER		
RM TEMPERATURE	:N/A		
MUD RES	:N/A		
MUD WEIGHT	:1.0		
WITNESSED BY	:JR DRILLING		
RECORDED BY	:B.HILL		
REMARKS 1	:70 DEGREE HOLE		
REMARKS 2	:		

GAMMA DENSITY 1:100 BH12-1A 10/10/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A.0 05/06/2011 VERSION = 3.64KF

GAMMA DENSITY 1:100 BH12-1A 10/10/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 16.2 ELECT. CUTOFF : 99000 BIT SIZE : 146.05
PRESENTATION NAME/DATE = 9068A.0 05/06/2011 VERSION = 3.64KF

TOOL CALIBRATION BH12-1A 10/10/12 20:29
TOOL 9068A TM VERSION 1
SERIAL NUMBER 514

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun01,12	13:18:24	GAMMA	0.000	[API-GR]	1.000	[CPS]
	Jun01,12	13:18:24	GAMMA	545.000	[API-GR]	197.000	[CPS]

COMPENSATED DENSITY
GAMMA - CALIPER
BH-12-3A

Century WIRELINE SERVICES

COMPANY	:CENTERMOUNT COAL	OTHER SERVICES:	
WELL	:BH-12-3A	DIP	
FIELD	:N/A	NEU	
COUNTRY	:CANADA		
PROVINCE	:BRITISH COLUMBIA		
LSD	:N/A		
SECTION	:N/A		
TOWNSHIP	:N/A		
RANGE	:N/A		
LICENSE NO.	:N/A		
UNIQUE WELL ID.	:N/A		
PERMANENT DATUM	:GL	ELEVATION KB	:N/A
LOG MEASURED FROM	:GL	ELEVATION DF	:N/A
DRL MEASURED FROM	:GL	ELEVATION GL	:N/A
DATE	:10/26/12	RIG NUMBER	:OK #24
DEPTH DRILLER	:304.30	LOGGER TD	:304.00
BIT SIZE	:133.35	ARRIVAL TIME	:14:00
LOG TOP	:0.00	DEPARTURE TIME	:20:00
LOG BOTTOM	:303.75	CIRC STOPPED	:N/A
CASING LOGGER	:9.40		
CASING DRILLER	:10.40		
CASING TYPE	:SURFACE		
BOREHOLE FLUID	:WATER		
RM TEMPERATURE	:N/A		
MUD RES	:N/A		
MUD WEIGHT	:1.00		
WITNESSED BY	:B. EDGREN		
RECORDED BY	:M. LEBEDA		
REMARKS 1	:AZIMUTH: 115, SLANT ANGLE: 60		
REMARKS 2	:WATER LEVEL @ 12M.		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

GAMMA DENSITY 1:200 BH-12-3A 10/26/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.20 ELECT. CUTOFF : 99999 BIT SIZE : 133.35
PRESENTATION NAME/DATE = BULK DENSITY_CRM.0 10/22/2012 VERSION = 3.64KG

GAMMA DENSITY 1:200 BH-12-3A 10/26/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.20 ELECT. CUTOFF : 99999 BIT SIZE : 133.35
PRESENTATION NAME/DATE = BULK DENSITY_CRM.0 10/22/2012 VERSION = 3.64KG

TOOL CALIBRATION BH-12-3A 10/26/12 16:53
TOOL 9239C1 TM VERSION 2025
SERIAL NUMBER 2404

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun02,12	16:01:05	GAMMA	0.000	[API-GR]	4.000	[CPS]
	Jun02,12	16:01:05	GAMMA	545.000	[API-GR]	635.000	[CPS]
2	Jun02,12	16:20:27	VOLTAGE	23.000	[MV]	6860.000	[CPS]
	Jun02,12	16:20:27	VOLTAGE	225.000	[MV]	34055.000	[CPS]
3	Jun02,12	16:00:49	CALIPER	Default	[CPS]	Default	[CPS]
	Jun02,12	16:00:49	CALIPER	Default	[CPS]	Default	[CPS]
4	Jun02,12	16:01:58	DEN(LS)	1.620	[G/CC]	13852.000	[CPS]
	Jun02,12	16:01:58	DEN(LS)	2.612	[G/CC]	1895.000	[CPS]
5	Jun02,12	16:02:26	DEN(SS)	1.590	[G/CC]	45738.000	[CPS]
	Jun02,12	16:02:26	DEN(SS)	2.580	[G/CC]	18052.000	[CPS]
6	Jul02,12	19:44:14	CALIPERL	100.000	[MM]	236854.000	[CPS]
	Jul02,12	19:44:14	CALIPERL	200.000	[MM]	339407.000	[CPS]
7	Jun02,12	16:20:44	CURRENT	23.000	[UA]	2925.000	[CPS]
	Jun02,12	16:20:44	CURRENT	225.000	[UA]	18770.000	[CPS]
8	Jun02,12	16:00:49	F	Default	[CPS]		
9	Jun02,12	16:00:49	X	Default	[CPS]		

Century WIRELINE SERVICES

COMPENSATED DENSITY GAMMA - CALIPER NW-12-1D

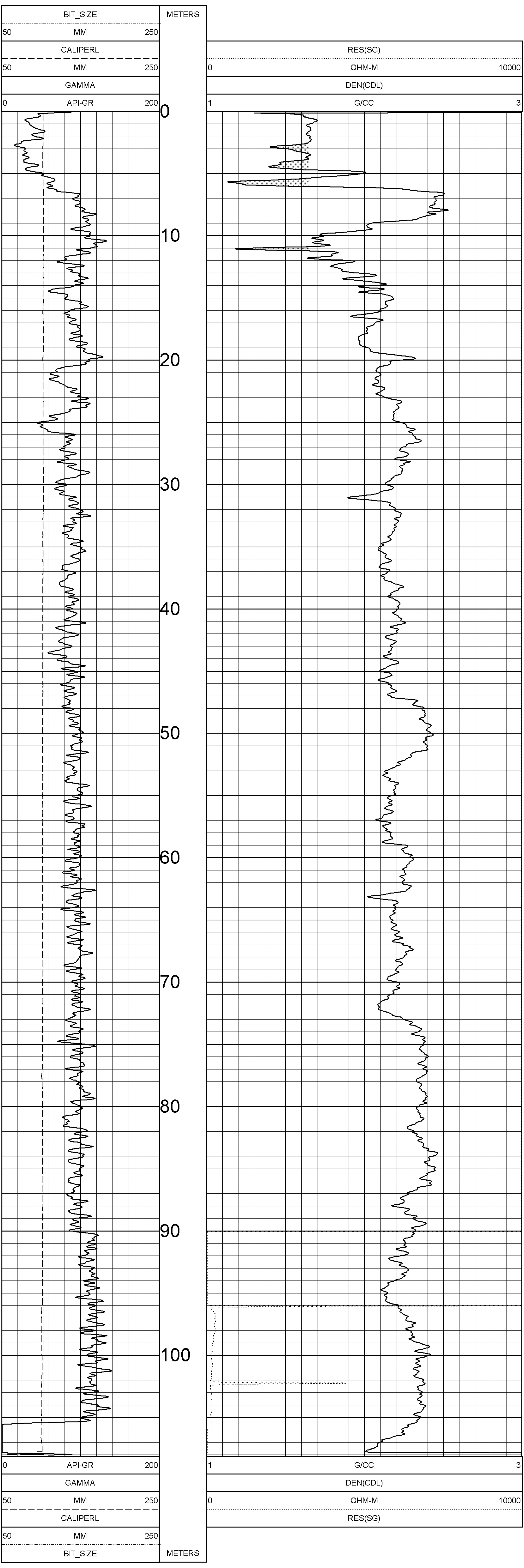
COMPANY	CENTERMOUNT COAL		
WELL	NW-12-1D		
FIELD	N/A		
COUNTRY	CANADA		
PROVINCE	BRITISH COLUMBIA		
LSD	N/A		
SECTION	N/A		
TOWNSHIP	N/A		
RANGE	N/A		
LICENSE NO.	N/A		
UNIQUE WELL ID.	N/A		
PERMANENT DATUM	GL	ELEVATION KB	N/A
LOG MEASURED FROM	GL	ELEVATION DF	N/A
DRL MEASURED FROM	GL	ELEVATION GL	N/A
DATE	10/22/12	RIG NUMBER	OK #24
DEPTH DRILLER	108.20	LOGGER TD	108.30
BIT SIZE	104.00	ARRIVAL TIME	14:00
LOG TOP	0.00	DEPARTURE TIME	15:00
LOG BOTTOM	108.06	CIRC STOPPED	N/A
CASING LOGGER	8.20		
CASING DRILLER	8.20		
CASING TYPE	SURFACE		
BOREHOLE FLUID	WATER		
RM TEMPERATURE	N/A		
MUD RES	N/A		
MUD WEIGHT	1.00		
WITNESSED BY	B. EDGREN		
RECORDED BY	M. LEBEDA		
REMARKS 1	VERTICAL		
REMARKS 2	LOGGED THRU PVC PIPE. DENSITY LOG WILL BE AFFECTED		

OTHER SERVICES:
NEU
DEV

GAMMA DENSITY TP 1:200 NW-12-1D 10/22/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.20 ELECT. CUTOFF : 99999 BIT SIZE : 104.00
PRESENTATION NAME/DATE = BULK DENSITY TP_CRM.0 10/22/2012 VERSION = 3.64KG



GAMMA DENSITY TP 1:200 NW-12-1D 10/22/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 177
MAGNETIC DECL : 15.20 ELECT. CUTOFF : 99999 BIT SIZE : 104.00
PRESENTATION NAME/DATE = BULK DENSITY TP_CRM.0 10/22/2012 VERSION = 3.64KG

TOOL CALIBRATION NW-12-1D 10/22/12 14:22
TOOL 9239C1 TM VERSION 2025
SERIAL NUMBER 2404

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun02,12	16:01:05	GAMMA	0.000	[API-GR]	4.000	[CPS]
	Jun02,12	16:01:05	GAMMA	545.000	[API-GR]	635.000	[CPS]
2	Jun02,12	16:20:27	VOLTAGE	23.000	[MV]	6860.000	[CPS]
	Jun02,12	16:20:27	VOLTAGE	225.000	[MV]	34055.000	[CPS]
3	Jun02,12	16:00:49	CALIPER	Default	[CPS]	Default	[CPS]
	Jun02,12	16:00:49	CALIPER	Default	[CPS]	Default	[CPS]
4	Jun02,12	16:01:58	DEN(LS)	1.620	[G/CC]	13852.000	[CPS]
	Jun02,12	16:01:58	DEN(LS)	2.612	[G/CC]	1895.000	[CPS]
5	Jun02,12	16:02:26	DEN(SS)	1.590	[G/CC]	45738.000	[CPS]
	Jun02,12	16:02:26	DEN(SS)	2.580	[G/CC]	18052.000	[CPS]
6	Jul02,12	19:44:14	CALIPERL	100.000	[MM]	236854.000	[CPS]
	Jul02,12	19:44:14	CALIPERL	200.000	[MM]	339407.000	[CPS]
7	Jun02,12	16:20:44	CURRENT	23.000	[UA]	2925.000	[CPS]
	Jun02,12	16:20:44	CURRENT	225.000	[UA]	18770.000	[CPS]
8	Jun02,12	16:00:49	F	Default	[CPS]		
9	Jun02,12	16:00:49	X	Default	[CPS]		

Century WIRELINE SERVICES

COMPENSATED DENSITY
GAMMA - CALIPER
NW-12-2D

COMPANY :CENTERMOUNT COAL
WELL :NW-12-2D
FIELD :N/A
COUNTRY :CANADA
PROVINCE :BRITISH COLUMBIA

OTHER SERVICES:
NEU
DEV

LSD :N/A
SECTION :N/A
TOWNSHIP :N/A
RANGE :N/A
LICENSE NO. :N/A
UNIQUE WELL ID. :N/A

PERMANENT DATUM :GL — ELEVATION KB :N/A
LOG MEASURED FROM :GL — ELEVATION DF :N/A
DRL MEASURED FROM :GL — ELEVATION GL :N/A

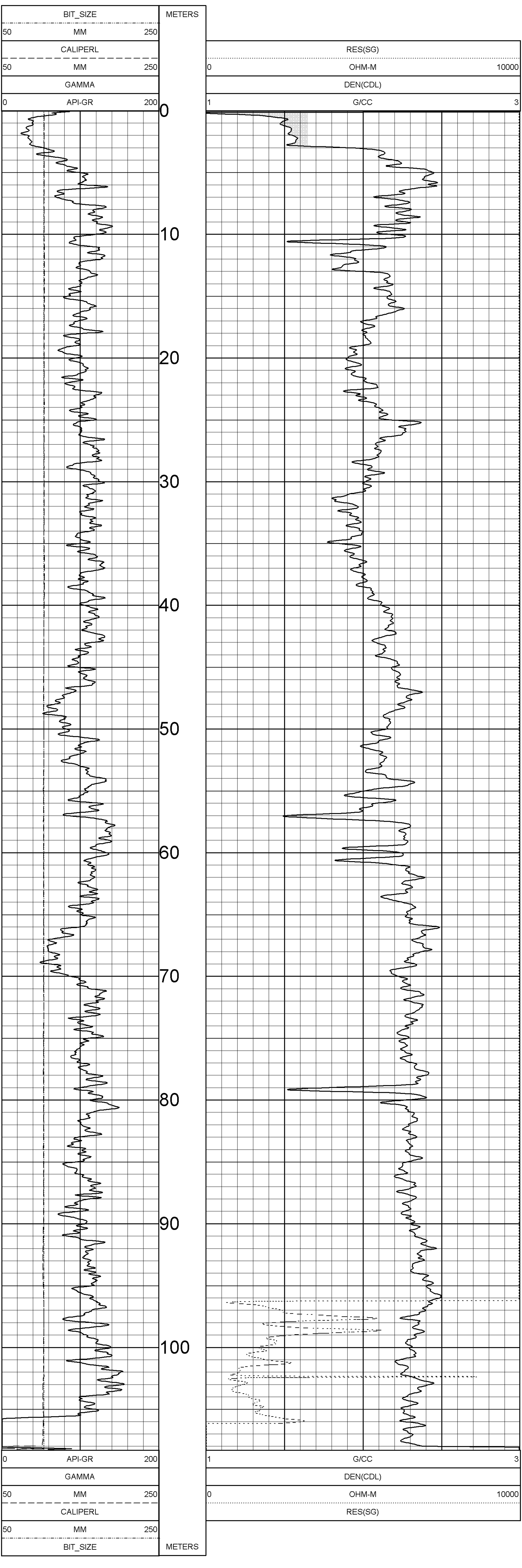
DATE :10/22/12 — RIG NUMBER :OK #24
DEPTH DRILLER :107.60 — LOGGER TD :108.50
BIT SIZE :104.00 — ARRIVAL TIME :12:00
LOG TOP :0.00 — DEPARTURE TIME :13:30
LOG BOTTOM :108.26 — CIRC STOPPED :N/A
CASING LOGGER :6.00
CASING DRILLER :6.10
CASING TYPE :SURFACE
BOREHOLE FLUID :WATER
RM TEMPERATURE :N/A
MUD RES :N/A
MUD WEIGHT :1.00
WITNESSED BY :B. EDGREN
RECORDED BY :M. LEBEDA
REMARKS 1 :VERTICAL
REMARKS 2 :LOGGED THRU PVC LINER, DENSITY CURVE WILL BE AFFECTED .

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

GAMMA DENSITY TP 1:200 NW-12-2D 10/22/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 — NEUTRON MATRIX : SANDSTONE — MATRIX DELTA T : 177
MAGNETIC DECL : 15.20 — ELECT. CUTOFF : 99999 — BIT SIZE : 104.00
PRESENTATION NAME/DATE = BULK DENSITY TP_CRM.0 10/22/2012 — VERSION = 3.64KG



GAMMA DENSITY TP 1:200 NW-12-2D 10/22/12

LOG PARAMETERS

MATRIX DENSITY : 2.65 — NEUTRON MATRIX : SANDSTONE — MATRIX DELTA T : 177
MAGNETIC DECL : 15.20 — ELECT. CUTOFF : 99999 — BIT SIZE : 104.00
PRESENTATION NAME/DATE = BULK DENSITY TP_CRM.0 10/22/2012 — VERSION = 3.64KG

TOOL CALIBRATION NW-12-2D 10/22/12 13:17
TOOL 9239C1 TM VERSION 2025
SERIAL NUMBER 2404

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Jun02,12	16:01:05	GAMMA	0.000	[API-GR]	4.000	[CPS]
	Jun02,12	16:01:05	GAMMA	545.000	[API-GR]	635.000	[CPS]
2	Jun02,12	16:20:27	VOLTAGE	23.000	[MV]	6860.000	[CPS]
	Jun02,12	16:20:27	VOLTAGE	225.000	[MV]	34055.000	[CPS]
3	Jun02,12	16:00:49	CALIPER	Default	[CPS]	Default	[CPS]
	Jun02,12	16:00:49	CALIPER	Default	[CPS]	Default	[CPS]
4	Jun02,12	16:01:58	DEN(LS)	1.620	[G/CC]	13852.000	[CPS]
	Jun02,12	16:01:58	DEN(LS)	2.612	[G/CC]	1895.000	[CPS]
5	Jun02,12	16:02:26	DEN(SS)	1.590	[G/CC]	45738.000	[CPS]
	Jun02,12	16:02:26	DEN(SS)	2.580	[G/CC]	18052.000	[CPS]
6	Jul02,12	19:44:14	CALIPERL	100.000	[MM]	236854.000	[CPS]
	Jul02,12	19:44:14	CALIPERL	200.000	[MM]	339407.000	[CPS]
7	Jun02,12	16:20:44	CURRENT	23.000	[UA]	2925.000	[CPS]
	Jun02,12	16:20:44	CURRENT	225.000	[UA]	18770.000	[CPS]
8	Jun02,12	16:00:49	F	Default	[CPS]		
9	Jun02,12	16:00:49	X	Default	[CPS]		

Appendix IV:

Fall 2012 Bingay Coal Project

– Exploration Drilling, Trenching and Analyses Program

(3)

2012

October 19, 2012

F. J. NUNN
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA

Mr. Ted Nunn, P.Eng.
Centerpoint Resources Inc.
1385 1095 West Pender Street
Vancouver, BC V6E 2M6

Via email: tednunn@centerpointcanada.com, tednunn@shaw.ca

Subject: 2012 Bingay Coal Project – Exploration Drilling, Trenching and Analyses Program

Dear Mr. Nunn:

Introduction
In accordance with your request, the results of the summer and fall 2012 exploration drilling, trenching and coal analysis program are presented in this report. Five core holes were completed to further evaluate coal quality and geologic stratigraphy in proposed mine area.

Surface geologic exploration was conducted by trenching to relate coal location and thickness to geophysical seismic exploration findings. The exploration holes were completed to provide infill geologic and coal quality information. Selected coal samples were submitted for numerous laboratory analyses including raw coal float, raw and clean VM, mineralization, proximate analysis, coking and several others. The purpose of these analyses is to assess and document coal quality. TED PLEASE ENHANCE AS NEEDED

Each of these programs are summarized below and detailed geologic and stratigraphic data are provided on the attached tables.

Borehole Exploration Program
The **five-hole drilling** exploration program was conducted in August and September 2012 by FB Drilling/638446 BC Ltd., using an HQ EF50 (Discover Drill) diamond drill core rig. Approximately **955 meters** (m) were drilled and cored.

The trenching program was conducted between October 4 and October 12, 2012. The trenches were excavated using a D330 track-mounted excavator. Approximately **483 m** of trench were completed during the program.

Geologic logging was completed by Spring MacAskill, B.Sc. Centermount Project Geologist. Each borehole was logged for hole total depth, core recovery, general description of rocks and possible rock formation, rock quality designation (RQD), coal seam thickness, and other observed geologic characteristics. Coal location, thickness and general characteristics of associated bedrock were documented in the trench.

The holes and trenches were located and intended to provide infill geologic, stratigraphic and coal thickness and quality data, which will be used to support the Bingay Gemcom GEMS mine model. The data will also be used to refine our understanding of the Bingay geologic structure and coal tonnage.

Summary information regarding each exploration hole is provided below. The hole locations are shown on figure1.

<u>2012-04DA: Pad 19,</u> Location 5562580 N, 643930 E

This hole originated from the southwest side of Bingay Hill. The initial hole azimuth was established at 200^o (south-southwest) with a dip of 51^o and based on geologic logging, the maximum hole depth was 125 m (412 feet). The hole was logged by Century Wireless Services who, along with the drillers, also reported a total depth of 125 m (412 ft.). However the calculated recovered core length was 114.46 m (375.5 ft.) resulting in about 10.54 m difference between measured depth and core recovery.

The coal seams encountered in this hole were

Coal Seams	Thickness (m)
10	1.57
10R	2.63
8/7/6 or 5	0.97
7/6 or5	0.33
4	2.41
3	0.49
2	0.55
3 or 2	0.54
Total Recovered Coal	**9.48**

The coal seam identifications are inferred from information provided in the Geological Report on the Bingay Main Coal Property (15, February 2011) geology report prepared by C. Gwyneth Cathyl-Bickford, P.Geo.(BC) Lic. Geol.(WA).

Due to hole stability problems the hole was drilled with bentonite mud and the geophysical logs were completed inside the drill string.

<u>2012-05DA: Pad 18,</u> Location 5562600 N, 644110 E

This hole originated from the top of Bingay Hill. The initial hole azimuth was established at 200^o (south-southwest) with a dip of 39^o and based on geologic logging the maximum hole depth was 216 m (718 feet). Century Wireless Services logged this hole as 218.30 m and the drillers reported the hole as 219 m. Approximately recovered 216 m of core were recovered.

Coal Seams	Thickness (m)
13B	0.22
12T	6.28
12	6.23
10	11.07
10R	1.96
8/7/6 or 5	1.77
4	1.28
4R	0.27
3	0.25
2	0.26
Total Recovered Coal	**29.59**

No information regarding hole stability problems is available, however this hole was drilled using bentonite drilling mud.

Eleven (11) samples were submitted to Elk Valley Environmental Services for laboratory analysis.

<u>2012-06DA: Pad 20</u>, Location 5562455 N, 644120 E

This hole was originated from a location topographically below Pad 18 on the south side of Bingay Hill. The original azimuth was set for 135^{o} with a dip of 51^{o}. Century Wireless Services logged this hole and the true azimuth was 132.8^{o}. Based on geologic logging, the hole total depth was 298.72 m however Century Wireless recorded the true depth of 298.72 m. Based on the drillers the hole depth was 299.31 m and recovered 280.75 m of core.

The coal encountered in this hole included:

Coal Seams	Thickness (m)
10A?	0.45
10R?	1.39
10?	2.81
?	0.06
?	0.08
9/8/7/6	0.87
7/6 or 5	0.74
8/7/6 or 5	0.44
7/6 or 5	0.54
8/7/6 or 5	0.71
8?	1.24
7?	0.66
6?	0.75
5?	0.21
4	3.08
4R	0.86
3	0.16
2	0.18
1	1.11
Total Recovered Coal	**16.34**

Identification of specific coals seams was difficult due to hole stability issues and the lack of clearly identifiable marker beds. Several sections of core were lost due to fractured rocks and the need for drilling with a tricone bit.

Two (2) samples were submitted to Elk Valley Environmental Services.

<u>2012-07DA: Pad 12</u>, Location 5563120N, 644005E

This hole was located further northwest of the other holes on the west side of Bingay Hill.
The original azimuth was set for 135^{o} with a dip of 51^{o}. Geologic logging recorded the hole total depth as 235 m, while Century Wireless logged this hole and the true azimuth was 130.4^{o}, with a true depth of 235.00 m. About 218.8 m of core was recovered.

This hole was also highly unstable. The drill became stuck and 3 sections of coal were not recovered. As a result this hole was drilled with bentonite mud.

Coal Seams	Thickness (m)
7?	0.53
8?	0.17
9?	1.58
10	19.68
10R	2.2
?	0.44
?	0.91
?	0.30
?	0.16
?	0.80
Total Recovered Coal	**28.21**

Identification of specific coals seams was also difficult due to hole stability issues and the lack of clearly identifiable marker beds. Due to drilling problems the hole was cased to 40.23 m. Field observations suggest the drilling problems were likely due to faulting, excessive water production and close proximity to the ground surface

No samples were collected for laboratory however; samples collected at 1.5 m intervals for selenium analysis are stored onsite in metal containers.

<u>2012-08DA:</u> adjacent to monitoring well MW11-5D

This hole was drilled adjacent to monitoring well MW11-5D, which is located on the south side of the Bingay Main Camp. The initial azimuth was set at 290^o with a dip of 47^o. Century Wireless logged the hole as 310^o with the same dip. Hole depth based on geologic logging is 82.49 m while the drillers reported the depth as 87.78 m. The hole depth recorded by Century was 75.45 m, which indicates the hole was filled with caving or slough. Approximately 82.49 m of core were recovered.

Only one coal seam was encountered in this hole, which consisted of Coal Seam 10 at 55.927 m thick. It is important to note due to hole stability problems the hole's total depth ended in coal; i.e., the coal seam's entire thickness was not penetrated.

The coal encountered in this hole was stable so other drilling additives were used instead of bentonite to potentially improve sample quality. The following drilling additives were used instead of bentonite:

- Penetrol: non-ionic wetting agent
- EZ-Mud Gold: clay/shale stabilizer
- Quik-Trol Gold LV: Low viscosity highly dispersible filtration
- 550X Drilling Polymer Additive

Twenty seven (27) samples were submitted to Elk Valley Environmental Services for analysis. Unlike previous holes these samples were not washed.

Borehole Analytical Results

Samples were submitted from 4 of 5 boreholes for analysis of coal quality parameters noted above. Coal from 2012-07DA was not submitted because the samples were contaminated with excessive bentonite mud.

Analytical results for samples collected from the other holes showed elevated ash content which appeared to originate from large amounts of bentonite (soda ash) contained within drilling mud used to maintain hole stability drilling.

The analytical results from hole 2012-08DA confirmed that bentonite in drilling mud artificially increased the ash percentage in the coal quality analyses. The borehole from 48 m to 74 m was not drilled with standard drilling mud thus sample #120368 through sample #120382 were not affected by bentonite. The samples collected when drilling with polymer were intended to serve as analytical control samples.

Based on the finding from hole 2012-08DA, the remaining samples from holes also drilled with bentonite mud can be assumed to have elevated ash contents.

After the contamination source was identified, the contamination was attempted to be removed by washing the coal with water. When washing proved ineffective, different mixtures of drilling polymers were used during drilling.

Based on the analytical results, coal will not be washed prior to analysis because ash content is not affected.

The analytical laboratory indicates that sample reserves remain available for compositing by seam and for further coking quality analyses.

TRENCHING

The trenching program was completed between October 4 to October 12, 2012. The trench was completed to provide geologic and stratigraphic information including thicknesses and location of various formations and coal sequences. This work was conducted to support analysis and interpretation of geophysical seismic data.

The trench width was generally 1.5 m and the trench length was approximately 483 m. The trench depth ranged between about 1 and 5 m below ground surface. The trench extended from the west to the east side of the property on the north side of Bingay Hill. The approximate location of the trench can be seen on Figure 1, starting at UTM 5563342 N, 643635 E in the west and ending at UTM 5563192 N, 644398 E in the east side of the property. The 2012 trench was excavated by Russ Phillp using a 330 John Deer track-mounted excavator and logged by Spring MacAskill, B.Sc. in Geology.

The trench generally followed the pathway of a previously excavated trench completed by William Shenfield and Stephen Gardner in 1996. The previous excavation resulted disturbed soil, potentially contaminated samples and poor interpretation of exposed rocks.

The trench findings are summarized in Table 1: Bingay 2012 Exploration Trench

The trench encountered approximately 33 coal seams, ranging in thickness between 0.1 and 9.8 m including “sandy coal”. Rocks found between the coal consisted of sandstone, siltstone and overburden. Several coal seams were also separated by uncemented gravel deposits. Approximately length of 84.3 meters of coal was measured.

Minor structural folding was observed in the exposed rocks around UTM 5563343 N, 643937 E.

Table 1: Bingay 2012 Exploration Trench

Start Date: 2012 October 4							Total Length: 483 metres									
Stop Date: 2012 October 12							Width: Nominal 1.5 metres									
Excavated by: 330 John Deer Track Mounted Excavator							Logged by: Spring MacAskill									
Operated by: Russ Phillp							UTM: Nad 83									
Time/Date	**From**			**To**			**Thickness**		**Width (m)**	**Sub Length (cm)**	**Sample ID**	**Strike/ Dip**	**Description**	**Unit Thickness (m)**		**Comments**
	Location ID	**Northing**	**Easting**	**Location ID**	**Northing**	**Easting**	**From**	**To**								
04-Oct-12	2012-T1	5563342	643935	2012-T01	5563345	643925	0	6.5					Overburden, sandstone is diving too deep to dig w/excavator 330 John Deer	Overburden	6.5	WEST END OF 2012 TRENCH
04-Oct-12	2012-T2	5563342	643939	2012-T02	5563348	643938	6.5	8.35	1.85	0	120386		Vf SST grey/brown, red/orange oxidation, poorly indurated with int coal and mud	SST	13.6	
04-Oct-12	2012-T3						8.35	15.4	7.05	6.7		345/40 (E)	Noticeable beds on side of trench, orange weathering, mod soft, grey silty mudstone - with sandstone int and coal, calcite in fractures (fizzes profusely w/HCL)		0	
04-Oct-12				2012-T1A	5563343	643937	15.4	18.8	3.4				Wet/damp dark grey siltstone, highly oxidizes w/ shiny/metallic coaly		0	
04-Oct-12	2012-T4	5563351	643954				18.8	20.1	1.3	8	120387	260/31.5	Sandy siltstone with laminations of vf SST (grey)		0	

												(N-NE)				
04-Oct-12	2012-T5	5563349	643954				21.5	23.6	2.1	10.1			Coal seam 2	**2 Coal**	**2.1**	
5:47PM, 04-Oct-12	2012-T6	5563347	643955				23.6	24.3	0.7	10.8			Parting between coal seam 2/2R	Parting	0.7	
04-Oct-12							24.3	27	2.7	13.5			Coal Seam 2R	**2R Coal**	**2.7**	
5:57PM,04 -Oct-12	2012-T7	5563346	643957				27	28	1	14.5	120388	162/20 (West)	Beginning of hard vf-fine SST w/ferruginous material (oxide grains), chert fragments (sulfur smell when hammering)	SST	17.8	Small fold
04-Oct-12	2012-T8	5563333	643966				28	36.4	8.4			0/71	Fine SST grey, with orange oxidation and ferruginous material (oxide grains), laminations		0	
04-Oct-12	2012-T9	5563332	643969				36.4	42.9	6.5				Vf SST thin laminations, fissile, brown oxidized grains		0	
04-Oct-12	2012-T10	5563329	643973				42.9	44.8	1.9				End of vf sandy siltstone, fining upward to coal, orange grey weathering - start coal seam 3L		0	
04-Oct-12							44.8	51	6.2	20.7			Coal seam 3L	**3L Coal**	**6.2**	
04-Oct-12	2012-T11						51	54.1	3.1	23.8			Mud, then vf SST, grey, creation, fine laminations SST parting, then mud	Parting	3.1	
04-Oct-12							54.1	57.5	3.4	27.2			Coal Seam 3	**3 Coal**	**3.4**	
05-Oct-12	2012-T12	5563319	643983				57.5	59.25	1.75	28.95			Mud/Clay	Parting	6.45	
05-Oct-12							59.25	63.95	4.7	33.65			Light brown/tan mudstone w/coal int, orange oxidation		0	
05-Oct-12							63.95	65.4	1.45	35.1	1.45		Coal seam 4	**4 Coal**	**1.45**	
05-Oct-12							65.4	70.5	5.1	40.2			Overburden	Overburden	5.1	Poor stratigraphic identification due to

																previous subsurface disturbance
05-Oct-12							70.5	71.3	0.8	41			Coal seam 4R?	**4R Coal ?**	**0.8**	
05-Oct-12	2010-T13						71.3	81	9.7	50.7			Hard siltstone, grey-blue with red oxidation	Siltstone	9.7	
															0	
06-Oct-12	2012T13A	5563317	644005				81	98.6	17.6				Unknown, Overburden	Overburden:	17.6	
06-Oct-12							98.6	98.9	0.3				Small (30cm) Coal seam 5 or 6?	**Coal 5/6?**	**0.3**	
06-Oct-12							98.9	107.3	8.4				Unknown, Overburden	Overburden	9.3	
06-Oct-12							107.3	108.2	0.9				Ponding water, hard to tell if a coal seam is under it		0	
06-Oct-12	120389	5563318	644036				108.2	115.9	7.7		120389	14/81 (N E)	Very hard, light grey vf silty SST, cherty (sulfur smell when hammering), Massive	Silty SST	7.7	
06-Oct-12							115.9	128.3	12.4				Unknown, Overburden	Overburden	12.4	
06-Oct-12	2012-T14	5563320	644056				128.3	128.7	0.4				Potentially a small 40cm coal seam 6 or 7?	**Coal 6/or7?**	**0.4**	
															0	
11:13AM, 07-Oct-12	120390	5563319	644062				128.7	131.1	2.4	52.4	120390		Vf-fine SST light-med grey, faint cross bedding, red/orange oxidation	vf SST	22.2	
11:27AM, 07-Oct-12	120391	5563316	644069				131.1	147.9	16.8	69.2	120391		Grain size thinning to vf SST, red/orange oxidation		0	
07-Oct-12							147.9	150.9	3	72.2			Continuation of vf SST, massive		0	
07-Oct-12							150.9	153.6	2.7	74.9		212/70 (W)	Silty mudstone int w/coal, more recessive	Mudstone	2.7	
11:39AM, 07-Oct-12							153.6	154.6	1	75.9			Coal, 1 metre thick coal seam 7/8/ or 9?	**Coal 7/8 or9?**	**1**	
11:41AM, 07-Oct-12	120392	5565511	644083				154.6	161.7	7.1	83	120392		Vf SST, grey	vf SST	7.1	

11:50AM, 07-Oct-12												218/80	Silty sandstone with coal/plant fragments, faint cross bedding		0	
11:57AM, 07-Oct-12							161.7	166.3	4.6	87.6			Coal seam 10?	**Coal 10 ?**	**4.6**	
12:03PM, 07-Oct-12	120393	5563311	644086				166.3	176.25	9.95	97.55	120393		Vf silty SST med grey, oxidized, fissile (fractured), cross bedding	silty SST	9.95	
							176.25	177.2	0.95	98.5			Coal seam 10R?	**Coal 10R?**	**0.95**	
12:26PM, 07-Oct-12	120394	5563306	644094				177.2	180.7	3.5	102	120394	208/74 (W)	Silty mudstone, fissile grey, orange oxidation with thicker (30cm) beds, cross bedding indicated west way up	Mudstone	3.5	
EOT 07-OCT-12	2012-T15	5563300	644099								2012-010-01?		Rock Ledge		0	
															0	
3:22PM, 2012-10-08	2012-T15A	5563304	644100				180.7	188.9	8.2	8.2			Coal seam 12	**12 Coal**	**8.2**	
08-Oct-12							188.9	198.7	9.8	18			"Dirty" coal/sandy coal	**sandy coal**	**9.8**	
08-Oct-12							198.7	199.2	0.5	18.5	2012-010-2?		Potential rider of SST	rider	0.5	
08-Oct-12							199.2	203.9	4.7	23.2			"Dirty" coal/sandy coal	**sandy coal**	**4.7**	
08-Oct-12							203.9	209.6	5.7	28.9	2012-010-3?		Rock formation	Rock	5.7	
3:14PM, 2012-10-08							209.6	225.4	15.8	44.7			Gravel with boulders	Gravel - boulders	15.8	
10-Oct-12							225.4	243.4	18	18			Gravel to sand/clay	Gravel - sand/clay	18	
10-Oct-12	2012T-010-1	5563285	644166				243.4	245.7	2.3	20.3	121154		siltstone	Siltstone	2.3	

10-Oct-12							245.7	252.6	6.9	27.2			Coal	**coal**	**6.9**	
10-Oct-12							252.6	254.1	1.5	28.7			Rider	Rider	1.5	
10-Oct-12							254.1	254.25	0.15	28.85			Coal	**coal**	**0.15**	
10-Oct-12							254.25	254.6	0.35	29.2			Dirty Coal (mud w/coal int)	**dirty coal**	**0.35**	
10-Oct-12							254.6	255	0.4	29.6			Coal	**coal**	**0.4**	
10-Oct-12							255	255.15	0.15	29.75			Mudstone	mudstone	0.15	
10-Oct-12							255.15	256.1	0.95	30.7			Coal	coal	0.95	
10-Oct-12							256.1	261.6	5.5	36.2			Dark/black mudstone with abundant coal int	mudstone	21.4	
4:13PM, 2012-10-10	2012-010-2	5563270	644179				261.6	263.6	2	38.2	121155	199/81 (W)	Black mudstone w/ int coal, relatively hard, near vertical		0	
10-Oct-12							263.6	277.5	13.9	52.1			Mudstone		0	
10-Oct-12							277.5	278.2	0.7	52.8			Coal	**Coal**	**0.7**	
4:33PM, 2012-10-10	2012-010-3	5563271	644196				278.2	280.2	2	54.8	121156		Mudstone w/int coal, yellow/orange weathering	mudstone	2	
10-Oct-12							280.2	280.4	0.2	55			Coal	**coal**	**0.2**	
10-Oct-12							280.4	282.7	2.3	57.3			Oxidized rock, really broken/fractured	rock	2.3	
10-Oct-12							282.7	285.1	2.4	59.7			Coal	**coal**	**2.4**	
10-Oct-12							285.1	285.4	0.3	60			Mudstone w/int coal, yellow/orange weathering	mudstone	0.3	
10-Oct-12							285.4	288.2	2.8	62.8			Coal	**coal**	**2.8**	
10-Oct-12							288.2	289.1	0.9	63.7			Silty mudstone	mudstone	0.9	
10-Oct-12							289.1	289.2	0.1	63.8			Coal	**coal**	**0.1**	
10-Oct-12							289.2	289.3	0.1	63.9			Mudstone w/int coal, yellow/orange weathering	mudstone	0.1	

10-Oct-12							289.3	289.4	0.1	64			Rock	rock	0.1	Due to trench depth and instability, rock types could not be positively identified
10-Oct-12							289.4	289.8	0.4	64.4			Coal	**coal**	**0.4**	
10-Oct-12							289.8	292.7	2.9	67.3			Rock	rock	2.9	
10-Oct-12							292.7	294.4	1.7	69			Coal	**coal**	**1.7**	
10-Oct-12							294.4	295.1	0.7	69.7			Siltstone, with orange oxidation	siltstone	0.7	
10-Oct-12							295.1	295.5	0.4	70.1			Coal	**coal**	**0.4**	
10-Oct-12							295.5	295.7	0.2	70.3			Rock	rock	0.2	
10-Oct-12							295.7	296	0.3	70.6			Coal	**coal**	**0.3**	
10-Oct-12							296	296.75	0.75	71.35			Mud	mud	0.75	
10-Oct-12							296.75	298.7	1.95	73.3			Coal	coal	1.95	
10-Oct-12							298.7	298.9	0.2	73.5			Mudstone w/coal int	mudstone	0.2	
10-Oct-12							298.9	300.3	1.4	74.9			Coal w/mudstone int	coal/mudstone	1.4	
10-Oct-12							300.3	301.7	1.4	76.3			Soft Clay	mud	1.4	
5:04PM, 10-Oct-12	2012-010-3	5563271	644196				301.7	302.9	1.2	77.5			Sandy siltstone	siltstone	1.2	
															0	
11-Oct-12							302.9	305.5	2.6	2.6			Dirty coal/ sandy coal	**dirty coal**	**2.6**	
11-Oct-12							305.5	307.7	2.2	4.8			Coal	**coal**	**2.2**	

3:00PM, 11-Oct-12	2012-TOCT11-1	5563260	644219				307.7	324.7	17	21.8	121152	201/83 (E)?	Blocky, very hard blue/grey siltstone w/ coal/plant fragments, fissile laminations in some areas, near vertical/hard to tell dipping direction	siltstone	17	
11-Oct-12							324.7	327.2	2.5	24.3			Overburden	OB	2.5	
11-Oct-12	2012-TOCT11	5563254	644210				327.2	347.9	20.7	45	121157		Grey sandy siltstone w/ plant fragments, laminations, grain size increasing down slope, wave ripples	siltstone	20.7	
11-Oct-12							347.9	381.9	34	79			Gravel	gravel	34	
3:36PM, 11-Oct-12	2012TOCT11-3	5563229	644286				381.9	400.3	18.4	97.4	121153		Very hard sandy siltstone grey/blue	siltstone	18.4	
															0	
12-Oct-12							400.3	403.3	3	3			Coal	**Coal**	**3**	Trench not entered because of sidewall instability
12-Oct-12							403.3	407.3	4	7			SST	SST	4	
12-Oct-12							407.3	423	15.7	22.7			Clay/gravel	Clay/gravel	15.7	
12-Oct-12							423	426.4	3.4	26.1			Coal	**Coal**	**3.4**	
9:02AM, 12-Oct-12	2012-T012-1	5563198	644301				426.4	440.1	13.7	39.8	121151		Rock	Rock	13.7	
							440.1	440.5	0.4	40.2			Coal (dirty)	**Coal (dirty)**	**0.4**	
							440.5	442.7	2.2	42.4			SST with int coal, orange weathering	SST	2.2	
							442.7	443.1	0.45	42.85			Coal (dirty)	**Coal (dirty)**	**0.45**	

								5								
							443.15	450	6.85	49.7			Brown vf SST with orange weathering, blocky to fissile sections	Vf SST	6.85	
							450	453.6	3.6	53.3			Coal	**Coal**	**3.6**	
							453.6	459.7	6.1	59.4			Orange oxidized rock (vf SST/mudstone) really fractured, coal int	vf SST/mudstone	6.1	Inferences made from top of trench
							459.7	460.6	0.9	60.3			Coal	**Coal**	**0.9**	Trench not entered because of sidewall instability
							460.6	461.7	1.1	61.4			Rock	Rock	1.1	
9:23AM, 12-Oct-12							461.7	463.1	1.4	62.8			Coal	**Coal**	**1.4**	
							463.1	471.1	8	8			Gravel	Gravel	8	Trench not entered because of sidewall instability
							471.1	479.5	8.4	16.4			Overburden	OB	8.4	
		5563192	644398				479.5	483.9	4.4	20.8			Gravel	Gravel	4.4	EAST END OF 2012 TRENCH
Key:	OB - overburden		SST : Sandstone		Vf: Very fine		int: interbedded							**Sum:**	**482.5**	
														Total Coal:	**84.25**	
														Total OB:	44.2	

DISCUSSION

The 2012 exploration and infill drilling program provided useful information to support ongoing mine model and resource development. Proper identification of the coal and rock units, structural interpretation, and correlation of coal seams and bedrock with existing data will be required using GEMCOM GEMS.

In addition, future drilling should use non-bentonite drilling mud to remove potential contaminates from coal quality analyses.

Closure

In trust this report meets your current requirements. Please do not hesitate to contact me if you have further questions.

Regards,

Spring MacAskill, B.Sc.
Project Geologist

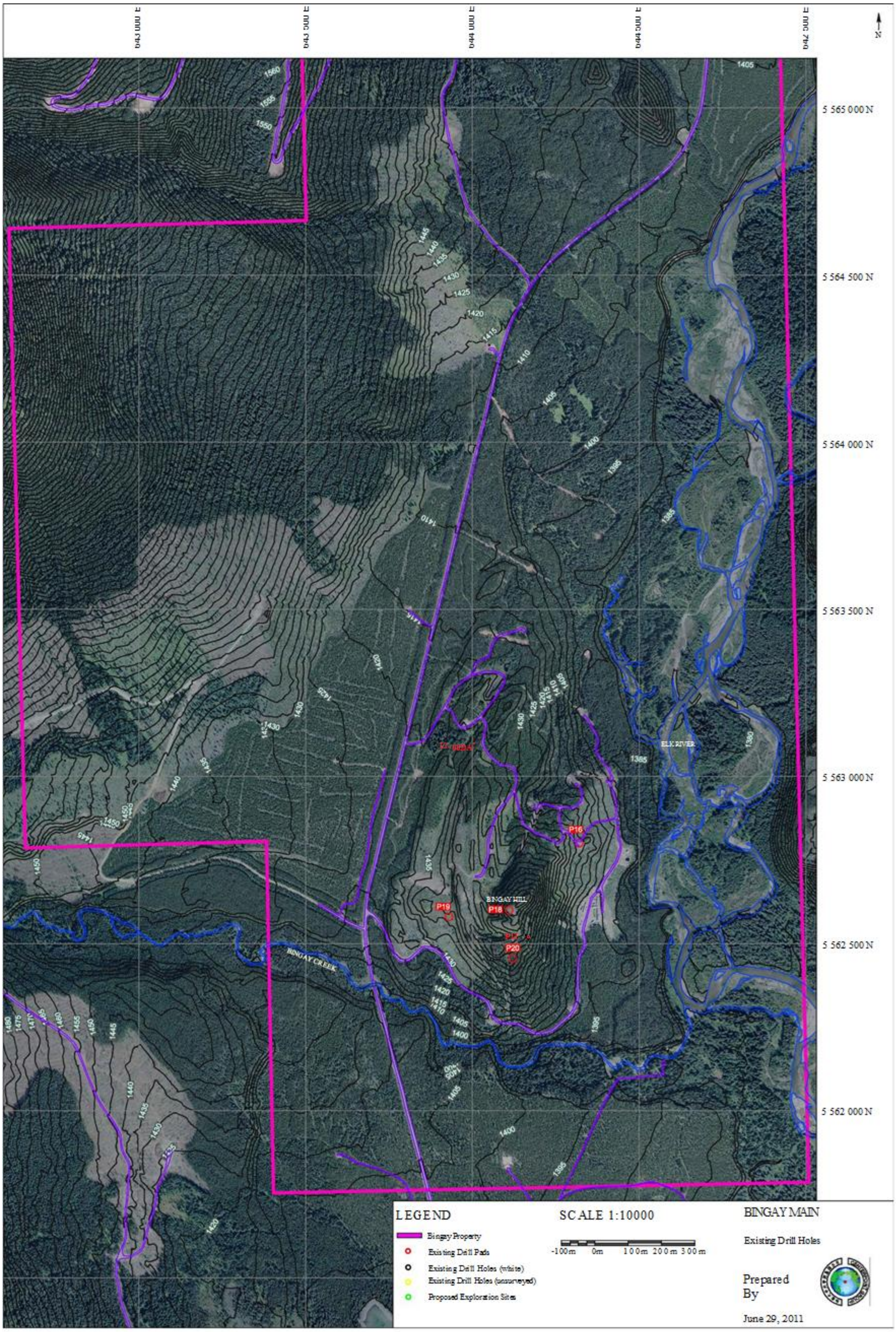
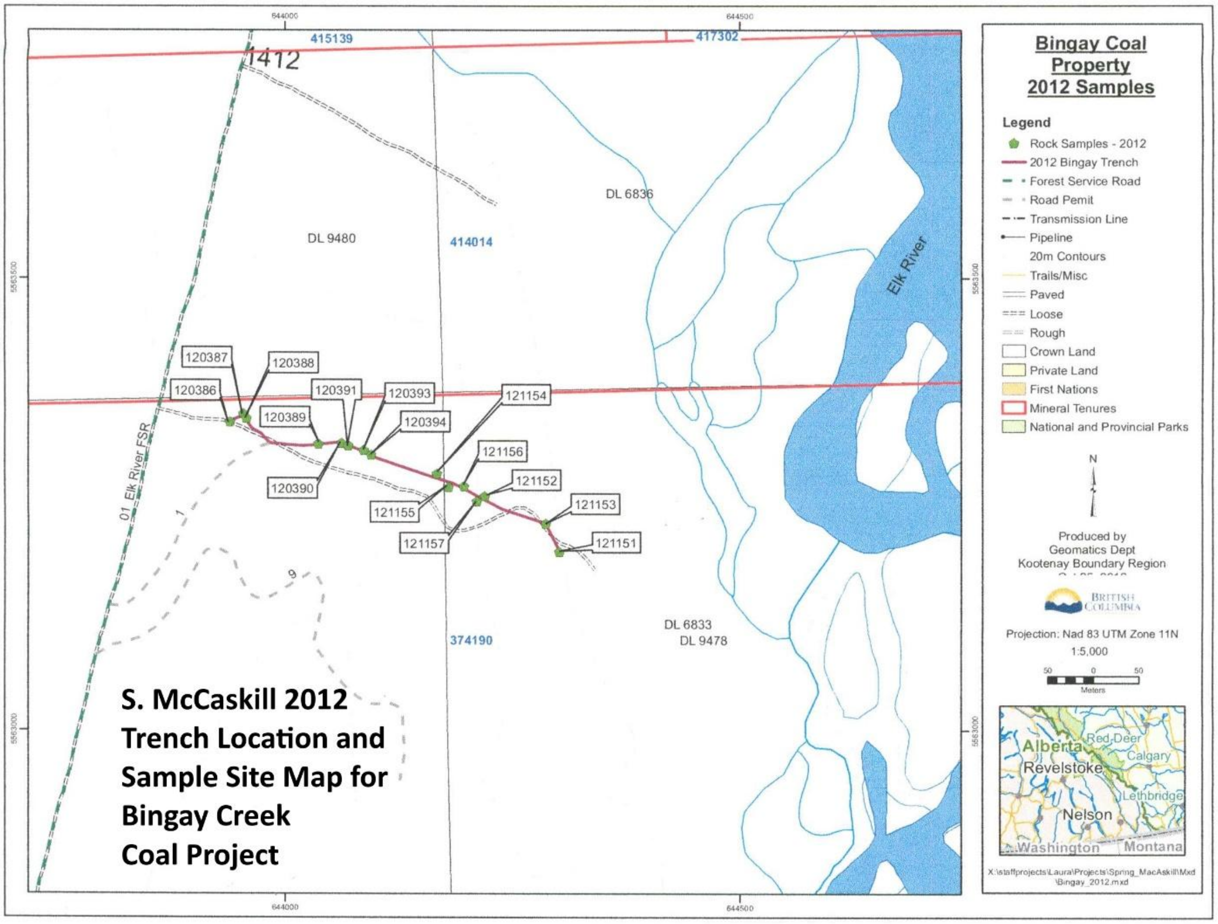


FIGURE 1: 2012 Bingay Coal Exploration Project Borehole Plan


Bingay Coal Property 2012 Samples
Legend
Rock Samples - 2012
2012 Bingay Trench
Forest Service Road
Road Pemit
Transmission Line
Pipeline
20m Contours
Trails/Misc
Paved
Loose
Rough
Crown Land
Private Land
First Nations
Mineral Tenures
National and Provincial Parks
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Produced by
Geomatics Dept
Kootenay Boundary Region
Projection: Nad 83 UTM Zone 11N
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Revelstoke
Lethbridge
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Montana
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415139
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DL 6836
DL 9480
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Elk River
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121151
01 Elk River FSR
374190
DL 6833
DL 9478
S. McCaskill 2012
Trench Location and
Sample Site Map for
Bingay Creek
Coal Project

Appendix V

2012 Rock Photographics Report (by Spring MacAskill)

Report 120628 for
Spring MacAskill,
Centermount Coal Ltd.,
1385 - 1095 West Pender Street,
Vancouver, BC, V6E 2M6 **July, 2012**
Ph:250-608-0034

Samples: 120251 Sierra, 120252 Shenfield, 8R269454 Moosewood, 8R269455 Moose Mountain, 8R269457 Bingay

Summary:

Sample 120251 Sierra is of well sorted metamorphosed siltstone consisting of equant grains 0.05-0.1 mm in size dominated by quartz with less abundant micritic calcite (stained orange brown by limonite), much less abundant sparry calcite (with thin limonite rims), accessory hematite, carbonaceous opaque lenses and chert, and minor plagioclase, quartzite, and zircon. Bedding, parallel to a weak foliation, is defined by elongate lenses of carbonaceous opaque and hematite/limonite and by one layer with abundant zircon. Two calcite-quartz veinlets cut across the foliation at a high angle. One of these is offset up to 1 mm along a fracture zone parallel to foliation in an area containing abundant lenses of carbonaceous opaque and hematite and remnants of a calcite veinlet.

Sample 120252 Shenfield is of well sorted cherty arenite that consists mainly of angular to subangular grains of a variety of types of chert, rocks intermediate between chert and mudstone, lesser fragments of mudstone, in part strongly hematitic, and of single quartz grains, and minor fragments of chalcedony, quartzite, and carbonaceous opaque in a sparse matrix of sericite. Three layers are dominated by quartz fragments and contain minor calcite cement.

Sample BR269454 Moosewood is of cherty arenite that contains angular fragments of a variety of cryptocrystalline to extremely fine grained chert, mudstone (variable from sericite-rich to hematite-rich), quartz grains, and minor ones of siltstone, quartzite, and carbonaceous opaque. Fragments are closely packed, with a very sparse matrix dominated by sericite.

Sample 8R269455 Moose Mountain is of well sorted slightly foliated siltstone containing angular fragments of quartz and much less abundant ones of mudstone and chert, moderately abundant ones of carbonaceous opaque, and minor ones of muscovite, tourmaline, and chalcedony in a moderately abundant cryptocrystalline matrix of uncertain composition, probably dominated by plagioclase, quartz, and sericite. Rare fragments are of zircon and tourmaline.

Sample 8R269457 Bingay is of well sorted arenite containing angular fragments of quartz, chert, cherty mudstone, and mudstone (ranging from sericite-rich to hematite-rich) with minor fragments of latite/quartzite, quartzite, siliceous siltstone, carbonaceous opaque, chalcedony, and hematite in a very sparse groundmass of quartz-sericite with trace calcite.

Sample 120251 Sierra **Siltstone**
Veinlets: Calcite-Quartz; Calcite

The sample is of well sorted metamorphosed siltstone consisting of equant grains 0.05-0.1 mm in size dominated by quartz with less abundant micritic calcite (stained orange brown by limonite), much less abundant sparry calcite (with thin limonite rims), accessory hematite, carbonaceous opaque lenses and chert, and minor plagioclase, quartzite, and zircon. Bedding, parallel to a weak foliation, is defined by elongate lenses of carbonaceous opaque and hematite/limonite and by one layer with abundant zircon. Two calcite-quartz veinlets cut across the foliation at a high angle. One of these is offset up to 1 mm along a fracture zone parallel to foliation in an area containing abundant lenses of carbonaceous opaque and hematite and remnants of a calcite veinlet.

mineral	**percentage**	**main grain size range**	
quartz	60-65%	0.05-0.1	
micritic calcite/limonite	20-25	0.003-0.005	
sparry calcite	4- 5	0.05-0.07	
opaque/hematite	1- 2	amorphous, 0.02-0.04	
chert	1- 2	0.05-0.08	
plagioclase	minor	0.05-0.08	
quartzite	minor	0.01-0.02	
zircon	minor	0.02-0.06	
chlorite	trace	0.005-0.01	
rutile	trace	0.02-0.04	
apatite	trace	0.03-0.05	
tourmaline	trace	0.03-0.05	
veinlets			
1) calcite-quartz	2- 3	0.07-0.2	(a few up to 0.5 mm)
2) calcite	0.3	0.03-0.05	
3) hematite/limonite	0.3	amorphous	

Quartz forms equant grains.

Calcite forms equant grains with two main textures. More abundant are particles of micritic calcite that are stained orange throughout by limonite. Much less abundant are single grains of sparry calcite, many of which have a thin rim of light to medium brown limonite.

Hematite forms disseminated patches up to 0.15 mm in size and equant grains (0.20-0.04 mm).

Carbonaceous opaque forms lenses subparallel to bedding and concentrated in one main layer.

Chert forms equant fragments consisting of aggregates of equant grains 0.005-0.01 mm in size. Some of these grade texturally into extremely fine grained quartzite.

Plagioclase forms equant anhedral grains that were altered slightly to sericite.

Rutile forms anhedral subrounded to subangular grains, some of which have a light to medium brown colour and others of which are colourless.

Zircon forms subhedral stubby prismatic to subrounded grains that are concentrated moderately in one layer parallel to foliation, which also probably represents the original sedimentary bedding plane orientation.

Apatite forms subrounded grains.

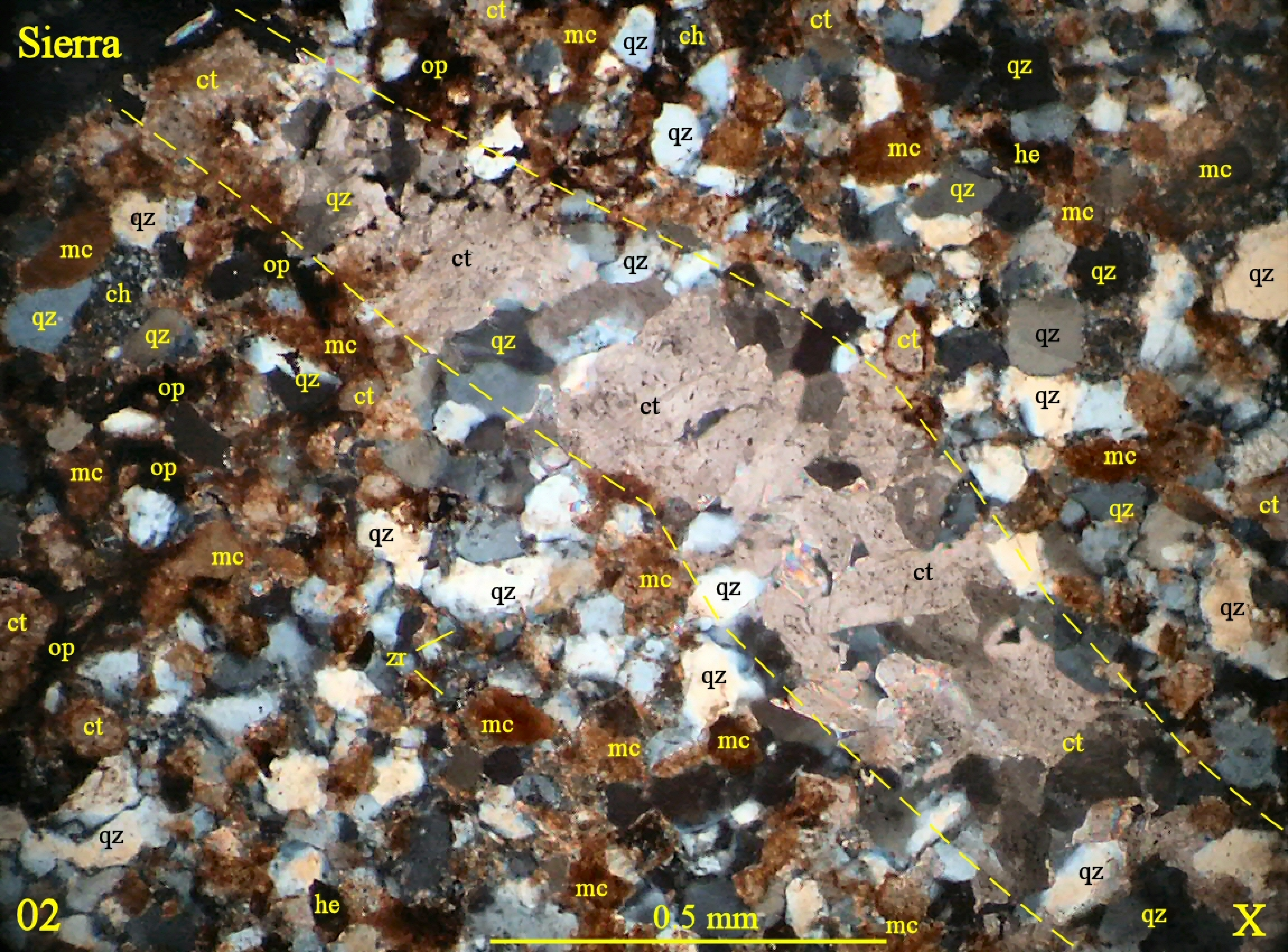
Tourmaline forms a subrounded grain with pleochroism from pale to dark slightly bluish green and a slightly larger grain with pleochroism fro pale to light yellowish green.

(continued on page 2)

Two diffuse veinlets 0.2-0.3 mm wide of calcite and quartz cut across foliation at a high angle. Calcite in these veinlets is free of limonite stain and contains minor dusty opaque/semi-opaque inclusions.

Parallel to foliation is an elongate open fracture zone that locally contains a calcite veinlet up to 0.05 mm wide and is bordered by abundant lenses of hematite and of carbonaceous opaque, suggesting that the veinlet was formed in a fracture along a plane of weakness that was caused by the presence of the carbonaceous opaque lenses. Subparallel to this is a similar veinlet of calcite up to 0.05 mm wide.

Limonite/hematite forms wispy lenses parallel to foliation.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Sample 120252 Shenfield   Cherty Arenite

The sample is well sorted and consists mainly of angular to subangular grains of a variety of types of chert, rocks intermediate between chert and mudstone, lesser fragments of mudstone, in part strongly hematitic, and of single quartz grains, and minor fragments of chalcedony, quartzite, and carbonaceous opaque in a sparse matrix of sericite. Three layers are dominated by quartz fragments and contain minor calcite cement.

mineral	percentage	main grain size range	
detrital			
chert	60-65%	cryptocrystalline-0.005 (some qz 0.02-0.03 mm)	
chert/mudstone	12-15	cryptocrystalline-0.005	
quartz	8-10	0.2-0.5	
mudstone	5- 7	cryptocrystalline-0.005	
hematite-rich mudstone	3- 4	cryptocrystalline	
quartzite	0.3	0.03-0.05	
chalcedony	minor	0.02-0.07	
carbonaceous opaque	trace	amorphous	
zircon	trace	0.03-0.05	
groundmass			
sericite	2- 3	0.005-0.01	
calcite	0.1	0.05-0.1	(mainly in quartz-rich layers)

Chert forms equant to moderately elongate fragments showing a wide variety of texture. Some are cryptocrystalline. Some of these contain coarser grained patches of quartz that were formed by recrystallization of chert prior to incorporation into the present rock. A few chert fragments contain 20-25% spheroids of quartz (0.03-0.05 mm diameter). One chert fragment contains a grain of tourmaline (0.03 mm) with pleochroism from pale to medium green.

Fragments of cherty mudstone consist of chert with moderately abundant limonite and/or hematite.

Mudstone fragments are weakly to moderately foliated and consist of sericite and hematite/ limonite with minor to moderately abundant chert. With increasing chert content and decreasing sericite content, they grade into cherty mudstone. Some fragments are dominated by sericite.

Some mudstone fragments are semi-opaque to opaque because they contain abundant hematite.

Some mudstone fragments, mainly some of those rich in sericite, have outlines suggesting that they were flattened between harder fragments, mainly chert and quartz grains.

A few mudstone fragments are gradational to fine siltstone with 5% quartz grains averaging 0.02 mm in size.

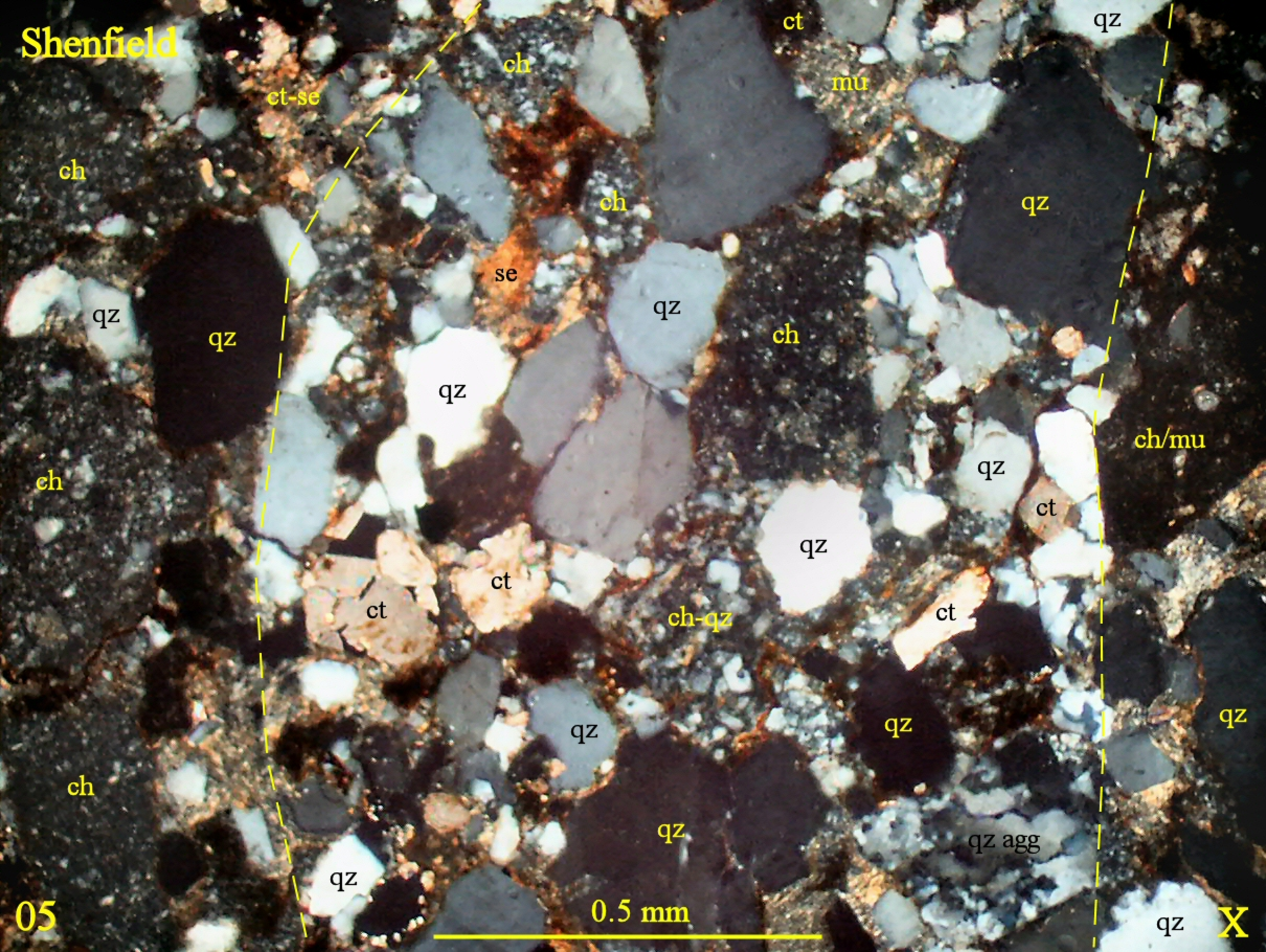
Quartz forms equant single grains and a few aggregates, the latter mainly of equant grains (0.05-0.08 mm). A few fragments are of siliceous siltstone consisting of quartz grains (0.03-0.05 mm) in a much less abundant matrix of quartz (0.01-0.015 mm). A few fragments are of quartzite consisting of equant quartz grains 0.04-0.1 mm in size.

A few fragments are of chalcedony showing radiating and spheroidal textures.

A few ragged fragments up to 0.8 mm long are of hematite and carbonaceous opaque, and may represent altered wood.

Zircon forms a few subrounded equant grains.

Three layers up to 1.2 mm thick are dominated by fragments of single quartz grains with less abundant fragments of chert and mudstone. A sparse matrix contains grains of calcite and a few patches of sericite.


Shenfield
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Sample BR269454 Moosewood Cherty Arenite

Angular fragments of a variety of cryptocrystalline to extremely fine grained chert, mudstone (variable from sericite-rich to hematite-rich), quartz grains, and minor ones of siltstone, quartzite, and carbonaceous opaque. Fragments are closely packed, with a very sparse matrix dominated by sericite.

mineral	percentage	main grain size range
fragments		
chert	65-70%	cryptocrystalline-0.02
mudstone	12-15	cryptocrystalline-0.01
quartz	12-15	0.2-0.5
siltstone	0.5	0.005-0.02
quartzite	0.5	0.05-0.1
carbonaceous opaque	0.1	up to 0.8 mm long
chalcedony	0.1	0.05-0.08
matrix		
sericite	2- 3	0.005-0.015

Chert forms fragments varying widely in texture and grain size. A few contain several spheroids (0.05 mm) of quartz with radiating textures. One consists of semi-opaque chert that was cut by several wispy quartz veinlets. A few chert fragments contain patches of chalcedony, probably formed by recrystallization of silica. Several chert fragments contain minor to moderately abundant equant subhedral grains of pyrite (0.003-0.02 mm).

Mudstone forms angular equant to slightly elongate fragments that range from sericite-rich to hematite-rich.

Quartz forms equant grains.

Siltstone forms scattered fragments that contain abundant quartz grains (0.02-0.05 mm) in a sparse to moderately abundant mudstone matrix.

Chalcedony forms a few fragments, some elongate, that consist of fan-textured aggregates of quartz, with individual grains up to 0.1 mm long. Some have a centreline.

Quartzite forms a few fragments of equant quartz grains. One fragment of quartz vein or quartzite was deformed strongly.

A few elongate fragments of carbonaceous opaque have a texture suggesting that they represent altered wood fragments. The largest contain minor flakes of muscovite parallel to the length of the fragment.

Sample 8R269455 Moose Mountain Siltstone

The sample is of well sorted slightly foliated siltstone containing angular fragments of quartz and much less abundant ones of mudstone and chert, moderately abundant ones of carbonaceous opaque, and minor ones of muscovite, tourmaline, and chalcedony in a moderately abundant cryptocrystalline matrix of uncertain composition, probably dominated by plagioclase, quartz, and sericite. Rare fragments are of zircon and tourmaline.

mineral	**percentage**	**main grain size range**	
detrital			
quartz	50-55%	0.03-0.1	(a few up to 0.25 mm)
mudstone	12-15	0.003-0.01	
chert	7- 8	0.002-0.005	
carbonaceous opaque	0.5	amorphous	
hematite	0.1		
muscovite	0.1	0.05-0.15	
chalcedony	minor	0.07-0.1	
tourmaline	minor	0.03-0.07	
latite	trace	0.02-0.05	
Ti-oxide	trace	0.003-0.01	
zircon	trace	0.03-0.05	(one 0.1 mm long)
apatite	trace	0.05-0.07	
groundmass			
plagioclase-quartz-sericite	20-25	0.002-0.005	

Quartz forms equant to locally elongate angular grains.

Mudstone forms slightly elongate grains, many of which have a weak to moderate foliation. They range from sericite-rich to hematite-rich.

Chert forms equant to slightly elongate fragments. A few fragments were recrystallized slightly to moderately to coarser grained aggregates, some with the texture of chalcedony.

Carbonaceous opaque forms slightly to moderately elongate fragments from 0.1-0.25 mm long and locally up to 0.4 mm long. A few slender fragments are from 0.4-1.0 mm long; many of these have irregular outlines. Most carbonaceous opaque fragments show no internal structure, and one has an internal structure suggesting it originated from wood. .

Muscovite forms stubby to elongate flakes.

Chalcedony forms a few fragments.

Tourmaline forms equant grains with pleochroism from pale to light yellowish green, and locally from pale green to medium/dark slightly bluish green.

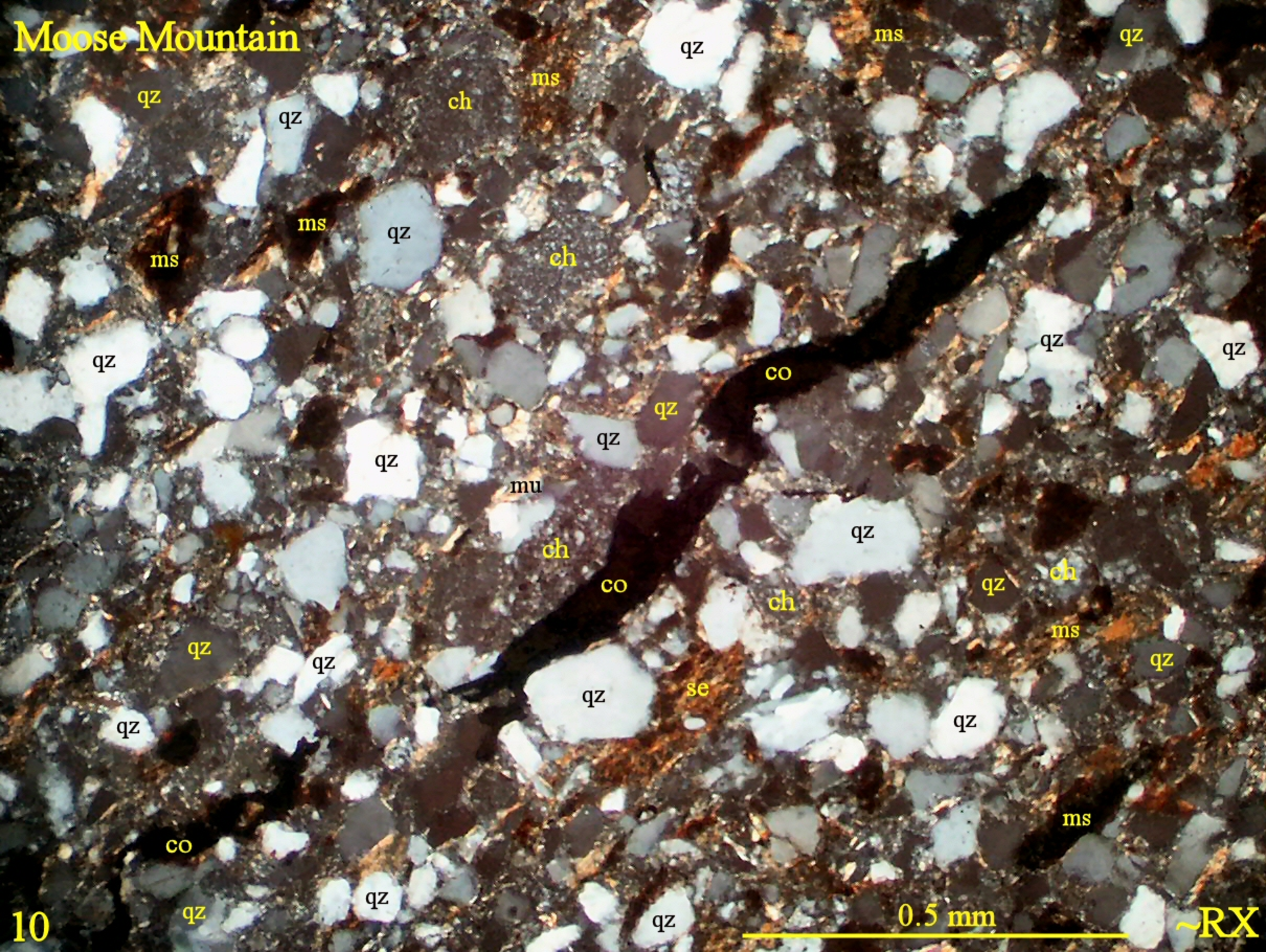
One slightly elongate fragment is of hypabyssal latite that consists of interlocking equant to slightly prismatic plagioclase grains.

Ti-oxide (probably after ilmenite) forms one fragment 0.18 mm across.

Zircon forms equant subangular to subrounded grains.

Apatite forms subrounded grains.

The groundmass is cryptocrystalline and probably consists of plagioclase, quartz, and sericite.


Moose Mountain
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Sample 8R269457 Bingay Cherty Arenite

The sample is of well sorted arenite containing angular fragments of quartz, chert, cherty mudstone, and mudstone (ranging from sericite-rich to hematite-rich) with minor fragments of latite/quartzite, quartzite, siliceous siltstone, carbonaceous opaque, chalcedony, and hematite in a very sparse groundmass of quartz-sericite with trace calcite.

mineral	percentage	main grain size range
detrital		
quartz	45-50%	0.2-0.5
chert, cherty mudstone	25-30	0.005-0.01
mudstone	15-17	0.005-0.01
latite	0.3	0.02-0.05
quartzite	0.2	0.03-0.05
chalcedony	0.2	0.03-0.05
carbonaceous opaque	0.2	amorphous
siliceous siltstone	0.1	0.02-0.03 (quartz grains); 0.005-0.01 (groundmass)
hematite	0.1	0.02-0.05
tourmaline	trace	0.12
Ti-oxide	trace	0.15
zircon	trace	0.07
groundmass		
quartz-sericite	2- 3	0.003-0.015
calcite	trace	0.05-0.1

Quartz forms equant to slightly elongate single grains.

Chert forms equant angular fragments with grain size ranging from cryptocrystalline to 0.015 mm. Some grains contain slightly coarser recrystallized patches of quartz or chalcedony. A few fragments contain abundant hematite. Scattered fragments are of cherty mudstone that is similar to cryptocrystalline chert with the addition of sericite and hematite.

Mudstone forms equant to slightly elongate fragments composed of various combinations of sericite and hematite/limonite, with most being hematite-rich.

Latite forms a few equant fragments consisting of slightly interlocking grains of plagioclase that was altered slightly to dusty sericite.

Quartzite forms a few fragments up to 0.5 mm in size of aggregates of equant quartz grains. One very fine grained quartzite fragment also contains 2-3% sericite.

Chalcedony forms a few angular elongate fragments consisting of fan-textured aggregates.

Carbonaceous opaque forms one irregular fragment 1.3 mm long, a few elongate, irregular fragments up to 0.3 mm long and a few equant fragments up to 0.2 mm across. Some of the carbonaceous fragments, including the largest one, are concentrated in one layer that is perpendicular to the length of the section. A few hematite-rich mudstone fragments contain seams of carbonaceous opaque up to 0.015 mm wide.

A few fragments up to 0.5 m long are of siliceous siltstone consisting of equant angular quartz grains (0.02-0.03 mm) in a groundmass of much finer grained quartz, in part cherty.

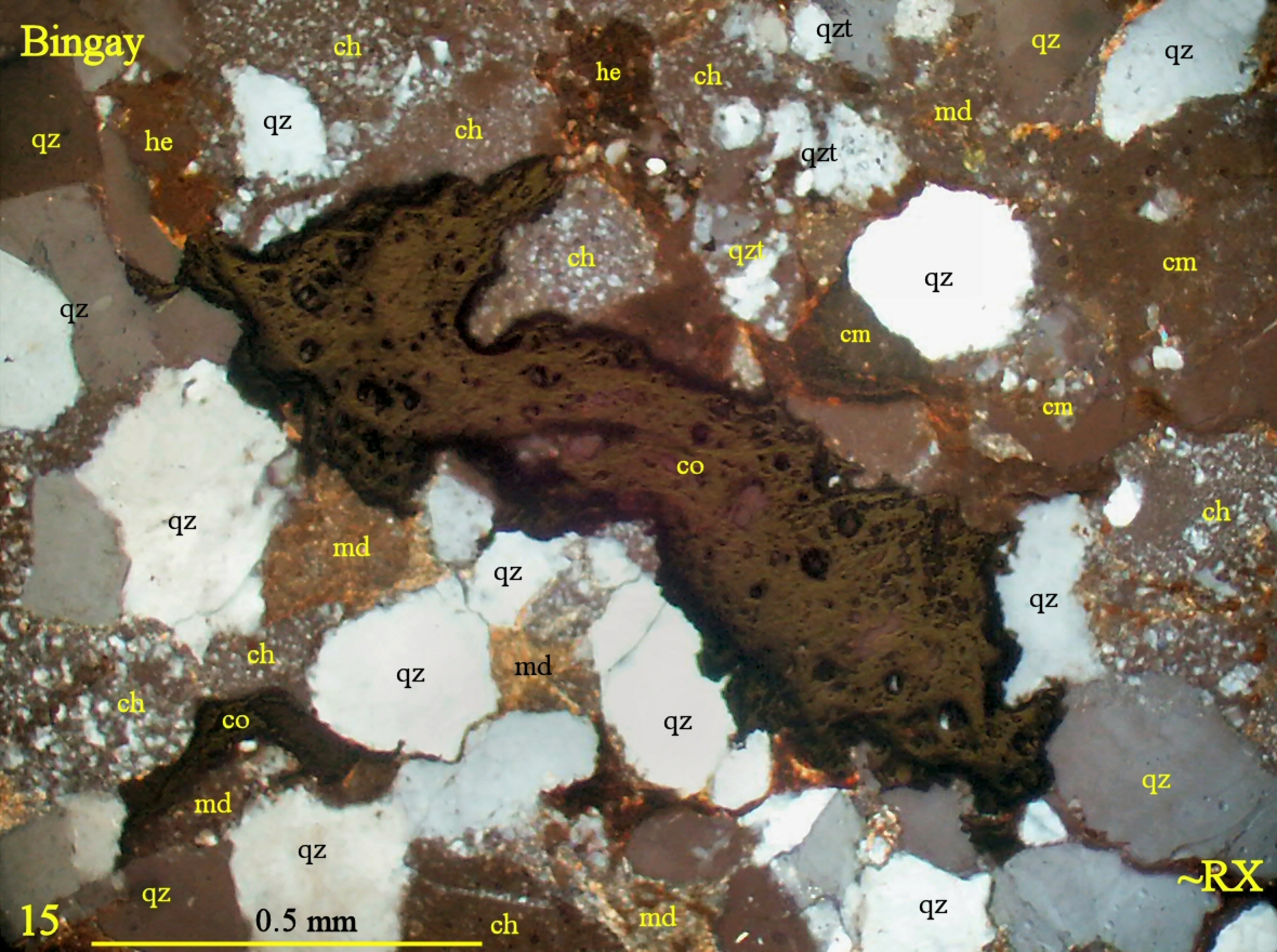
A few fragments up to 0.3 mm in size are of hematite or dominated by hematite. In some of these hematite has euhedral outlines and locally contains minor relic cores of pyrite.

Tourmaline forms one equant grain that is colour zoned with pleochroism from pale to medium orange and green.

(continued)

Ti-oxide (after ilmenite) forms one patch 0.15 mm long.
Zircon forms one angular grain in chert.

The sparse groundmass is similar texturally to some of the mudstone fragments and is difficult to distinguish from small mudstone fragments.
Calcite forms a few equant grains.


Bingay
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Photographic Notes:

The scanned sections show the gross textural features of the sections; these features are seen much better on the digital image than on the printed image. For the photographs, sample numbers are shown in the upper left corner, photo numbers are shown in the lower left corner, and the letter in the lower right corner indicates the lighting conditions: P = plane light, X = plane light in crossed nicols; R = reflected light, RP = reflected light and plane incident light; ~RX = reflected light in moderately crossed nicols and incident light in crossed nicols. Locations of photographs are shown on the scanned sections.

List of Photographs
(page 1 of 2)

Photo	Section	Description
01	Sierra	equant grains of quartz, micritic calcite (mc; stained orange by limonite), sparry calcite (minor limonite along margins of some), with abundant equant to elongate zircon grains, one grain of rutile, and a few grains of chert.
02	Sierra	equant grains of quartz, micritic calcite (mc; stained orange by limonite) and calcite (ct, some with rims of limonite/hematite), with minor fragments of chert and zircon; cut by veinlet of calcite-quartz with diffuse margins; top left: cavity in core of vein zone parallel to foliation; moderately more abundant patches and lenses of opaque/hematite in envelope about this zone.
03	Sierra	equant grains of quartz, micritic calcite (mc; stained orange by limonite), less abundant calcite (ct; commonly with limonite rim), and minor chert; late veinlet of calcite with cavity in core and with abundant lenses of hematite in an envelope up to 0.3 mm wide.
04	Shenfield	variety of fragments of chert, chert with patches of quartz (ch/qz), muddy chert (ch/cm, cm), and mudstone (md), and a few grains of quartz. One mudstone fragment has abundant sericite and two others do not. Matrix is sparse or non-existent.
05	Shenfield	quartz-rich band dominated by quartz grains with much less abundant fragments of chert, chert with quartz grains, quartz aggregates, and mudstone; the sparse matrix contains scattered grains of calcite and patches of sericite; the surrounding rock contains fragments of chert, cherty mudstone, and quartz in a sparse matrix of sericite and minor calcite.
06	Shenfield	angular fragments of chert, some recrystallized, some with disseminated grains of quartz, one of chalcedony/recrystallized chert (cc); a few of cherty mudstone to silty mudstone (cm), the latter with disseminated quartz grains, mudstone, in part moderately to strongly hematitic; a few of single or double quartz grains and minor groundmass of sericite, hematite, and calcite.
07	Moosewood	fragments of chert of various grain sizes between fragments, some with minor sericite and hematite, one with quartz spherulites; fragments of quartz grains, fragments of mudstone, mainly hematitic and one sericite-rich fragment; one fragment of siltstone containing quartz grains and one ragged sericite/muscovite flake in a cherty groundmass.

List of Photographs

(page 2 of 2)

Photo	Section	Description
08	Moosewood	elongate fragment of quartzite, fragments of chert, cherty mudstone (cm), quartz, chalcedony, cherty chalcedony (ch/cc), mudstone with patches of hematite and one irregular one large of carbonaceous opaque, and cherty siltstone (st; quartz grains in a cherty matrix); no obvious matrix.
09	Moosewood	fragments of quartz, chert, chert with patches of quartz, quartzite, mudstone, sericite-rich mudstone, cherty mudstone, and one elongate fragment of carbonized wood; no obvious matrix.
10	Moose Mountain	equant angular fragments of quartz, less abundant ones of chert and mudstone (varies from hematite-rich to sericite-rich), and elongate fragments of carbonaceous opaque with irregular outlines, minor muscovite flakes; extremely fine grained to cryptocrystalline groundmass probably of quartz-plagioclase-sericite is difficult to distinguish optically from very fine mudstone and chert fragments.
11	Moose Mountain	equant angular fragments of quartz, less abundant ones of chert and mudstone (varies from hematite-rich to sericite-rich), equant to irregular patches of carbonaceous opaque, one large grain of hematite, one fragment of hypabyssal latite consisting of plagioclase, one fragment of siliceous siltstone (st), and one flake of muscovite; extremely fine grained to cryptocrystalline groundmass probably of quartz-plagioclase-sericite is difficult to distinguish optically from very fine mudstone and chert fragments.
12	Moose Mountain	equant angular fragments of quartz, less abundant ones of chert and mudstone (varies from hematite-rich to sericite-rich), elongate, irregular fragments of carbonaceous opaque, one fragment of Ti-oxide (after ilmenite?), one flake of muscovite; extremely fine grained to cryptocrystalline groundmass probably of quartz-plagioclase-sericite is difficult to distinguish optically from very fine mudstone and chert fragments.
13	Bingay	equant angular fragments of quartz, chert, cherty mudstone (one with patches of hematite) and mudstone (mainly hematite-rich, one sericite-rich); no matrix.
14	Bingay	equant angular grains of quartz, chert, cherty mudstone, and mudstone (mainly hematite-rich with one sericite-rich fragment), with two fragments of latite (equant plagioclase with dusty sericite), and one fragment of hematite-carbonaceous opaque.
15	Bingay	large and small irregular carbonaceous fragments, fragments of quartz grains, chert, cherty mudstone, sericite-rich mudstone, quartzite, and hematite.

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Tel: (604)-597-1080
email: jppayne@telus.net

Appendix VI

2012 Geochemcial Characterization Report (by Access)

(Include: Field Work Memorandum – Field Cell Set-Up)

ACCESS

BINGAY CREEK COAL PROJECT
GEOCHEMICAL CHARACTERIZATION REPORT

Prepared for:

CENTERPOINT GROUP

April 2012

LIST OF TABLES

LIST OF FIGURES

Appendix: 2012 October Field Work-FINAL

1 INTRODUCTION

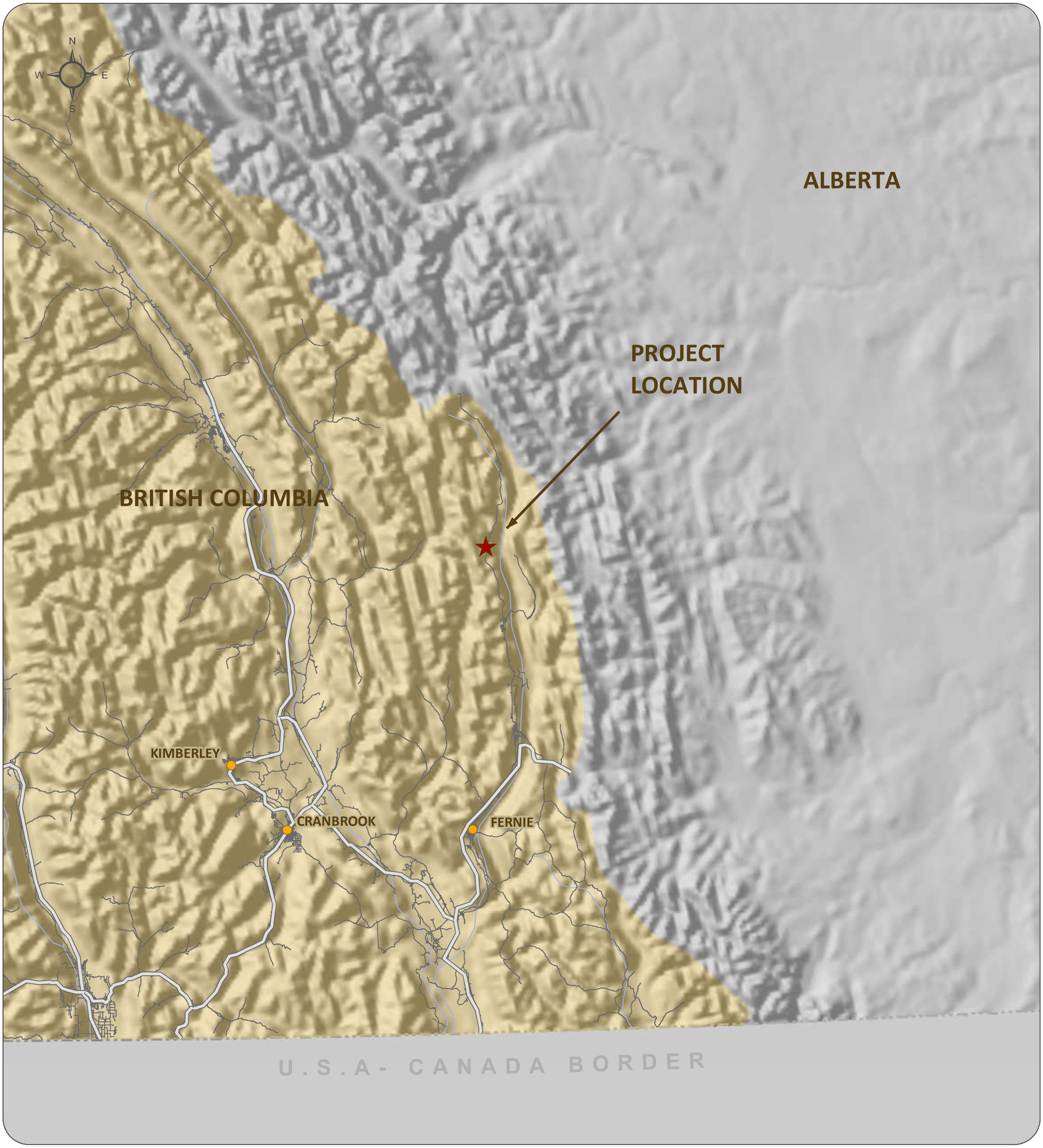
Access Consulting Group (Access) was retained by Centermount Coal Ltd (CCL) to conduct a geochemical characterization program to support assessment and permitting of the Bingay Creek Coal project in south-eastern British Columbia. This report summarizes the results of the geochemical characterization program that was initiated during 2011 for CCL. The report also contains a brief discussion of the geochemical characterization programs that are intended to be conducted during 2012 to support the assessment and permitting on this project.

1.1 PROJECT LOCATION

The Bingay Main property is situated in the Elk River valley in south-eastern British Columbia, Canada, approximately 21 km north of the community of Elkford. The property covers an area of 1175 ha, and is bounded to the west by longitude 115°00' W, to the south by latitude 50°10' N, to the east by the Elk River, and to the north by latitude 50°15' N. Figure 1 shows the location of the project in the SE region of British Columbia.

The Bingay Main property is centered on Bingay Hill, a small hill that rises approximately 100 m above the surrounding terrace at the confluence of the Elk River and Bingay Creek. The Elk River valley is a north-south trending valley that lies at an elevation of 1350 m in the project area. Adjacent to the project, the Elk River is a wide, extensively braided river with a floodplain approximately 300 to 600 m wide. Large terraces, approximately 25 to 50 m above the floodplain, are adjacent to the river on either side. The valley bottom itself is approximately 2.5 km wide, and rises steeply 600 to 800 m to the ridge tops.

Several watercourses are present within the project area. The dominant feature is the Elk River, which flows from north to south along the eastern edge of the property. Several tributaries to the Elk River transect the property from west to east. From south to north, these are Bingay Creek, No Name Creek 1, Hornickel Creek, No Name Creek 2, and Forsyth Creek. Several small isolated ponds are present on Bingay Hill at the south end of the property, and a large wetland complex is present at the north end of the property associated with No Name Creek 2.



BINGAY CREEK COAL PROJECT

FIGURE 1

BINGAY CREEK PROJECT LOCATION

ACCESS

1.2 SITE GEOLOGY

The following geological information is found in Section 3.0 of the Bingay Project pre-feasibility study (CCL, 2012), and represents a concise summary of geological conditions at the site.

> "The Bingay Main property includes the western margin of the Elk Valley coalfield. The coalfield is an infaulted remnant of a substantially larger body of coal-measures, correlative with the Crowsnest Basin to the south and the Highwood Pass/Mount Allen/Canmore coalfields to the north. During deposition of the Mist Mountain coal-measures, the Fernie Sea (the local name for the Interior Seaway) lay to the east and Northeast, and orogenically-elevated highlands lay to the Southwest. Figure 2 shows a stratigraphic column of Bingay Main.
>
> Coal-measures in the Bingay Main area are hosted by the Mist Mountain Formation of the Kootenay Group, of latest Jurassic to earliest Cretaceous age. The Mist Mountain Formation is underlain by Jurassic rocks of the Morrissey and Fernie formations. At the crest of the Greenhills Range, east of the Bingay Main property, the Mist Mountain Formation is overlain by the younger coal-measures of the Elk Formation, also of Cretaceous age. Although younger coals are known from the overlying Elk Formation in the Greenhills Range, the Elk coals appear to have been stripped away by erosion within the Bingay Main property. Bedrock in the proposed mine area consists primarily of siltstone, mudstone and sandstone with interbedded coal seams, which are exposed in the central Bingay Hill and along the east side of the proposed open pit adjacent to the Elk River.
>
> Overburden, generally consisting of coarse sand and gravel is present on the west and north sides of the proposed pit area, and thick silt and clay is located on the north side of the pit area. Thin deposits of silty sand and gravel overlying bedrock are present on the proposed pit's south and east sides.
>
> The Bingay property is situated within the geologic Bingay Syncline, a steeply dipping bedrock fold which dips to the northeast beneath the Elk River. The syncline's southern nose extends along the southern slope of Bingay Hill above the north bank of Bingay Creek. Because of the synclinal structure, the bedding in the proposed mining area ranges between generally sub-vertical (45 to 65 degrees) to vertical. The eastern syncline limb is known to be significantly less steep than the western limb.
>
> The mudstone, siltstone and coal layers appear relatively soft, however coal-bearing erosion resistant sandstone layers form prominent bedrock ridges in the southwestern part of the proposed mining area and also along Bingay Creek.
>
> Numerous small faults have been observed in exploration rock core and geologic maps show the west-dipping Bourgeau Thrust Fault extending along the west part of the proposed mine area."

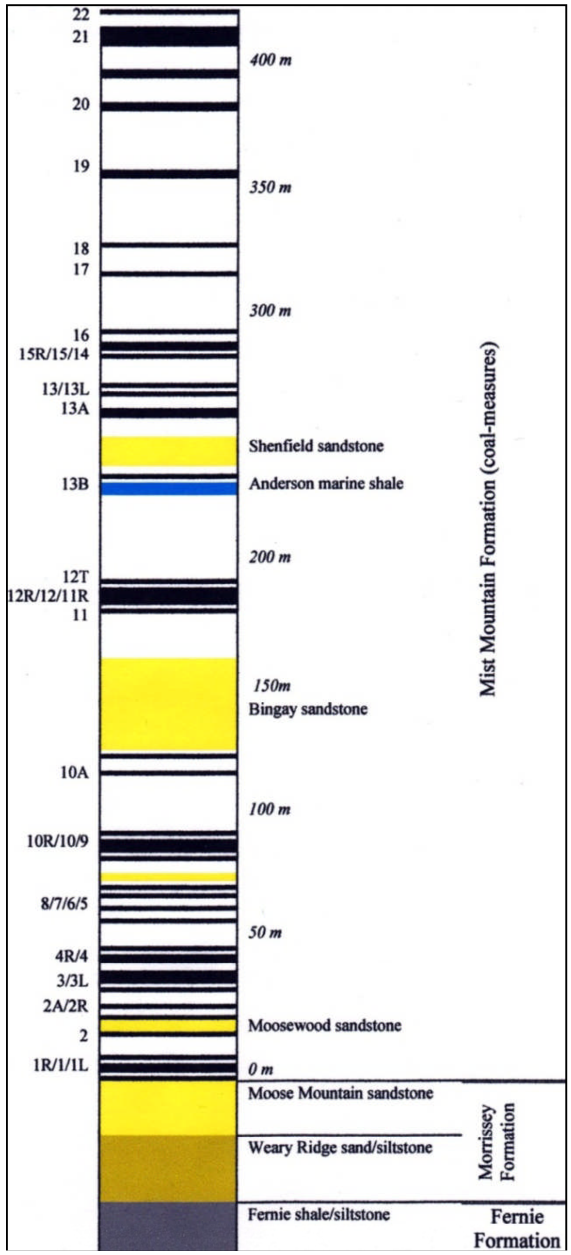


Figure 2: Bingay Stratigraphic Column (CCL, 2012).

2 PREVIOUS GEOCHEMICAL CHARACTERIZATION STUDIES

Two geochemical characterization studies have been conducted on the property by the Minesite Drainage Assessment Group (MDAG) in 2004 (MDAG, 2004a and MDAG, 2004b). These reports were conducted in a two (2) phased approach, with both studies being completed in November 2004. The focus of these two studies was to provide an initial assessment of the acid rock drainage and metal leaching (ARD/ML) potential of the Bingay Creek coal property. This section provides a brief summary of the results of these assessments.

2.1 MDAG PHASE 1 ML/ARD ASSESSMENT (MDAG, 2004A)

The assessment involved the collection of 18 samples from core that was drilled in 1983, and as such was approximately 21 years old. The use of older core was intended to provide kinetic conditions by which to evaluate the onset of acidic conditions. An additional 12 samples were collected from outcrops and trenches around the property.

The paste pH values of samples collected at the site ranged from 5.2 to 8.5 which showed that there is some acid generating potential contained within the rock from the site. There was no correlation found between sulphide content and paste pH.

Total sulphur ranged from 0.02 to 0.82% within rock lithologies sampled, excluding coal. High sulphur values, up to 5.35%, were found to occur within coal seam #13.

Sulphide sulphur was found to be the dominant form of sulphide mineralization in the samples representing approximately 70% of the total sulphur. Barium sulphate (barite) was found to also be present in the samples.

Neutralization potential (NP) in the samples was determined to be provided by dolomite and calcite.

The unavailable NP in the samples was found to range between 2 to 10 kg CaCO3/tonne. Correlation of inorganic carbon-NP and bulk-NP was strong for samples with an NP value greater than 30 kg CaCO3/tonne, while below 10 kg CaCO3/tonne there was no correlation.

The study determined that there was potential within some of the samples for long-term net acid generation. The number of samples with potential to generate acidity was determined to be dependent on the amount of unavailable NP within the rock.

A screening level evaluation of metal leaching potential was based on whole rock ICP-MS and a comparison to crustal abundance values for individual elements. This initial screening identified the potential f l leaching of silver, bismuth, cadmium, gallium, selenium and thallium. No extractive test work was conducted during this phase of the assessment.

Arsenic and selenium showed some correlation with sulphide concentrations. This indicates that the rate of release of these elements will be controlled to a degree by the oxidation of sulphide minerals within the host rocks.

Selenium concentrations were found to be similar in magnitude to those reported from nearby coal mines which are hosted within the same geologic formation.

Two water samples were collected from the #10 and #12 coal seams. These samples had alkalinity values that were s significantly greater than acidity values, thus resulting in pH values greater than 7. Sulphate within the water samples was less than 10 mg/L. These results were taken to indicate that there were no ARD concerns from the time period that the samples were taken.

2.2 MDAG PHASE 2 ML/ARD ASSESSMENT (MDAG, 2004B)

This second assessment focused on the analysis of 78 samples from a single drill hole on the property. The assessment work did not analyze coal seams within the drill hole.

Paste pH values in the analyzed samples were all greater than or equal to 7.0 indicating that there is currently no acid generation within the deposit under in-situ conditions.

Total sulphur in the samples ranged from 0.03 to 1.09% with only three samples having total sulphur content above 0.5%. The highest total sulphur contents were found in samples from the sandstone, siltstone and shale units. Sulphide sulphur was found to represent approximately 92% of the total sulphur. The bulk NP in the samples ranged from 5 to 444 kg CaCO3/tonne. Inorganic carbon correlated well with bulk-NP above 20 kg CaCO3/tonne which represents most of the samples analyzed.

A screening level evaluation of metal leaching potential based on ICP-MS and crustal abundances showed similar results as those from the first phase of assessment.

Using an adjusted sulphide based neutralization potential ratio (SNPR) and correcting for unavailable NP it was determined that eight samples would be classified as acid generating with an additional two samples being considered as uncertain due to an SNPR between 1 and 2. All samples with an NP greater than 34 were classified as being net acid neutralizing with no potential for acid rock drainage.

An evaluation of lithology was conducted on the samples from the borehole to determine geochemical trends. A minor amount of the sandstone (2/32 samples) and siltstone (4/32 samples) units were classified as having the potential for acid generation concerns based on the SNPR value. One sample of the mudstone was identified as having uncertain acid generation potential.

3 STUDY APPROACH

The geochemical characterization program consisted of data analyses and the integration of two distinct data components:

(1) A variety of static test data on 222 samples selected by ACCESS from diamond drill holes (DDHs) core from 17 DDHs drilled during 2010 and 2011
(2) 381 contiguous samples for contained selenium via low level ICP conducted on a subset of three of the 2010 DDHs. The 381 selenium samples were collected by CCL and analyzed by Elk Valley Environmental Services, Sparwood BC.

This report builds upon results from the MDAG studies (MDAG, 2004a and MDAG, 2004b). The conclusions presented by MDAG were integrated into the recommendations presented in this report forming a potential waste rock management strategy.

3.1 SAMPLE COLLECTION

Sampling of diamond drill core was conducted by Access personnel during a visit to the project site between November 14 and November 18, 2011.

The following list of assumptions was used in order to guide the sample selection process:

[redacted]

100% of waste rock excavation is to come from the open pit portion of the project.
Underground mining operations will not generate additional excavation of waste rock to surface.
A pit floor elevation of 1355 meters above sea level (masl) was assumed at the time of the study.

In order to focus on rock likely to be excavated during operations, only DDHs sited within the pit, or drilled into the pit were selected for sampling. In addition, samples were chosen from drill core at an elevation above 1355 masl, as this was the proposed elevation of the pit floor according to CCL. Sampling was conducted in order to maximize spatial representation and distribution from the available drill holes. In order to maximize spatial distribution, sampling of DDHs with shared collar locations was concentrated slightly toward the bottom of each drill hole and above the 1355 masl cutoff.

Three main rock lithologies, which comprised over 75% of all of the samples, were noted on the Bingay Creek Property including mudstone, siltstone and sandstone. Sandstone was further differentiated into several sub-lithologies including the Moose Mountain Sandstone, Anderson Sandstone, and Weary Ridge Sandstone, but none of these exceeded 1.6% of the total number of samples. It should be noted that the number of samples provides a reasonable estimate, but does not necessarily accurately represent the actual relative volumes of the each lithology present in the proposed open pit. The estimate of relative volumes of each lithology is improved by summing the interval thicknesses for each lithology. These percentages may be useful as a first approximation for the relative expected proportions of each lithologies generated from the open pit, but are subject to the spatial distribution limitations of the DDH locations. A summary of the relative frequencies of sampling from the 17 DDHs within the proposed pit footprint and above 1355 masl in elevation, from which geochemical testing samples were taken, is provided in Table 1.

Table 1: Summary of Bedrock Samples above 1355m Elevation

Description	Lith Code	# of Sample Intervals	Rel. Frequency (# of Samples)	Sum of Interval Thicknesses (m)	Rel. Frequency (Thickness)
Coal	CL	208	20.9%	131.6	13.3%
Ironstone	IS	9	0.9%	2.9	0.3%
Mudstone	MS	199	20.0%	155.0	15.7%
Shenfield Siltstone	SSLTS	4	0.4%	5.0	0.5%
Siltstone (Undifferentiated)	SLTS	327	32.9%	402.9	40.7%
Sandstone (Undifferentiated)	SS	220	22.1%	260.8	26.4%
Moose Mountain Sandstone	MMSS	16	1.6%	20.1	2.0%
Anderson Sandstone	ANSS	6	0.6%	4.4	0.4%
Weary Ridge Sandstone	WRSS	5	0.5%	6.6	0.7%
Total		**994**	**100.0%**	**989.4**	**100.0%**

3.2 NUMBER OF SAMPLES

A total of 222 samples were collected by Access from the 17 DDHs from within the open pit footprint. Figure 3 shows the location of the drill holes used in the sampling program along with the preliminary pit shell outline that was available at the time of the sampling in November of 2011. It should be noted that subsequent revisions to the mine plan have resulted in a different pit shell than what is shown in Figure 3. All were submitted to SGS Minerals of Burnaby, BC for static geochemical testing. All samples were analyzed for metals using 31 element ICP-MS (aqua regia digestion) including selenium with a 0.1 ppm detection limit. A subset of 110 samples were analyzed for the full suite of acid base accounting (ABA) using the standard Sobek method with sulphate via HCl digestion.

Total inorganic carbon (TIC) was used to calculate the carbonate neutralization potential (NP_{carb}) and was analyzed using HCl digestion and coulometric titration. The remaining 112 samples were analyzed for TIC and total sulphur via the Leco furnace method, with sulphate measurements evaluated by HCl digestion. A total of 86 out of the 110 samples for which the full suite of ABA results were obtained, were also subjected to 24 hour shake flask extraction (SFE) tests using deionized water with a 3:1 water to solids ratio. The SFE supernatant water was then analyzed for pH and dissolved metals.

MEND, 2009 provides broad guidance on adequate sample representation. The number of samples collected for this study is generally consistent with the recommendations on adequate sampling numbers in MEND, 2009 for a prefeasibility level assessment for a project of Bingay Creek's size.

The number of samples selected for analyses approximately represents the relative frequencies of each lithology within the footprint of the open pit area and is shown in Table 1. A summary of the lithologies samples that were collected by ACCESS, for each type of static test analysis is provided in Table 2.

Table 2: Summary of Static Testing by Lithology

Description	Lith Code	Count of ICP	Count of ABA	Count of S+TIC	Count of SFE
Coal	CL	34	32	11	20
Ironstone	IS	2	2	0	2
Mudstone	MS	51	19	32	15
Shenfield Siltstone	SSLTS	2	0	2	0
Siltstone (Undifferentiated)	SLTS	74	37	37	30
Sandstone (Undifferentiated)	SSLTS	53	25	27	16
Moose Mountain Sandstone	MMSS	3	2	1	1
Anderson Sandstone	ASS	1	1	0	1
Weary Ridge Sandstone	WRSS	2	1	1	1
Total		**222**	**110**	**112**	**86**

In addition to the above sample collection, a total of 21 samples (7 samples from each major waste rock lithology) were collected by ACCESS from the core of 17 DDHs during the geochemical sampling program and were delivered to CCL, for the determination of specific gravities (SG) f .

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Siltstone (Undifferentiated)	SLTS	74	37	37	30
Sandstone (Undifferentiated)	SSLTS	53	25	27	16
Moose Mountain Sandstone	MMSS	3	2	1	1
Anderson Sandstone	ASS	1	1	0	1
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Total		**222**	**110**	**112**	**86**

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4 RESULTS

Data were compiled and analysis carried out using Excel™ and XLSTAT™ software. For the purpose of statistical analysis, all results below minimum detection limits were assigned a value of the detection limit. There was no exceedance of the upper detection limits for any of the parameters sampled.

The sample's lithological information and logging notes were determined by CCL geologists at the time of logging. At the time of sample collection, ACCESS noted that intervals assigned a certain lithology could contain significant proportions of a secondary lithology, generally intercalated over a scale of centimeters to meters. As indicated by the logging notes, assigned lithological codes may contain a secondary lithology of up to 50% of the interval. For example, an interval of sandstone should be interpreted as "predominantly sandstone". Minor lithologies including: Shenfield Siltstone, Moose Mountain Sandstone, Anderson Sandstone, and Weary Ridge Sandstone were grouped with the undifferentiated lithologies if no significant differences in values where noted. These minor lithologies were then plotted and group with the major undifferentiated lithologies. Where they differ in values it was noted in the body of text.

4.1 ACID ROCK DRAINAGE POTENTIAL

The summary statistics from the static acid base accounting (ABA) test of waste rocks during 2011 are shown below in Table 3. The waste rock types at Bingay Main average less than 0.2% sulphur with only a few samples having total sulphur contents greater than 0.2%. Sulphate sulphur in the waste rocks were low in all samples, which indicates that there has not been a great degree of weathering on the rocks post deposition and that sulphide sulphur is the dominant form of sulphur in the deposit. The mudstone unit had the highest average total sulphur content of the three primary waste rock units, with values of 0.16 and 0.13 kg $CaCO_3$/tonne respectively.

Total inorganic carbon (TIC) contents are typically greater than 1%, in all samples, with the mudstone unit having the lowest average TIC values. Given the prevalence of organic carbon in rock lithologies at Bingay Main, the TIC content of the rocks was used to determine the carbonate neutralization potential (NP_{Carb}). Neutralization potential (NP) measured using the Sobek method is referred to as NP_{Sobek}. The acid potential (AP) of the waste rocks sampled tends to be low due to the low sulphide sulphur content.

Figure 4 shows some of the results from the 2011 static test work program conducted on the Bingay Main waste rocks.

A sub-set of the samples were analyzed for NP_{Sobek} to understand the relation between these two measures of NP (NP_{Carb} and NP_{Sobek}). The results of this comparison are shown in Figure 6 along with a 1:1 dashed line. The results show that for the mudstone and siltstone units the NP_{Carb} is typically greater than the NP_{Sobek}. The sandstone unit values for these two measurements plots very near to the 1:1 line. The coal unit typically has an NP_{Sobek} value greater than that of the NP_{Carb}. Mineralogical analyses of the waste rock units at the site are needed to better understand the potential for non-carbonate inorganic carbon sources.

Table 3: Summary Statistics for Static ABA Testing of Bingay Main Waste Rock

Mudstone								
Parameter	TIC	T-S	S - SO_4	Sobek NP	$CaCO_3$ NP	AP	NPR_{Carb}	NPR_{Sobek}
Units	%	%	%	kg $CaCO_3$/tonne			unitless	
Count	51	51	51	20	51	51	51	20
Max	6.80	0.84	0.02	125.00	566.67	12.81	1888.89	128.00
Min	0.02	0.04	0.01	4.40	1.67	0.30	0.27	1.10
Average	1.02	0.16	0.01	40.92	84.69	1.78	122.04	37.96
P10	0.03	0.07	0.01	5.45	2.50	0.30	3.11	9.59
P50	0.24	0.13	0.01	23.50	20.00	0.94	25.00	33.17
P90	2.43	0.30	0.01	80.46	202.50	3.75	272.00	86.22

Values less than detection limit assigned a value equal to detection limit for statistical determination

Sandstone								
Parameter	TIC	T-S	S - SO_4	Sobek NP	$CaCO_3$ NP	AP	NPR_{Carb}	NPR_{Sobek}
Units	%	%	%	kg $CaCO_3$/tonne			unitless	
Count	59	59	59	29	59	59	59	29
Max	8.13	0.49	0.06	603.80	677.50	7.19	1605.56	1425.00
Min	0.06	0.03	0.01	8.60	5.00	0.30	4.59	4.17
Average	1.66	0.09	0.01	112.94	137.95	1.21	196.42	178.50
P10	0.28	0.04	0.01	17.82	23.67	0.30	24.09	15.36
P50	0.91	0.07	0.01	57.50	75.83	0.94	102.00	67.36
P90	3.45	0.14	0.03	255.86	287.50	2.31	475.20	462.14

Values less than detection limit assigned a value equal to detection limit for statistical determination

Siltstone								
Parameter	TIC	T-S	S - SO_4	Sobek NP	$CaCO_3$ NP	AP	NPR_{Carb}	NPR_{Sobek}
Units	%	%	%	kg $CaCO_3$/tonne			unitless	
Count	72	72	72	36	72	72	72	36
Max	6.57	0.65	0.02	434.10	547.50	15.63	1313.89	1154.67
Min	0.03	0.02	0.01	4.60	2.50	0.30	3.39	2.28
Average	1.53	0.11	0.01	110.43	127.89	1.81	127.71	114.77
P10	0.14	0.05	0.01	9.40	11.83	0.63	8.00	7.65
P50	1.33	0.09	0.01	62.15	110.42	1.25	74.17	44.29
P90	2.92	0.19	0.01	318.45	243.33	3.41	242.35	236.77

Values less than detection limit assigned a value equal to detection limit for statistical determination

The potential f (ARD) to occur at Bingay Main is highly dependent on the amount of unavailable neutralization potential (NP) within the different waste rocks. Prior geochemical characterization test work by MDAG (2004) showed that there could be as much as 10 kg CaCO3/tonne of unavailable NP in some materials. The sensitivity of material classification as being potentially acid generating (PAG) or non-acid generating (NAG) is shown in Table 3 with a comparison between TIC (%) and the corrected NP_{Carb} shown in Table 4. The results in the table show that the mudstone waste rock type has the highest likelihood of being classified as PAG materials, depending on the amount of unavailable NP.

Table 4: Comparison of the Effect of Unavailable Neutralization Potential on Materials Classification

Rock Type	Uncorrected NPR_{Carb}					Corrected NPR_{Carb} (-10 NP_{Carb})				
	<1	≥1 and ≤2	>2 and ≤4	>4	% PAG (≤2)	<1	≥1 and ≤2	>2 and ≤4	>4	% PAG (≤2)
Coal	16	0	6	17	41	32		1	6	82
Mudstone	3	2	8	38	10	22	0	0	29	43
Siltstone	0	0	2	70	0	8	0	1	63	11
Sandstone	0	0	0	58	0	3	0	1	54	5

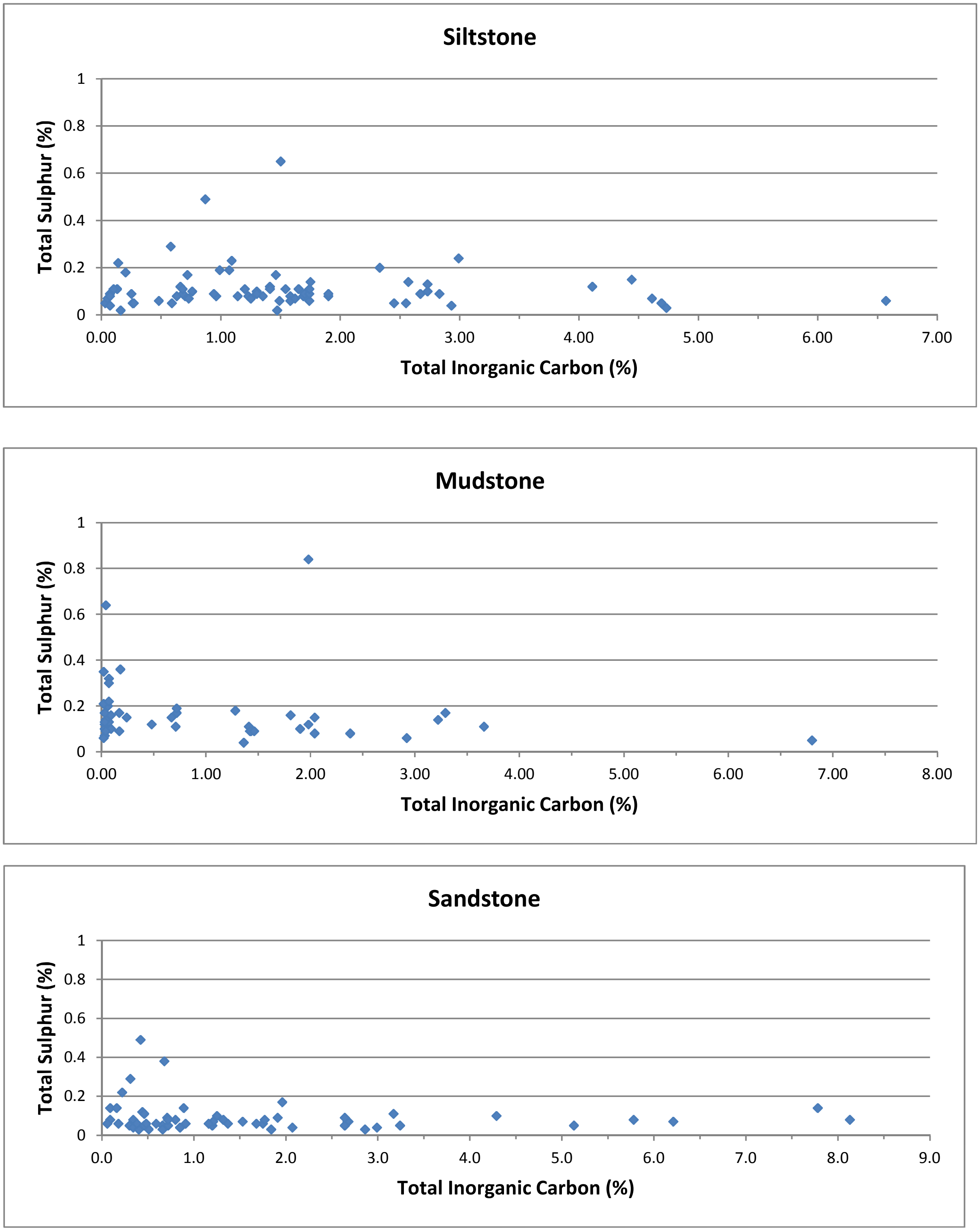
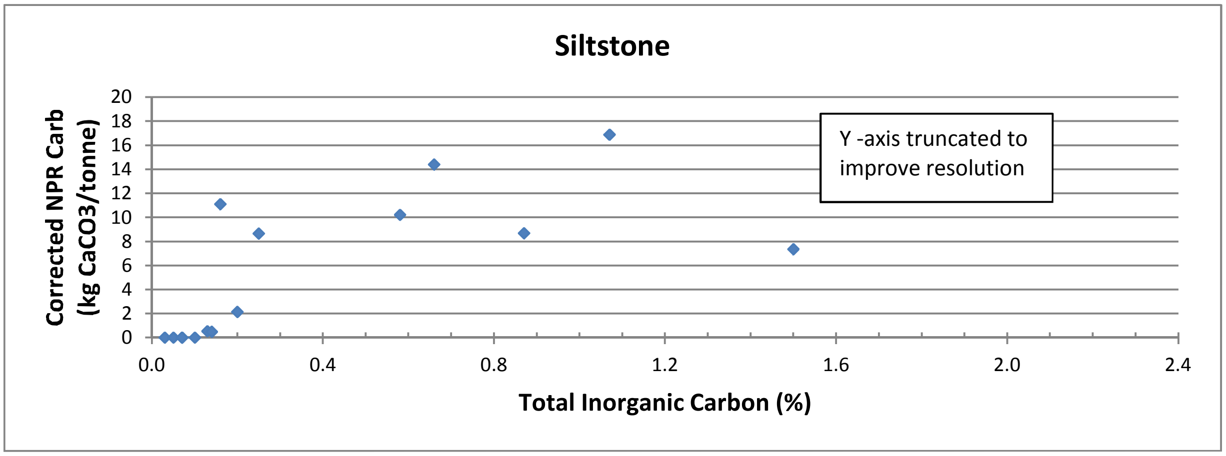
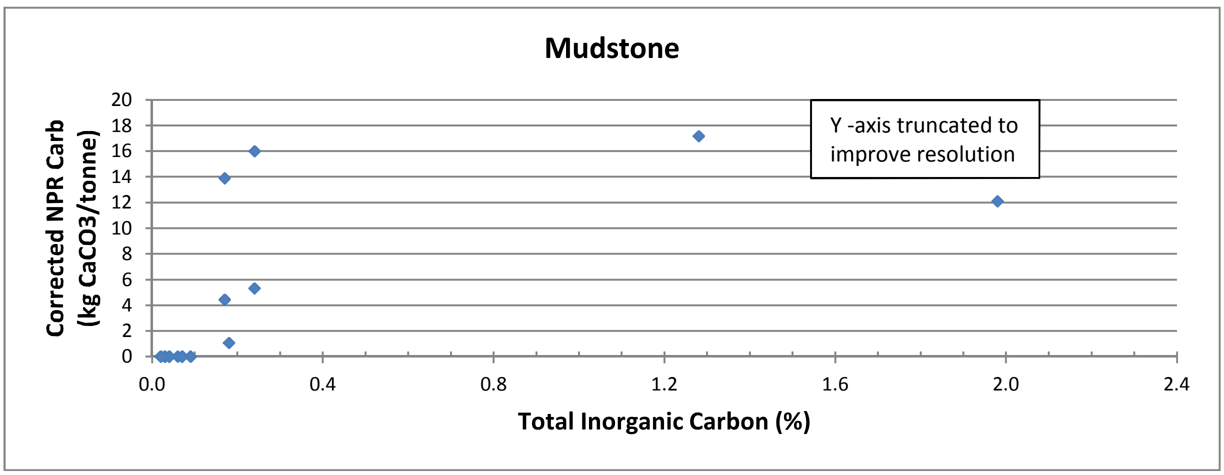


Figure 4: Total Sulphur versus Total Inorganic Carbon for Major Lithologies at Bingay Creek





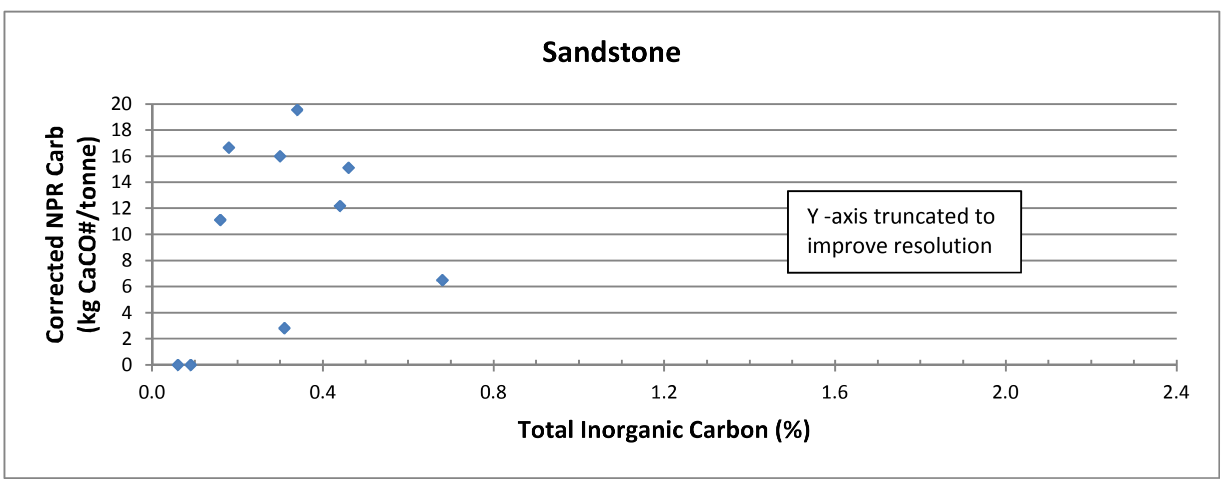


Figure 5: Corrected NP_{carb} versus TIC for Major Lithologies at Bingay Creek

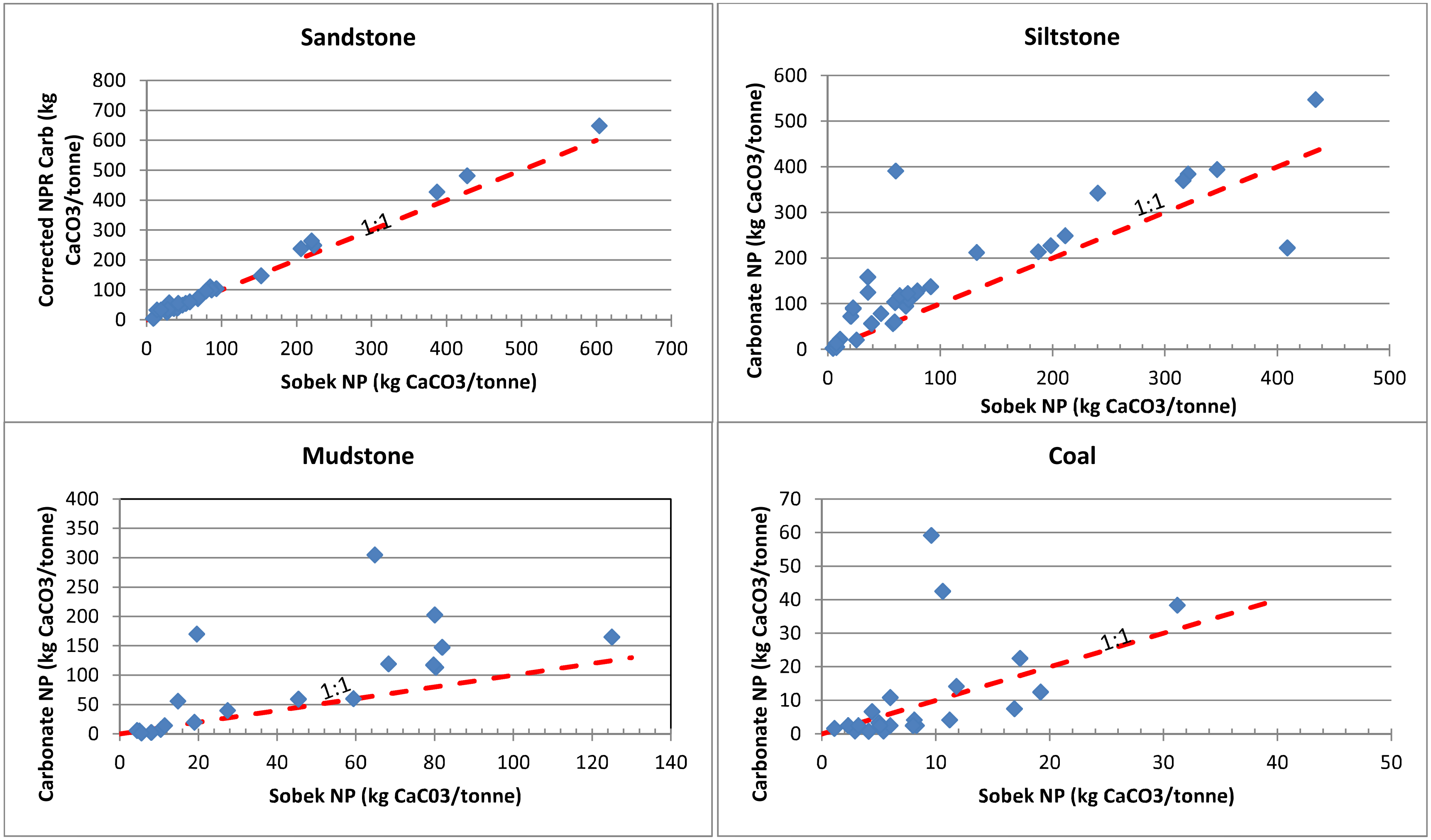


Figure 6: Carbonate NPR versus Sobek NP with a 1:1 Line

4.2 BARITE

Another factor that may affect the ABA classification of geologic material at this site is the presence of barite ($BaSO_4$) within the deposit. Barite has an extremely low solubility and is not considered to have potential to generate acid. The average barium contents for the major rock lithologies are as follows: mudstone 380 ppm sandstone: 300 ppm, siltstone 383 ppm with maximum barium contents of: mudstone 676 ppm sandstone: 2033 ppm, siltstone 671 ppm. Based on these mineral contents it is possible that the sandstone unit may have some samples with the potential for overestimation of the acid generation potential as a result of the presence of barite. The potential for the presence of barite to influence the materials classification is presented below in section 4.3.

4.3 METAL LEACHING POTENTIAL

There are three primary types of waste rock present at the Bingay Main site: mudstone, siltstone and sandstone. A minor amount of ironstone and marine sediments associated with the Anderson Formation are also present at the site; however the amount of these materials expected to be excavated as a result of open pit mining represent well less than 1% of the total waste rock to be disturbed through mining.

Selenium is the primary element of concern from a metal leaching perspective although an evaluation of the potential for metal leaching of other elements of potential concern was also conducted as part of the static geochemical characterization program. An evaluation of metal leaching potential was conducted using shake flask extraction (SFE) testing on 87 samples of the primary geological materials present at the site which are comprised of mudstone, siltstone, sandstone and coal. The procedure used for the SFE testing followed MEND, 2009 and utilized a 3 to 1 (3:1) water to solids ratio and de-ionized water as the extraction fluid.

The results of the SFE test work for the primary waste rock types are shown in Table 5. The SFE results show that all of the geologic materials at the site have the potential to leach selenium in excess of the Approved British Columbia Water Quality Guidelines (BCWQG) of 0.002 mg/L in any site discharge without any dilution. Figure 7 shows the results from the SFE testing versus the contained selenium content for the rock samples present at the site. The results show that for the coal, siltstone and sandstone units there is a slight increasing trend between selenium leaching and contained selenium. The mudstone unit appears to have a decreasing trend between selenium leaching and contained selenium. The sandstone rock type is associated with more than one geologic formation at the site and includes one sample of Moose Mountain Sandstone, one sample of Weary Ridge Sandstone and one sample of Anderson Sandstone.

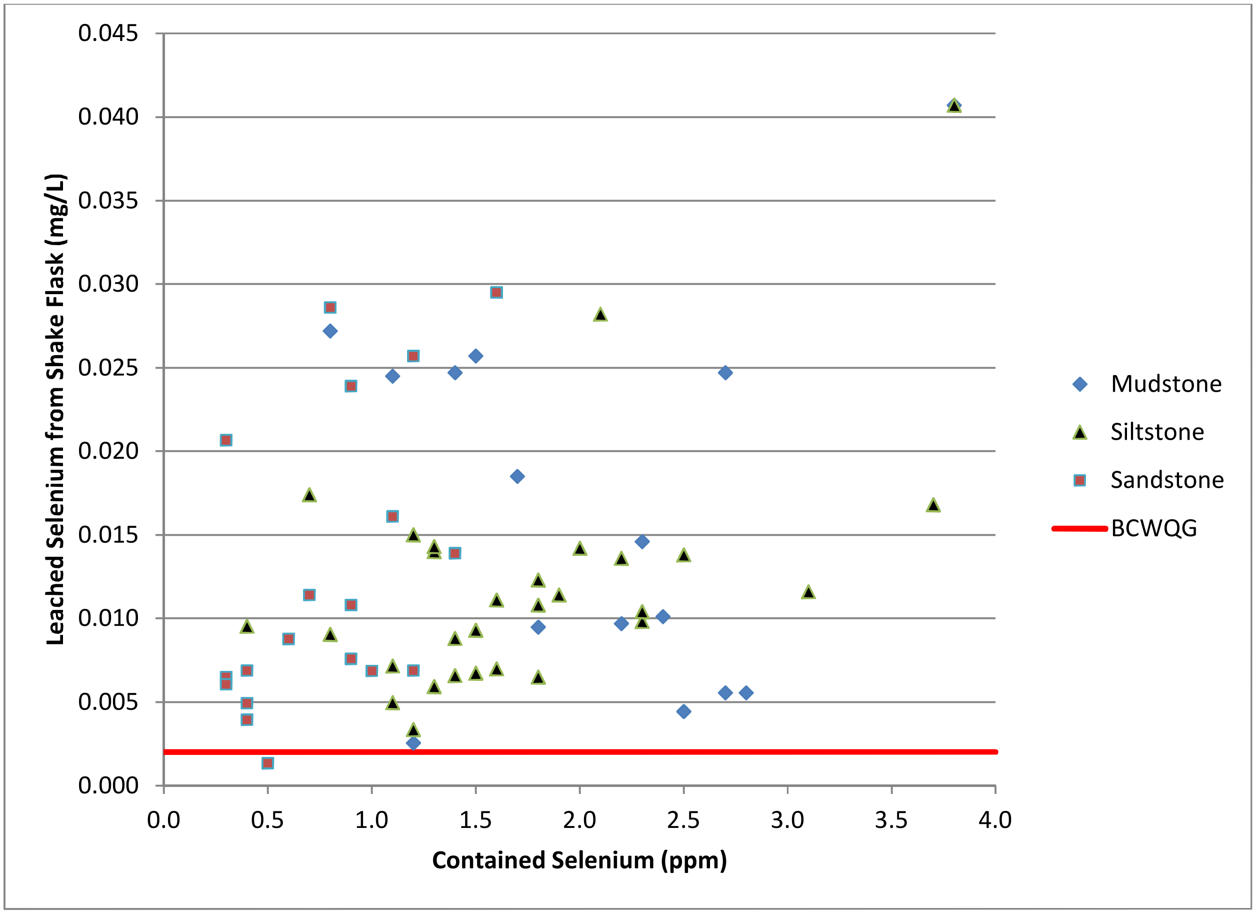


Figure 7: Selenium Shake Flask Extraction (SFE) results versus Contained Selenium

Table 5: Shake Flask Extraction Results for Select Parameters (unit in mg/L)

Mudstone												
Parameter	Hardness	Al	As	Cd	Cr	Cu	Fe	Pb	Mo	Ni	Se	Zn
Max	70.8	0.3840	0.0024	0.000093	0.0009	0.0016	0.064	0.01120	0.05820	0.0317	0.0407	0.029
Min	4.42	0.0419	0.0004	0.000003	0.0005	0.0005	0.003	0.00002	0.00920	0.0005	0.0026	0.001
Average	33.33	0.1130	0.0033	0.000017	0.0006	0.0008	0.011	0.00079	0.02915	0.0051	0.0165	0.004
P10	16.92	0.0498	0.0006	0.000003	0.0005	0.0005	0.003	0.00002	0.01982	0.0010	0.0049	0.001
P50	34.6	0.0813	0.0008	0.000011	0.0005	0.0005	0.005	0.00004	0.02770	0.0021	0.0146	0.002
P90	48.02	0.2114	0.0022	0.000032	0.0007	0.0014	0.023	0.00010	0.04050	0.0108	0.0266	0.006

Values less than detection limit assigned a value equal to detection limit for statistical determination

Sandstone												
Parameter	Hardness	Al	As	Cd	Cr	Cu	Fe	Pb	Mo	Ni	Se	Zn
Max	210	0.2860	0.0019	0.002990	0.0013	0.0498	0.876	0.01043	0.05850	1.7800	0.0286	0.799
Min	9.14	0.0129	0.0007	0.000003	0.0005	0.0005	0.003	0.00002	0.00103	0.0008	0.0013	0.001
Average	66.65	0.1080	0.0012	0.000278	0.0006	0.0035	0.060	0.00068	0.02258	0.1191	0.0117	0.047
P10	30.3	0.0306	0.0007	0.000005	0.0005	0.0005	0.003	0.00002	0.00294	0.0009	0.0046	0.001
P50	49.8	0.0964	0.0009	0.000019	0.0005	0.0005	0.003	0.00003	0.01810	0.0041	0.0082	0.002
P90	120.90	0.2413	0.0018	0.000552	0.0006	0.0016	0.042	0.00047	0.04157	0.0968	0.0244	0.010

Values less than detection limit assigned a value equal to detection limit for statistical determination

Siltstone												
Parameter	Hardness	Al	As	Cd	Cr	Cu	Fe	Pb	Mo	Ni	Se	Zn
Max	70.8	0.2240	0.0035	0.000093	0.0010	0.0019	0.028	0.00202	0.07920	0.0656	0.0407	0.029
Min	2.48	0.0354	0.0003	0.000003	0.0005	0.0005	0.003	0.00002	0.00771	0.0004	0.0034	0.001
Average	37.34	0.0911	0.0009	0.000016	0.0005	0.0010	0.007	0.00011	0.02900	0.0066	0.0121	0.005
P10	10.68	0.0419	0.0004	0.000004	0.0005	0.0005	0.003	0.00002	0.01126	0.0010	0.0064	0.001
P50	35.1	0.0813	0.0007	0.000010	0.0005	0.0009	0.005	0.00003	0.02320	0.0030	0.0108	0.002
P90	62.60	0.1496	0.0013	0.000029	0.0005	0.0017	0.013	0.00011	0.05772	0.0099	0.0169	0.013

Values less than detection limit assigned a value equal to detection limit for statistical determination

A single sample of the Moose Mountain sandstone unit was tested and this sample had a post SFE pH value of 5.63 and returned the highest results for aluminum, cadmium, copper, nickel and zinc. The Moose Mountain formation is not expected to represent a significant volume of waste rock; however, this unit will be assessed in greater detail as part of the ongoing geochemical characterization program for this project.

The results of the SFE evaluation for other elements of potential concern showed that there was an exceedance of the BCWQG for a couple of samples relating to chromium and zinc while other elements of potential environmental concern were below the relevant BCWQG. The SFE results for chromium and zinc are shown below in Figure 8 and Figure 9 respectively.

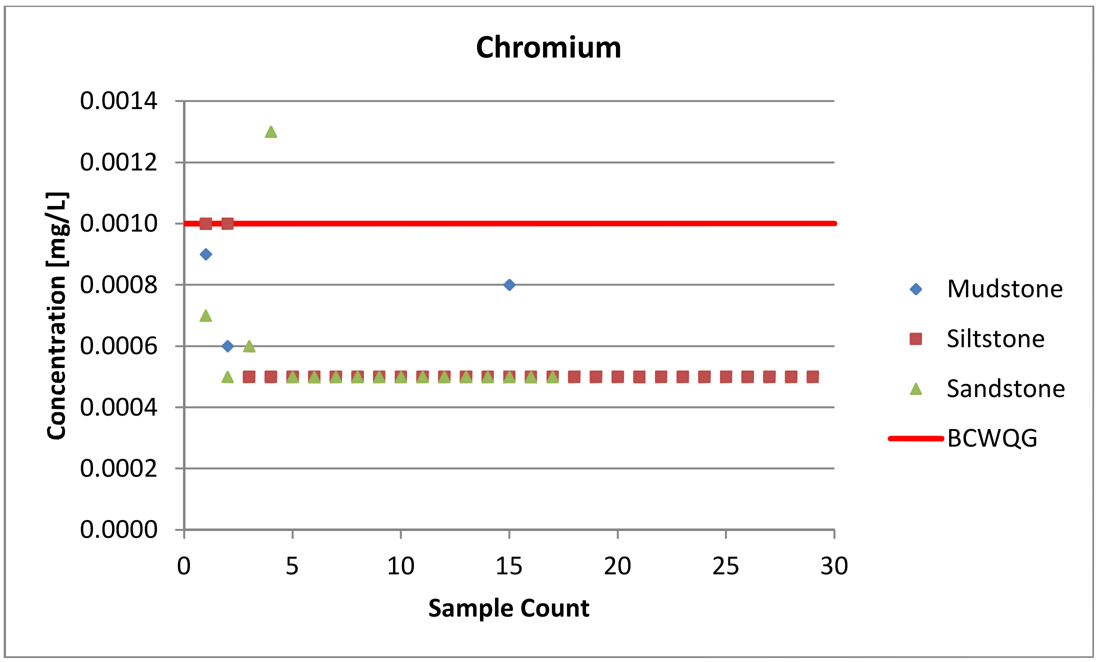


Figure 8: Chromium Shake Flask Extraction Results for Bingay Creek Lithologies

4.4 ELEMENTAL CONTENT RESULTS

The results of the analyses for contained metals were used to develop summary statistics for each element. This information is presented in Appendix 3 and is used to understand the distribution and range of elemental content within the Bingay Creek waste rock. These analyses are intended to be used primarily to assist in the selection of samples for the establishment of the kinetic testing program. These statistical results are not discussed in great detail in this report, as the primary focus of this section is on the evaluation of elevated elemental contents within individual lithologies.

4.4.1 Determination of Elevated Elemental Contents

An evaluation of contained metal content was conducted on the samples selected for geochemical characterization. The analytical results were compared to the average crustal abundance for each element in order to understand whether they were elevated in the Bingay Creek project area. Elements were considered to be elevated in content if their results were greater than ten times (10x) the average crustal abundance. This section contains a discussion of the elements of potential environmental concern that were classified as being elevated. These analytical results and their comparisons to the average crustal abundances, and 10x crustal abundances are contained in Appendix 4. It is important to note that the classification of an element as being elevated does not indicate that the element will leach at concentrations of potential concern.

4.4.2 Selenium

Selenium is an element of environmental concern for Bingay Creek, as well as for other coal projects in the southeastern British Columbia coal belt. Selenium has been shown to leach at elevated concentrations for all of the rock types and coal seams within the Bingay Creek project area. An evaluation of the elemental abundances in the site lithologies showed that selenium was elevated in most of the samples collected. A total of 21 out of 32 samples from the coal unit contained elevated selenium values as defined by >10X average crustal abundance. All of the mudstone samples that were analyzed contained elevated selenium content. All but 1 sample of the 73 siltstone samples contained elevated selenium. A total of 47 out of 53 samples of the Bingay Creek sandstone had elevated selenium content. The other sandstone units at the site had elevated selenium in a couple of samples, but it should be noted that the sample sets for these units are small. The summary statistics for contained selenium is present below in Table 6.

Table 6: Summary Statistics for Contained Selenium by Lithology

Statistic	Se (ppm) Coal	Se (ppm) Ironstone	Se (ppm) Mudstone	Se (ppm) Sandstone	Se (ppm) Sandstone Anderson	Se (ppm) Sandstone Moose Mountain	Se (ppm) Sandstone Weary Ridge	Se (ppm) Siltstone
No. of observations	32	2	48	53	1	3	2	73
Minimum	0.200	0.400	0.600	0.300	1.600	0.200	0.300	0.400
Maximum	8.900	0.500	3.900	2.300	1.600	0.700	0.900	4.100
1st Quartile	0.475	0.425	1.200	0.700	1.600	0.250	0.450	1.300
Median	0.850	0.450	1.750	0.900	1.600	0.300	0.600	1.600
3rd Quartile	1.250	0.475	2.425	1.200	1.600	0.500	0.750	2.100
Mean	1.128	0.450	1.885	1.009	1.600	0.400	0.600	1.777
Variance	2.263	0.005	0.646	0.190		0.070	0.180	0.606
Standard deviation	1.504	0.071	0.804	0.436		0.265	0.424	0.778

An evaluation of the relationship between selenium and sulphur was conducted to determine if the selenium is associated with the sulphide mineralization. Figure 9 shows the results of this evaluation for selenium. There is no apparent relationship between the contained selenium and sulphur values based on the available assay data for any of the material types at the site. A further evaluation of the potential relationship between selenium and other elements shown to leach at elevated concentrations was also conducted. Figure 10 shows the contained selenium, cadmium, and zinc concentrations versus the sulphur ICP-MS values for the Bingay Creek lithologies. The results of the comparison of contained selenium to cadmium are shown in Figure 11, while a comparison of contained selenium to zinc is shown in Figure 12. These comparisons show a positive correlation between the contained selenium content and the contained cadmium and zinc contents.

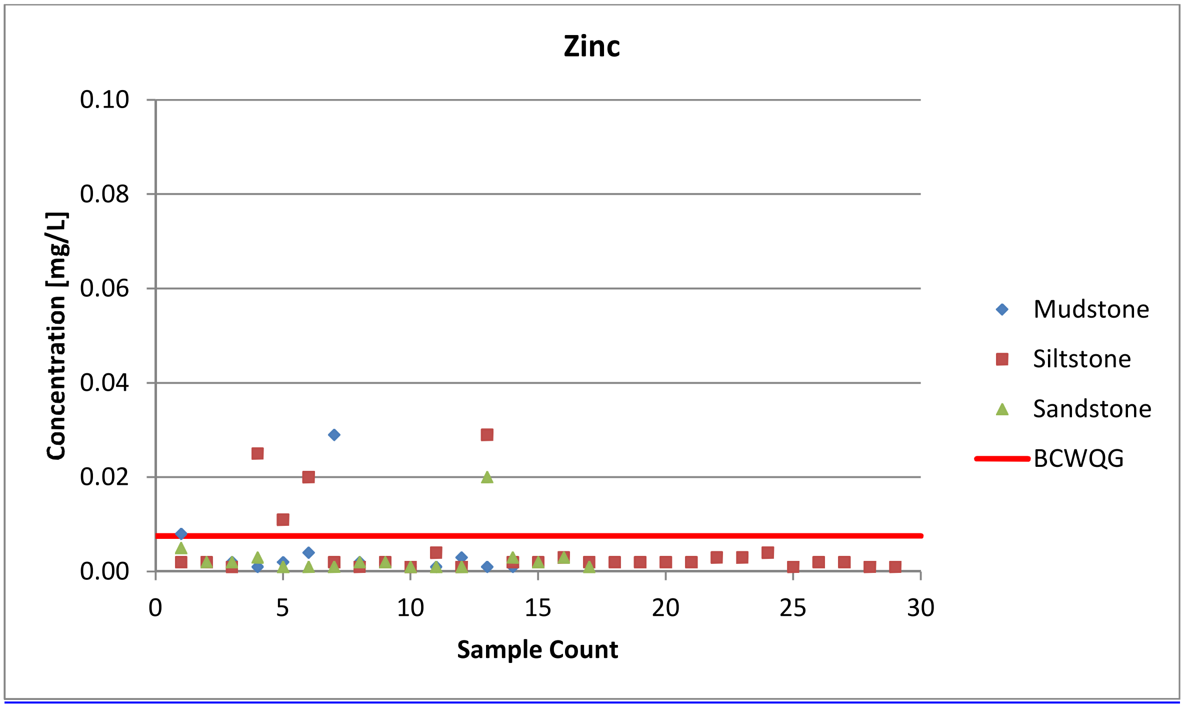


Figure 9: Zinc Shake Flask Extraction Results for Bingay Creek Lithologies

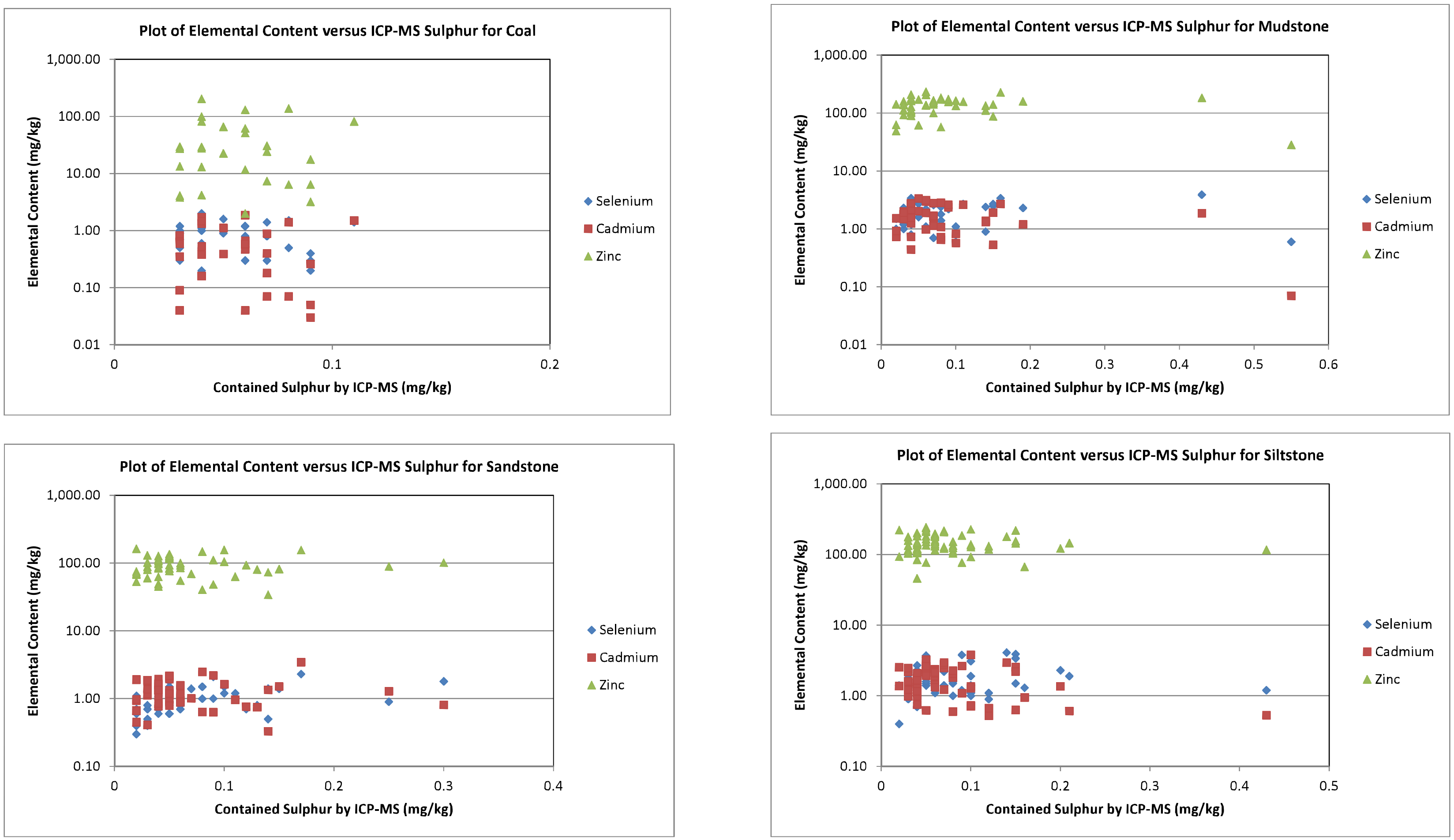


Figure 10: Contained Selenium, Cadmium, and Zinc versus Sulphur for Bingay Creek Lithologies

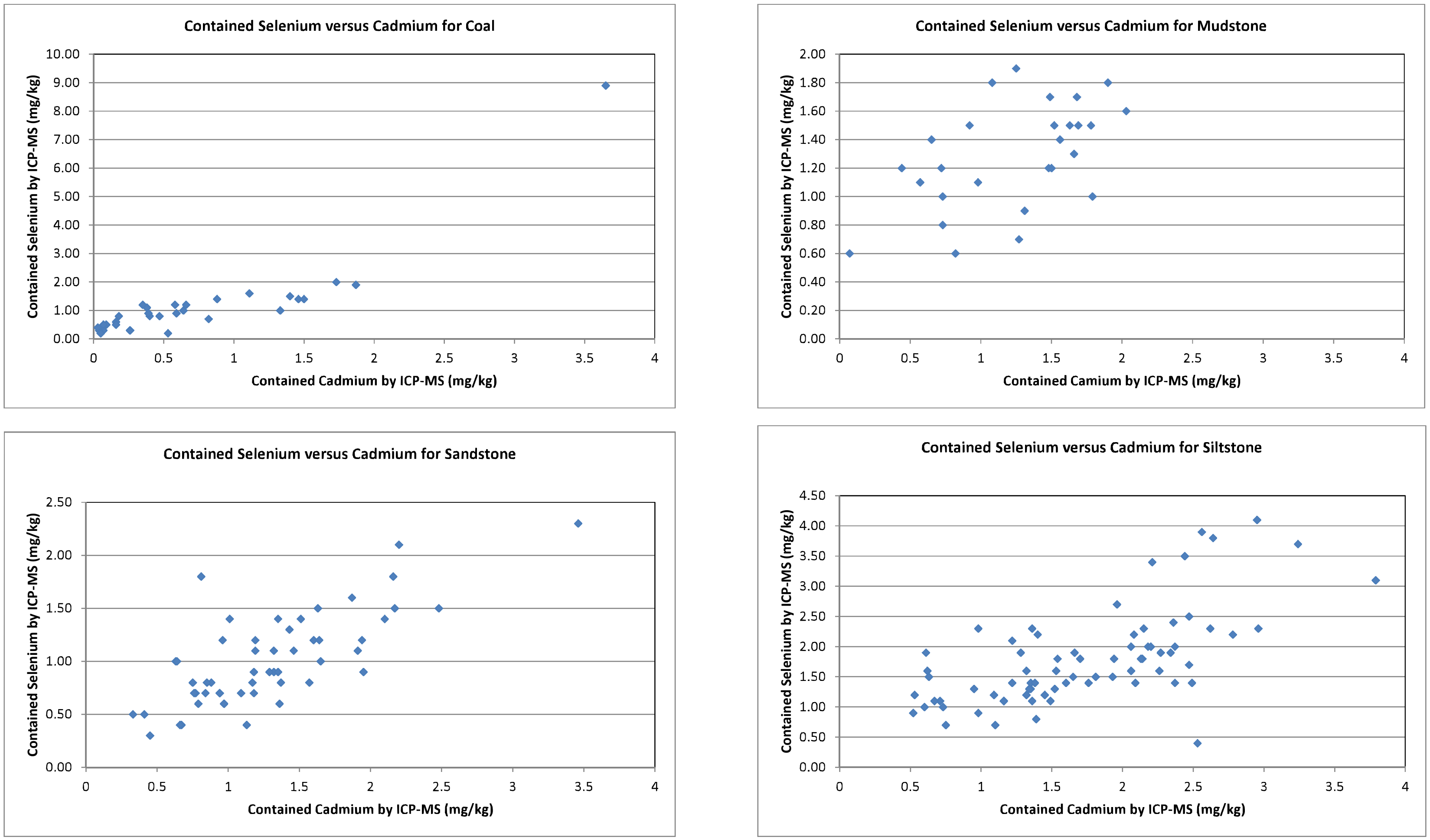


Figure 11: Contained Selenium versus Contained Cadmium for Bingay Creek Lithologies

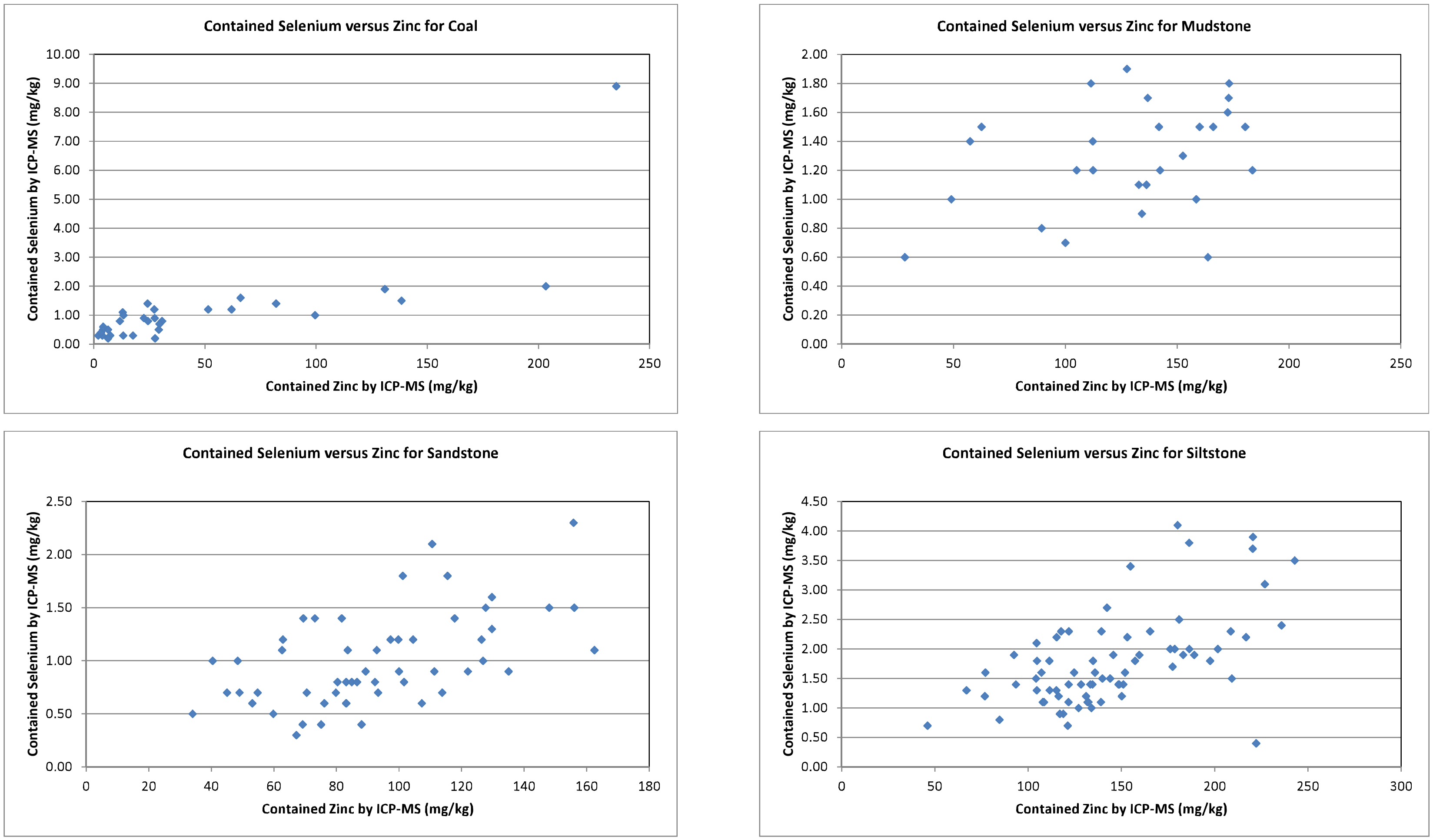


Figure 12: Contained Selenium versus Contained Zinc for Bingay Creek Lithologies

4.4.3 Arsenic

Arsenic was classified as being elevated in a total of 9 samples. The maximum arsenic content was 504.5 mg/kg in a coal sample (#21712) and it is believed that the sample in question may have contained some dilution from waste rock. This coal sample was the only sample from that lithology that had elevated arsenic values. There were 2 out of 73 samples from siltstone unit that contained elevated arsenic values (25.5 and 40.3 mg/kg). 2 out of 48 samples from the mudstone unit had elevated arsenic values (46.3 and 48.4 mg/kg). 3 out of 53 samples from the Bingay Creek sandstone unit contained elevated arsenic values (32, 27.4 and 26.2 mg/kg). The results of these evaluations showed that only a minor number of samples from the Bingay Creek project contain rock types with elevated arsenic levels, suggesting that this element will not be a significant factor in the drainage geochemistry.

4.4.4 Cadmium

Cadmium was classified as being elevated in a total of 88 out of 214 total samples that were analyzed for contained metals. There were 3 out of 32 samples from the coal unit that had elevated cadmium values (maximum content of 3.65 mg/kg). There were 41 out of 73 samples from the siltstone unit that were classified as containing elevated cadmium values (maximum content of 3.79 mg/kg). There were 27 out of 48 samples from the mudstone unit that contained elevated cadmium values (maximum content of 3.35 mg/kg). There were 16 out of 53 samples from the sandstone unit that contained elevated cadmium values (maximum content of 3.46 mg/kg). The single (1) sample of the Anderson sandstone unit had an elevated cadmium value of 1.85 mg/kg. Figure 11 shows the results of an evaluation of contained selenium versus cadmium content for the rock lithologies at the site. The results of this evaluation show that there is a positive relation between these elements, primarily for the coal and siltstone units. There appears to be a similar trend for both the mudstone and sandstone units although there is a significantly greater scattering to these two datasets.

5 DISCUSSION OF OTHER ELEMENTS OF INTEREST

5.1 MERCURY

There was a single (1) sample of the coal (#21712) that returned elevated mercury content (1.97 mg/kg). It should be noted that this is the same sample that contained abnormally high arsenic content as well as having the highest cadmium content. It is believed that there is some level of contamination of this coal sample with waste rock, but this still would not explain why the sample contained such high results of mercury, arsenic and cadmium.

5.2 BARIUM

Barium is present in the Bingay Creek deposit in the form of barite ($BaSO_4$). Barite has extremely low solubility even under low pH conditions and if present in significant concentrations within a deposit may result in an overestimation of the AP of the samples as determined based on total sulphur. The MEND, 2009 guidance document provides a formula for the estimation of barite from the total sulphur content of a sample based on the molecular weight of barium within barite.

The formula is: %Ba x (32.07/137.34) = %barite–S.

Where: % is percent, Ba is Barium, and S is sulphur.

This document also states that 0.01% barite-S is equal to 442.8 mg/kg barium. Table 7 below presents the summary statistics for barium.

Table 7: Summary Statistics for Barium by Lithology

Statistic	Ba (ppm) Coal	Ba (ppm) Ironstone	Ba (ppm) Mudstone	Ba (ppm) Sandstone	Ba (ppm) Sandstone Anderson	Ba (ppm) Sandstone Moose Mountain	Ba (ppm) Sandstone Weary Ridge	Ba (ppm) Siltstone
No. of observations	32	2	48	53	1	3	2	73
Minimum	16.300	271.000	74.100	78.900	628.100	48.100	127.400	140.300
Maximum	446.700	329.200	676.400	2033.000	628.100	379.700	157.400	670.500
1st Quartile	50.550	285.550	252.325	194.500	628.100	55.650	134.900	298.300
Median	89.250	300.100	392.200	265.700	628.100	63.200	142.400	392.500
3rd Quartile	194.250	314.650	485.500	333.000	628.100	221.450	149.900	451.200
Mean	135.100	300.100	382.196	300.517	628.100	163.667	142.400	384.082
Variance	15018.505	1693.620	21670.452	68344.291		35059.803	450.000	17248.044
Standard deviation	122.550	41.154	147.209	261.427		187.243	21.213	131.332

A total of 20 out of 48 samples from the mudstone unit had barium in excess of 442.8 mg/kg, which represented a range from 0.01 to 0.015% barite-S. A total of 19 out of 73 samples from the siltstone unit had barium in excess of 442.8 mg/kg which represented a range from 0.01 to 0.015% barite-S. The undifferentiated sandstone unit only had two samples with elevated barium values suggesting that the potential for over-estimation of the AP in this unit is minimal. The Anderson Sandstone unit had 1 sample with elevated barium content representing 0.015% barite-S. These results suggest that the classification of both the siltstone and mudstone as being potentially acid generating should include determination of the barium concentration within the samples being tested. This will be part of the focus for the mineralogical evaluations to be conducted on these units.

6 DISCUSSION

6.1 DISCUSSION OF PRIOR STUDIES

The prior geochemical assessments should be considered as screening level efforts to understand the characteristics of the deposit. The identification of PAG materials within the deposit is based on laboratory analyses of older core from 1983 and the utilization of a calculated unavailable NP term of 10 kg $CaCO_3$/tonne which was taken to represent the maximum amount of unavailable NP. Lithological geochemical evaluations were made from a single drill hole and as such cannot be relied on to assist in understanding the spatial variability of geological materials in this deposit.

The prior assessments determined that all geologic materials with an NP value greater than 30 kg $CaCO_3$/tonne were classified as being non-acid generating. There was found to be a good correlation of whole rock ICP-MS assay results for calcium and magnesium to the bulk NP of the geologic materials indicating that it may be possible to identify areas with PAG concerns within the deposit using this correlation.

6.2 ACID GENERATION POTENTIAL

There is some potential for a minor amount of the waste rock at the Bingay Creek property to be classified as being potentially acid generating. The sulphide sulphur content of the waste rock lithologies is typically below 0.2% and as such the overall potential for acid generation is considered to be low. The potential for geological materials at the site to generate acid is in part driven by the amount of unavailable NP within the rocks and also by the presence of barite within the deposit. To better understand the amount of unavailable NP within the geological materials on site, a kinetic program is to be implemented during 2012.

To better understand the relative abundances of barite within the different lithologies, a mineralogical analysis is also being considered, as these results directly affect the material classifications. The results of these ongoing evaluations will be reported on in the future as more data becomes available. The mineralogical analysis will also be used to better understand the form of the carbonate mineralization within the samples. This information could be used to support the usage of the NP_{carb} as the most effective means of determining the NP for the Bingay Creek rock units.

With respect to the development of a materials classification system for waste rock at the Bingay Creek project it appears that there may be a correlation between TIC and the adjusted carbonate neutralization potential ratio (NPR_{carb}). The adjusted NPR_{carb} assumes that the amount of unadjusted NP_{carb} is equal to 10 kg $CaCO_3$/tonne. Materials with a TIC content of greater than 0.2% are typically classified as being non-acid generating as is shown in

Figure 4 of Section 4.1. The majority of waste rock materials present in the deposit have a TIC content of greater than 0.2% which supports that the majority of geological materials to be excavated at the site should be non-acid generating.

6.3 METAL LEACHING POTENTIAL

The evaluation of ML potential for the waste rock lithologies was conducted via SFE with de-ionized water as the extracting fluid, and represents the short term flushing that is expected to occur during the initial mining stages of these materials. This testing showed that selenium represents the major concern for ML at the site with essentially all of the tested samples being equal to or above the current British Columbia standards for this element (Government of British Columbia, Ministry of Environment, 2011). Leaching of chromium and zinc was also determined to potentially exceed the British Columbia Water Quality Guidelines for some samples (Government of British Columbia, Ministry of Environment, 2011).

As part of its mining plan CCL is intending to segregate materials with the potential to leach selenium into a separate waste rock dump in order to be able to utilize these materials as backfill following the end of open pit mining activities. The results of the comparison of selenium leaching via SFE, to the contained selenium content in the samples, showed that for most of the materials there is an increasing trend in the relationship. In order to derive a better understanding of this relationship, CCL will be establishing multiple humidity cell tests and field cells during 2012 in an effort to determine if there is an appropriate cut-off that can be used to identify materials that have a higher risk of ML.

The fact that all of the samples tested had the potential for leaching of selenium is taken as an indication that surface water management for the waste dumps needs to be developed in order to address potential flushing of selenium, and other elements that may be present in elevated concentrations. The current site plan for the property shows that there will be a series of sediment ponds that will be equipped with treatment facilities. Based on the current understanding of the site infrastructure it is recommended that the high selenium waste rock stock pile be located so that drainage can be directed towards Sediment Pond #1, or the wetland to the north, to facilitate treatment prior to discharge. The organics in the wetland may assist in the natural removal and attenuation of selenium from the drainage waters and as such may be favourable to assist in the removal of selenium during the operating phases of this project.

6.4 CONTAINED METALS

The evaluation of contained metals showed that there are a number of elements that occur above 10x their average crustal abundances. The two primary elements that were observed to be elevated are cadmium and selenium. The presence of elevated elemental contents within the geological material types at the site does not indication that these elements will cause concerns from a ML standpoint. Selenium in some deposits has been found to be associated with sulphide mineralization. An evaluation of the relationship between selenium and sulphur based on the ICP-MS assays data did not identify any trends that suggests that selenium is associated with the sulphide mineralization for the coal or waste rock units. This suggests that the concentration of selenium leaching from excavated materials should not be controlled by weathering of sulphidic mineralization present within the deposit. The evaluation of cadmium and zinc associations with sulphur showed that there were no apparent correlations between these elements and sulphur. The lack of theses correlations suggests that the leaching of these elements will not likely be influenced by weathering of primary sulphide mineralization within the geological materials of this deposit.

An evaluation into the potential relationship between cadmium and selenium shows that there appears to be a positive correlation between these two elements. This correlation is stronger for the coal units. The mudstone, sandstone and siltstone units have a similar relationship; however, there is a significantly greater degree of scattering found in these datasets. A similar evaluation conducted for selenium and zinc shows a positive correlation between contained selenium and zinc content within the different material types at the site, and is similar to the relationship shown for cadmium and selenium. The results of these evaluations suggest that trends in drainage chemistry for zinc and cadmium will be similar in nature to that of selenium, although the magnitude and duration of these trends cannot be determined based on the elemental content of these samples.

7 PROPOSED WORK FOR 2012

Geochemical characterization programs are intended to continue through 2012 in support of the environmental assessment and permitting of this project. The following section provides a brief discussion of the currently proposed 2012 work programs.

7.1 KINETIC PROGRAM INITIATION

7.1.1 Humidity Cell Establishment

Humidity cells f . The objective(s) of the humidity cell testing is to provide information on the long term geochemical behaviour of waste materials that are to be excavated at the site during open pit mining operations. In the pre-f

. Following the end of open pit mining CCL intends to backfill this material into the open pit as part of the site's reclamation activities. Two (2) humidity cells will be established for each of the major lithologies; mudstone, siltstone and sandstone in order to better understand the potential for ML of selenium from the waste rock materials and to determine if it is possible to identify a selenium concentration cut-off that can be incorporated into an operational waste rock management plan. Another objective of the humidity cell program is to provide a better understanding of the amount of unavailable NP contained within the rock units so as to improve the ability to classify materials accordingly. The humidity cells is currently proposed to be established using reject material from the static program conducted during the fall of 2011, as there is already existing static characterization of those materials.

7.1.2 Field Leach Barrel Establishment

The objective of this component of the kinetic testing program is to provide site based information on ML of waste rocks to supplement the information gained from the humidity cell component. A total of six field leach barrels will be established with two barrels for each of the mudstone, siltstone and sandstone units. The barrels will be food-grade quality and equipped with a drain port at the bottom of the container in order to collect samples of the leachate from each barrel. The drain port will discharge into a clean barrel used to quantify the volume of leachate that drained from each barrel tested. Monitoring of the leachate quantity and quality will be conducted through the snow free period by site based personnel.

The field leach barrels will be established at the site during 2012 using the same materials that were used in the fall 2011 static characterization program. Should it be necessary to acquire additional materials to fill the barrels then that material will be obtained from the existing core that is stored onsite. Any additional materials sourced for this component will have acid base accounting (ABA) and contained metals analysis conducted on them in order to determine the composite characteristics of the materials within each test barrel.

7.2 MINERALOGICAL EVALUATIONS

A small number of waste rock samples from the three primary waste rock types will be submitted for petrographic and X-Ray diffraction analyses in order to better understand the mineralogy present in the waste rock units. Consideration will be given to determining the presence of barite along with determining the sulphide and carbonate mineralization forms within the waste rock. This analysis will be conducted using samples that were submitted as part of the fall 2011 characterization program.

7.3 TEST WASTE DUMP CONSTRUCTION

A small waste rock dump will be constructed at the site in order to better evaluate the effect of construction practices on the infiltration and movement of water through the dump. The dump will be constructed using waste rock materials sourced from the small quarry located on site. Construction will be in a series of relatively thin (~ 1m) lifts that will have surface compaction conducted by the site excavator. A rubber liner will be placed at the base of the lifts in order to collect infiltrated water from individual lifts in different portions of the dump. The surface of the final lift will be used to test potential reclamation seed mixtures which will provide value added supplemental data to the final site reclamation and closure plan. Vegetation plots may also be established to test the uptake of selenium by vegetation. This portion of the field program is still being refined in conjunction with CCL and will be reported on at the end of 2012.

8 CONCLUSION

Centermount Coal Ltd. is proposing to develop the Bingay Creek coal project in southeastern British Columbia. This report presents the results of the 2011 geochemical characterization program for the project in order to assist in characterizing the geological materials on site for both their ARD and ML potentials. The information presented in this report builds on initial static geochemical testing conducted at the site by the MDAG in 2004.

This report was prepared for the exclusive use of CCL by the Access Consulting Group, and follows standard geochemical characterization testing procedures. The interpretations and representation of the data presented in this report reflects Access Consulting Group's professional judgment in light of the information available at the time of reporting. Any use that a third party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of the third party. Access Consulting Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that the information presented in this report is suitable for your purposes. Should you have any questions with respects to the contents of this report then please do not hesitate to contact the undersigned at (867) 668-6463.

Respectfully submitted,

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PROVINCE OF BRITISH COLUMBIA
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23774
APRIL 18/12

Scott Davidson, M.Sc., P.Geo.
Senior Project Manager

Internal review provided by

James Harrington, M.Sc.
President

9 REFERENCES

Centermount Coal Limited [CCL], (2012) 'Bingay Main Metallurgical Coal Project: Project Description', Submitted to BC Environmental Assessment Office, Version 2.

Government of British Columbia, Ministry of Environment (2011) Water Quality Guidelines (Criteria) Reports (Internet). Available from: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html. Accessed March 07, 2012.

Mine Drainage Assessment Group [MDAG], (2004) [2004a], 'Bingay Creek Project: First-Phase ML/ARD Results and Recommendations, Prepared for Hillsborough Resources Ltd., Surrey, BC.

Mine Drainage Assessment Group [MDAG], (2004) [2004b], 'Bingay Creek Project: Second-Phase ML/ARD Results and Recommendations, Prepared for Hillsborough Resources Ltd., Surrey, BC.

Mine Environment Neutral Drainage [MEND], (2009). 'Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials' CANMET – Mining and Mineral Science Laboratories, Smithers, BC., Report 1.20.1.

Field Work Memorandum:

Centermount Coal – Bingay Creek

Field Cell Set-up

To: Centermount Coal – Bingay Creek

From: Ethan Allen and Eri Boye, Access Consulting Group

CC: Scott Davidson, Access Consulting Group

Date: April 15, 2013

Re: Centermount Coal – Bingay Creek, Kinetic Field Cells Setup

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1. OVERVIEW

This report describes the field work conducted for Centermout Coal - Bingay Creek project by Access Consulting Group (ACCESS) on October 2th-6th 2012. The field work took place in the gated compound located at the Race Trac gas station/Resturant (Curry's Gas/Convience QPE) in Elkford, BC. Field work was conducted by Eri Boye and Ethan Allen of ACCESS. The following sections highlight the specific work conducted during this field trip.

2. FIELD CELL SETUP INTRODUCTION

On October 3rd, 2012 Ethan Allen and Eri Boye from ACCESS accompanied Bryan Edgren of *Centermount Coal* to the *Race Trac* gas station compound in Elkford, BC to inspect the prospective location (Figure 1) for the establishment of kinetic field cells. A total of six (6) field cells, one (1) control cell, seven (7) collection buckets, and a constructed structure to hold these containers as well as the materials to be placed in them were constructed at this location.

The six (6) - 200 liter food grade field cells, six (6) - 5 gallon collection buckets, and all fitting and vents for the six (6) field cells were purchased through *SGS Canada*, Burnaby BC, and shipped to site via *Manitoulin Transport*. *Manitoulin Transport* was also used to ship the rock material used in this study from *SGS Canada* to site. The material used to create the field cells consisted of 180 samples of crushed, coarse sample reject material left over from the 221 sample static testing program carried out by ACCESS on Centermount's Bingay Creek drill core which was collected in November, 2011. The control bucket, control collection bucket and all required fittings, and building materials used for the carrying structure were purchased at the the *Home Hardware* in Fernie, BC.

Figure 1. Kinetic Field Cell Site Location Prior to Construction – *Race Trac* Compound, Elkford, BC.

Table 1 shows the GPS coordinates of the kinetic field cells.

Table 1: Kinetic Field Cell Location

Waypoint	Northing (m)	Easting (m)	UTM Zone	Elevation (m)
BIN BARRLS	649253	5543253	11	1268

Figure 2 shows the ground breaking process and footings being setup thick, and consisted of pressure treated 2x6 lumber.

Figure 2: Foundation Establishment and Footing Placement

3. FIELD CELL SITE SELECTION

The field cell setup site selection was suggested by *Centermount Coal.* ACCESS had requested that the field cells be set up at the site of the proposed operation, and therefore be exposed to the meterologic conditions that would exist during all stage of the advancement of this project. However, *Centermount Coal* advised that site was not a secure location, as there that tampering or vandalism was likely to occur to the field cells if they were located at the site. As a result, a location 21 kilometers away at *Race* Trac gas station's secure compound at the edge of the town of Elkford was selected (see Figure 3). This location was but was deemed an acceptable compromise. During construction of the field cells, it was noted that Race Trac site has some potential for contamination from dust because of its proximity with two major roadways including the Fording Road and Elk Valley Highway. These roadways are frequently driven by large tractor trailors, commuter vechicles, buses, etc. To try to understand the potential for contamination from dust, a control bucket was established as with the six field cells.

Figure 3 Field Cell Location, Race Trac Gas Compound, Elkford, BC. Image from Google Maps

4. STRUCTURE CONSTRUCTION AND SAMPLING AND FIELD CELLS MATERIALS RECEIVED

On October 4th, 2012 Ethan Allen and Eri Boye from ACCESS continued the construction of the field cell support structure. *Manitoulin Transport* delivered both the sample materials and field cell materials to the *Race Trac* gas station compound. Figure 4 shows the site location, construction of the support structure, sampling material used, and a field cell bin (far right).

Figure 4: Construction of Support Structure, with Sample Materials (Wrapped on Pallets) and Field Cells (Far Right)

5. Support Structure Completed and Field Cells Setup

On October 5th, 2012 Access continued to work on the structure setup, and began to rough in the field cells (Figure 5), and the field cell fixtures (Figure 6). Field cell setup instructions were provided by *SGS Canada*, and were followed accordingly. MEND (2009) methologies and procedures were consulted and followed for the establishment of the field and control cells. Figure 7 shows the completed support structure and field and control cells setup.

6. Field Cell Sample Composition Rationale

The static testing program conducted on behalf of Centermount Coal (Access Consulting, 2012) included measurement of total contained selenium content via ICP-MS. Total contained selenenium showed minor but statistically significant variance between the three major predicted waste rock lithology populations (sandstone, siltstone and mudstone) with sandstone having the lowest and mudstone the highest mean selenium contents. Selenenium leaching via 24 hour shake flask conducted during the static testing did not show a clear distinction between any of the major lithologies and their selenium leaching potential. In addition, no clear relationship was observed between selenium content and selenium leaching via shake flask, except for a weak positive correlation between contained and leachable selenium within the siltstone samples. Because 24 hour shake flask extraction tests may not provide an accurate prediction of in-situ mine waste performance and selenium leaching, kinetic testing including both laboratory humdity cells and field cells were reccomended. Field cells are used to provide a prediction of actual site weathering behavior, while humidity cells can be used in order to calculate actual primary reaction rates.

The 24 hour shake flask testing did not show any significant relationships between lithology and leaching potential and the interbedding of lithologies may make segregation during mining difficult or infeasable, therefore a focus was placed on total selenium content irrespective of lithology with four of the field cells used for this purpose. Although shake flask tests did not show a clear correlation between total contained selenium and short term leaching behavior, it is anticipated that kinetic testing will show that lower contained selenium contents will result in lower and/or less protracted selenium leaching. Four field cells were created from samples of all lithologies based on selenium content while two were created based solely on lithogy. Because of the greater distinctiveness (visually and geochemically) between sandstone and the other two waste rock lithologies (siltstone and mudstone), one field cell was created using only sandstone samples and another using a mixture of siltstone and mudstone samples. Table 2 summarizes the field cell lithology and range of selenenium content of constituent subsamples.

Figure 5: Progression of Working on the Support Structure and Field Cells (Sample Pulps in the Foreground)

Figure 6: Installing Field Cell Fixtures and Plumbing

Figure 7: Completed Field Cells and Control Cell Installation and Plumbing

7. MATERIAL SORTING, FIELD BARRELS FILLING, HUMIDITY CELL SAMPLE COMPOSITING

Table 2 shows the corresponding lithologies, as well as the range of selenium content of samples placed in each field cell. All materials that were added to each field cell was weighted and recorded (Figure 8). A 50 gram representative sample was taken from each sample in order to create a representative humidity cell at SGS Canada for each field cell. Figure 9 shows ACCESS staff adding sample material to field cell number 6. Figure 10 shows the completed and filled field cells. Figure 11 shows the completed supporting structure and filled field cells with deliniating uprights with marking tape.

Table 2: Field Cell Number with the Corresponding Lithologies and Selenium Content (ppm) contained

Field Cell # Control Cell #	1	2	3	4	5	6	7
Lithology Unit	Mudstone Siltstone Sandstone	Mudstone Siltstone Sandstone	Mudstone Siltstone Sandstone	Mudstone Siltstone Sandstone	Sandstone	Mudstone Siltstone	None
Selenium Content (ppm)	0.2 (min) to > 1.0	1.0 to > 1.5	1.5 to > 2.0	2.0 to 4.1 (max)	0.2 to 2.3	0.4 to 4.1	None

Figure 8: Weighing and Recording Station (Sample Material Seen to Right)

Figure 9: Sample Material Being Added to Field Cell 6 (Mudstone / Siltstone)

Figure 10: Completed and Filled Field Cells

Figure 11: Completed Field Cells with Delineating Uprights with Marking Tape

Attachments:

1. Kinetic Field Cell Sampling Procedures
2. Field Cell Composite Tables

ATTACHMENT 1: KINETIC FIELD CELL SAMPLING PROCEDURES

SAMPLING PROGRAM PROCEDURES

A set of standard operating procedures (SOP) has been developed for sampling the collection buckets, and follows the MEND (2009) manual's recommendations for frequency and sampling methodologies (where relevant). This SOP is provided to the company/personnel responsible for sample collection. The required equipment is listed below.

Equipment Required:

- Calibrated Water Multimeter
- Cooler with Ice Packs,
- Trip Blanks
- 2 gallon of Deionized Water
- 8 Syringers with Luger locks and 8 45 micro Filer Tips
- Graduated Cylinder
- Camera
- Field Note Book and pencil / pen / Computer
- Data Collection Sheet / Digital Data Collection Sheet
- 16 - 120 ml bottles
- 8 Nitric Acid Preservative Vials
- 8 – 250 ml bottles
- Chain of Custody (CoC) form

The recommended sampling procedures are listed below. These procedures should be periodically reviewed and adjusted in response to results, if required.

Recommended Sampling Procedures

1. The sampling buckets should be checked monthly during months where average temperature is above 0^{o} C.
2. Sampling of leachate, including the following procedures should be conducted if:
    - The sample bucket contains at least 5L of water or
    - At least 3 times during the season when average temperature is above 0^{o} C. For example, May, July, September.

- Before any field measurements are taken with a Water Multimeter (YSI, Hanna, etc.) it must be calibrated with the appropriate calibration solutions and cleaned to prevent sample contamination.
- A trip blank is to be taken within the cooler (provided by the analytical laboratory)

- Samples are to be collected from each of the six field cell collection buckets, and the one control bucket. Samples are to be kept in a cooler with the trip blank, ice packs, and other samples, and must be kept at a temperature below 10 degrees Celsius at all times.
- Samples are to be shipped to the analytical laboratory for analysis as soon as possible.
- Photographs are to be taken of each field cell and control bucket, as well as the leachate in the seven collection bucket. Photos are to be provided to ACCESS and/or Centermount Coal's staff members.
- Notes should be taken if anything is out of the ordinary or that needs to be addressed and provided to ACCESS and / or Centermount Coal's staff members.
- Data to be recorded includes: gate of collection, reather (air temperature a cloud cover / precipitation), total volume in each bucket (7 total collect buckets), color of leachate sample, smell of leachate sample, temperature of leachate, field leachate pH, leachate ORP, specific conductivity of leachate, and dissolved oxygen in leachate. Data may be recorded digitally directly into the provided datasheet. The completed digital datasheet is to be provided to ACCESS and / or Centermount Coal's staff members.
- Samples need to be taken from each of the seven collection buckets for: dissolved metals, sulphate and chloride, and alkalinity, electrical conductivity, and pH.
    - Dissolved metal samples are to be collected in a syringe (with a luger lock) and filtered through a 45 micron filter tip. The filtered sample is to be deposited in a 120 ml container (provided by the analytical laboratory), with a minimum of 75 milliliters to be collected. The dissolved metals samples are to be preserved with Nitric Acid (provided by the analytical laboratory).
    - Sulphate and Chloride samples are to be collected from each of the seven collection buckets. Sampling involves filling a 120 ml container (provided by the analytical laboratory), with a minimum of 75 milliliters. No preservative is needed.
    - Alkalinity, Electrical Conductivity, and pH samples are to be collected from each of the seven collection buckets. Sampling involves filling a 250 ml container (provided by the analytical laboratory), with a minimum of 150 milliliters. No preservative is needed.
- Upon completing the sampling process, each collection bucket is to be rinsed three times with 250 ml of deionized water (will consist of up to 5.25 L of deionized water which will be provided by the analytical laboratory).
- A duplicate sample is to be taken on one of the six field cells, if sufficient leachate is available. The duplicate sample will follow the exact same sampling processes as mentioned above, and as performed on the sample that is being duplicated.
- A field blank is to be taken at the site. The procedures are the same as mentioned above, but deionized water is sampled in the place of the leachate.

- A Chain of Custody (COC) form (can be obtained from the analytical laboratory) is to be filled out, and is to accompany the samples being shipped to the analytical laboratory.
- All cooler and samplers with the coolers are to be kept in cold storage and delivery to the analytical laboratory. *Centermount Coal* is to be billed for all costs incurred.
- The analytical laboratory's reports are to be provided to Access and /or *Centermount Coal*'s staff members.
- The Field Sampling Form is provided below, and can be provided in a digital (Microsoft Excel) format.

Attachment 1: Kinetic Field Cell Sampling Form

ACCESS

Geochemistry - Kinetic Field Cell Sample Collection Form

Project Location:	**Clients Name:**		**Date:**	**Start Time:**	**End Time:**
Organization Sampler Works For:			**Weather (e.g. air temp, precip):**		
Sampler's Names (Bold Sample):			**Total # of Bottles Used:**	**Pictures Taken: #_______________ to #_________________**	

Insitu

Water MultiMeter Make/ Model/ SN#:

QA/QC Samples

Please Note: Sample Bottle Label; Duplicate Collection Details; De-Ionized Water Batch #'s for Blanks (once per trip)

Trip Blank (Yes/No), Notes:

Field Blank (Yes/No), Notes:

Duplicate (Yes/No), Notes:

Field Cell Collection Bucket(s) Data Entry

	Field Cell / Collection Bucket # 1		**Field Cell / Collection Bucket # 2**		**Field Cell / Collection Bucket # 3**		**Field Cell / Collection Bucket # 4**	
Volume in Collection Bucket		ml		ml		ml		ml
Leachate Color								
Smell of Leachate								
Leachate Temperature		°C		°C		°C		°C
Leachate pH		pH units		pH units		pH units		pH units
Leachate ORP		mV		mV		mV		mV
Specific Conductivity of Leachate		µS/cm		µS/cm		µS/cm		µS/cm
Dissolved Oxygen of Leachate		% saturation		% saturation		% saturation		% saturation
Dissolved Oxygen of Leachate		mg/L		mg/L		mg/L		mg/L
Diss. Metals Samples Taken (Y/N)								
HNO3 Added to Diss. Metals (Y/N)								
Sulfate / Chloride Sample Taken (Y/N)								
Alk, EC, Cond., pH Sample Taken (Y/N)								
Collection Bucket Rinsed (Y/N)								

Field Cell Collection Bucket(s) Data Entry

	Field Cell / Collection Bucket # 5		**Field Cell / Collection Bucket # 6**		**Field Cell / Collection Bucket # 7**		**Duplicate of Field Cell # _________**	
Volume in Collection Bucket		ml		ml		ml		ml
Leachate Color								
Smell of Leachate								
Leachate Temperature		°C		°C		°C		°C
Leachate pH		pH units		pH units		pH units		pH units
Leachate ORP		mV		mV		mV		mV
Specific Conductivity of Leachate		µS/cm		µS/cm		µS/cm		µS/cm
Dissolved Oxygen of Leachate		% saturation		% saturation		% saturation		% saturation
Dissolved Oxygen of Leachate		mg/L		mg/L		mg/L		mg/L
Diss. Metals Samples Taken (Y/N)								
HNO3 Added to Diss. Metals (Y/N)								
Sulfate / Chloride Sample Taken (Y/N)								
Alk, EC, Cond., pH Sample Taken (Y/N)								
Collection Bucket Rinsed (Y/N)								

Notes:

Page ________ of________

ATTACHMENT 2: KINETIC FIELD CELL SAMPLING PROCEDURES

1. FIELD CELL COMPOSITES TABLES

The following tables show the composition of field cells 1, 2, 3, 4, 5 and 6. 50 grams out of each sample that was used to create the field cells was collected to create a representative humidity cell for each field cell. This resulted in six composited samples being collected, which will result in six humidity cells to be additional cell established at *SGS Canada* – Burnaby. The setting up and results obtained from these humidity cells are to be used in conjunction with the results from the field cells. Grain size analysis and ICP-MS total metals will be conducted on splits from the six (6) composite humidity cell samples. *Centermount Coal* shipped the six (6) composite humidity cells samples to *SGS Canada* – Burnaby.

Field Cell 1 (< 1.0 ppm Se) - Breakdown of Composition, and Humidity Cell Collection

Holeid	From (m)	To (m)	Interval (m)	Sample ID	Lithology	Se contained (ppm)	Sampled Wt (g)	HC Sample
2011-01a	46.97	47.85	0.89	21523	Sandstone	0.6	3.3	x
2010-64a	19.73	20.11	0.38	21524	Sandstone	0.4	4.9	x
2010-64a	20.73	21.41	0.68	21525	Sandstone	0.7	4.7	x
2010-64a	25.30	26.82	1.52	21526	Sandstone	0.3	6.1	x
2010-64a	34.44	35.97	1.52	21527	Sandstone	0.5	8.1	x
2010-64a	42.06	43.59	1.52	21528	Sandstone	0.4	11.1	x
2010-64a	54.25	55.78	1.52	21531	Sandstone	0.9	13.6	x
2010-47a	25.30	25.75	0.45	21541	Siltstone	0.9	4	x
2010-47a	11.58	12.03	0.45	21544	Sandstone	0.5	3.4	x
2010-52a	38.71	40.23	1.52	21567	Siltstone	0.4	10.1	x
2010-52a	29.57	31.09	1.52	21568	Siltstone	0.7	3.4	x
2010-52a	20.42	21.95	1.52	21569	Siltstone	0.9	5.4	x
2010-62v	64.01	65.53	1.52	21570	Sandstone	0.3	9.7	x
2010-62v	60.45	60.96	0.51	21571	Sandstone	0.9	3.2	x
2010-62v	55.20	56.39	1.19	21572	Sandstone	0.7	5.5	x
2010-62v	47.24	48.77	1.52	21573	Sandstone	0.2	4.7	x
2010-62v	41.90	42.67	0.77	21574	Sandstone	0.3	9	x
2010-62v	32.40	32.78	0.38	21575	Mudstone	0.7	3	x
2010-62v	25.11	25.91	0.79	21577	Sandstone	0.8	5.9	x
2010-67a	56.69	59.74	3.05	21616	Sandstone	0.7	12.4	x
2010-67a	53.64	55.76	2.12	21617	Sandstone	0.7	2.7	x
2010-67a	50.60	51.39	0.79	21618	Sandstone	0.7	2.9	x
2010-67a	38.40	38.58	0.18	21620	Siltstone	0.7	0.7	x
2010-21a	6.52	6.63	0.11	21626	Mudstone	0.6	1.5	x
2010-60a	113.60	113.90	0.30	21637	Sandstone	0.6	2.3	x
2010-60a	90.22	92.02	1.80	21645	Sandstone	0.4	4.8	x
2010-60a	81.08	84.12	3.05	21647	Sandstone	0.7	3.9	x
2010-60a	62.79	63.30	0.51	21651	Mudstone	0.9	2.5	x
2010-38a	85.04	86.56	1.52	21663	Sandstone	0.7	6.7	x
2010-38a	53.04	54.56	1.52	21672	Sandstone	0.8	5	x
2010-38a	19.53	21.03	1.50	21679	Sandstone	0.8	4.5	x
2010-63v	70.45	71.90	1.45	21684	Sandstone	0.9	2.6	x
2010-63v	10.22	10.90	0.68	21697	Sandstone	0.6	4.5	x
2010-66a	108.51	110.31	1.80	21699	Sandstone	0.7	8	x
2010-66a	105.46	106.39	0.93	21700	Sandstone	0.8	2.5	x
2010-66a	95.42	96.32	0.90	21701	Sandstone	0.9	3	x
2010-66a	83.07	84.12	1.06	21703	Sandstone	0.8	4.5	x
2010-66a	74.98	75.92	0.94	21705	Siltstone	0.8	4.1	x
2010-66a	70.65	71.93	1.28	21706	Sandstone	0.8	5.5	x
2010-66a	65.84	66.51	0.67	21707	Sandstone	0.6	1.8	x
2010-66a	53.64	53.87	0.23	21708	Sandstone	0.9	0.5	x
2010-18a	91.14	92.66	1.52	21718	Sandstone	0.9	8.6	x
2010-18a	63.70	64.40	0.70	21723	Mudstone	0.6	1	x
2010-18a	60.95	61.58	0.63	21725	Mudstone	0.8	0.7	x

Notes: 9.5 cm to cell rim from top of rocks

Field Cell 2 (1.0 - 1.49 ppm Se) - Breakdown of Composition, and Humidity Cell Collection

Holeid	From (m)	To (m)	Interval (m)	Sample ID	Lithology	Se contained (ppm)	Sampled Wt (g)	HC Sample
2011-02a	35.33	35.66	0.33	21509	Mudstone	1.2	1.5	x
2011-02a	22.17	22.82	0.65	21512	Sandstone	1.1	1.6	x
2011-02a	13.46	14.33	0.87	21513	Siltstone	1.1	3.7	x
2011-01a	18.78	19.73	0.95	21517	Sandstone	1.2	2.1	x
2011-01a	41.76	42.17	0.41	21521	Sandstone	1.2	2.5	x
2010-64a	49.87	49.90	0.03	21529	Mudstone	1.0	3.8	x
2010-64a	51.21	52.73	1.52	21530	Mudstone	1.2	4.1	x
2010-47a	66.45	67.97	1.52	21532	Siltstone	1.1	2.5	x
2010-47a	42.06	43.59	1.52	21539	Siltstone	1.0	3	x
2010-47a	27.79	28.35	0.55	21540	Siltstone	1.2	4.1	x
2010-39a	62.94	63.70	0.76	21545	Siltstone	1.2	7.2	x
2010-39a	56.08	57.61	1.52	21546	Sandstone	1.2	9.3	x
2010-39a	53.04	53.34	0.30	21547	Sandstone	1.0	1.9	x
2010-39a	46.54	46.94	0.40	21548	Siltstone	1.3	4.9	x
2010-39a	36.66	37.74	1.08	21550	Siltstone	1.0	4.6	x
2010-39a	13.41	15.03	1.62	21554	Siltstone	1.3	5.5	x
2010-52a	47.85	48.45	0.60	21565	Mudstone	1.0	2.2	x
2010-52a	34.14	35.66	1.52	21566	Sandstone	1.2	5.2	x
2010-39a	35.17	36.27	1.10	21578	Mudstone	1.1	3.1	x
2010-42v	56.15	56.66	0.51	21581	Sandstone	1.0	5.9	x
2010-42v	52.73	54.25	1.52	21582	Sandstone	1.4	4.5	x
2010-42v	40.54	40.84	0.30	21585	Mudstone	1.4	3.2	x
2010-42v	27.34	28.35	1.00	21587	Siltstone	1.1	9.9	x
2010-69a	91.70	92.72	1.02	21594	Siltstone	1.3	2.6	x
2010-69a	50.19	50.90	0.71	21602	Siltstone	1.4	2.4	x
2010-69a	10.69	11.28	0.59	21610	Sandstone	1.1	1.2	x
2010-69a	8.23	8.65	0.42	21611	Sandstone	1.4	2.1	x
2010-67a	41.45	42.93	1.48	21619	Sandstone	1.4	5.1	x
2010-67a	29.26	30.28	1.02	21621	Siltstone	1.4	5	x
2010-21a	11.05	11.15	0.10	21628	Mudstone	1.2	1.4	x
2010-21a	33.22	36.27	3.05	21631	Mudstone	1.2	3.7	x
2010-60a	111.56	113.39	1.83	21638	Siltstone	1.4	2.95	x
2010-60a	85.80	87.17	1.37	21646	Sandstone	1.4	4.5	x
2010-60a	41.45	42.11	0.66	21654	Sandstone	1.3	2.1	x
2010-60a	33.92	35.00	1.08	21656	Mudstone	1.4	4.1	x
2010-38a	81.99	82.94	0.95	21664	Siltstone	1.4	5.6	x
2010-38a	80.47	81.99	1.52	21665	Siltstone	1.1	4.4	x
2010-38a	75.25	76.29	1.04	21667	Siltstone	1.2	4.4	x
2010-38a	72.85	74.37	1.52	21668	Siltstone	1.1	5.8	x
2010-38a	68.66	69.80	1.14	21669	Siltstone	1.2	4.5	x
2010-38a	56.08	57.61	1.52	21671	Siltstone	1.3	11.2	x
2010-38a	47.70	48.46	0.76	21673	Sandstone	1.0	3.9	x
2010-38a	37.80	39.32	1.52	21675	Siltstone	1.4	5.9	x
2010-38a	17.98	18.73	0.75	21680	Siltstone	1.4	5.4	x
2010-63v	81.69	83.04	1.35	21681	Sandstone	1.1	3.9	x
2010-63v	73.50	75.59	2.09	21682	Sandstone	1.1	5.6	x
2010-63v	26.10	26.82	0.72	21694	Siltstone	1.4	2.3	x
2010-63v	5.49	6.69	1.20	21698	Siltstone	1.4	4.6	x
2010-66a	26.21	29.26	3.05	21714	Mudstone	1.1	9.6	x
2010-18a	95.71	97.23	1.52	21719	Siltstone	1.1	5.4	x
2010-18a	23.56	24.21	0.65	21726	Mudstone	1.3	5.2	x
2010-18a	19.58	20.13	0.55	21729	Sandstone	1.2	3.4	x

Notes: 9.0 cm to cell rim from top of rocks

Field Cell 3 (1.5 – 1.99 ppm Se) - Breakdown of Composition, and Humidity Cell Collection

Holeid	From (m)	To (m)	Interval (m)	Sample ID	Lithology	Se contained (ppm)	Sampled Wt (g)	HC Sample
2011-02a	29.57	31.17	1.60	21510	Siltstone	1.5	9.1	x
2011-02a	26.77	27.57	0.80	21511	Siltstone	1.9	4.95	x
2011-01a	31.46	32.61	1.15	21519	Mudstone	1.6	8.95	x
2011-01a	36.78	37.30	0.52	21520	Siltstone	1.8	2.1	x
2011-01a	43.61	44.81	1.20	21522	Siltstone	1.8	5.2	x
2010-47a	51.21	52.73	1.52	21533	Siltstone	1.8	17.95	x
2010-47a	63.40	64.37	0.97	21536	Siltstone	1.9	5.65	x
2010-39a	15.51	16.46	0.95	21553	Siltstone	1.8	8.9	x
2010-52a	84.43	85.95	1.52	21555	Mudstone	1.7	9.9	x
2010-52a	57.00	58.52	1.52	21562	Mudstone	1.9	5.35	x
2010-52a	52.43	53.95	1.52	21563	Sandstone	1.5	5	x
2010-62v	29.69	30.48	0.79	21576	Mudstone	1.5	6.5	x
2010-42v	57.30	58.83	1.52	21580	Siltstone	1.9	16.8	x
2010-42v	25.30	25.69	0.39	21588	Sandstone	1.8	2.65	x
2010-42v	11.58	12.50	0.91	21590	Siltstone	1.5	4.4	x
2010-69a	108.81	111.86	3.05	21591	Siltstone	1.6	17.2	x
2010-69a	100.20	102.72	2.52	21592	Sandstone	1.6	4.8	x
2010-69a	78.33	79.73	1.40	21598	Sandstone	1.8	3.1	x
2010-69a	29.57	31.07	1.50	21607	Siltstone	1.6	7.2	x
2010-67a	67.95	68.88	0.94	21614	Mudstone	1.5	1.65	x
2010-67a	16.23	16.73	0.50	21623	Sandstone Anderson	1.6	2.8	x
2010-67a	10.97	12.62	1.65	21624	Siltstone	1.6	16	x
2010-21a	3.05	4.27	1.22	21625	Siltstone	1.5	2.7	x
2010-21a	7.60	7.92	0.32	21627	Mudstone	1.8	2.7	x
2010-60a	76.60	77.09	0.49	21648	Siltstone	1.8	2.85	x
2010-60a	54.87	56.69	1.82	21652	Siltstone	1.6	5.2	x
2010-60a	15.54	16.44	0.90	21660	Mudstone	1.5	2.8	x
2010-60a	7.62	7.92	0.30	21662	Mudstone	1.5	1.4	x
2010-38a	64.72	65.23	0.50	21670	Siltstone	1.5	3.45	x
2010-38a	43.17	43.89	0.72	21674	Mudstone	1.7	3.6	x
2010-63v	72.80	73.50	0.70	21683	Siltstone	1.7	3.3	x
2010-63v	67.89	68.19	0.30	21685	Mudstone	1.8	1	x
2010-63v	63.40	63.90	0.50	21687	Siltstone	1.9	2	x
2010-66a	78.03	78.68	0.65	21704	Sandstone	1.5	2.7	x
2010-66a	44.50	45.48	0.98	21709	Sandstone	1.5	2	x
2010-66a	20.12	21.48	1.36	21715	Siltstone	1.9	4.7	x
2010-66a	7.92	10.11	2.19	21717	Siltstone	1.6	9	x
2010-18a	86.56	87.78	1.22	21721	Mudstone	1.5	5.6	x

Notes: 11.0 cm to cell rim from top of rocks

Field Cell 4 (2.0 – 4.1 ppm Se) - Breakdown of Composition, and Humidity Cell Collection

Holeid	From (m)	To (m)	Interval (m)	Sample ID	Lithology	Se contained (ppm)	Sampled Wt (g)	HC Sample
2011-02a	8.49	8.80	0.31	21514	Mudstone	2.6	1.4	x
2011-01a	9.85	10.49	0.64	21515	Mudstone	2.5	1.2	x
2011-01a	14.33	14.69	0.36	21516	Mudstone	2.1	1.2	x
2011-01a	23.27	23.47	0.20	21518	Mudstone	3.4	0.9	x
2010-47a	57.30	58.83	1.52	21534	Siltstone	3.9	7.2	x
2010-47a	46.93	47.27	0.34	21537	Mudstone	3.4	2.8	x
2010-47a	19.20	20.45	1.25	21543	Mudstone	2.7	7.6	x
2010-39a	42.37	43.34	0.97	21549	Mudstone	2.3	5.1	x
2010-39a	28.74	29.19	0.45	21551	Mudstone	2.9	1.5	x
2010-39a	25.60	27.12	1.52	21552	Sandstone	2.1	5.1	x
2010-52a	78.33	78.94	0.61	21557	Sandstone	2.3	4.5	x
2010-39a	34.75	34.99	0.24	21579	Mudstone	2.7	2.8	x
2010-42v	46.33	46.93	0.60	21583	Mudstone	2.4	4.1	x
2010-42v	42.06	43.59	1.52	21584	Siltstone	2.3	8.4	x
2010-42v	31.39	31.65	0.26	21586	Mudstone	2.7	3	x
2010-42v	21.43	22.17	0.74	21589	Siltstone	3.8	5.9	x
2010-69a	83.26	84.43	1.17	21597	Siltstone	4.1	6	x
2010-69a	63.10	65.47	2.37	21599	Siltstone	2.0	4.3	x
2010-69a	61.50	62.02	0.52	21600	Siltstone	2.7	2.2	x
2010-69a	44.81	45.61	0.80	21603	Mudstone	2.3	0.9	x
2010-69a	43.86	44.32	0.46	21605	Mudstone	2.7	0.9	x
2010-69a	20.42	22.17	1.75	21609	Siltstone	2.2	5.9	x
2010-67a	75.96	76.85	0.89	21612	Mudstone	3.2	3.5	x
2010-67a	71.93	73.05	1.12	21613	Mudstone	2.8	2.1	x
2010-67a	63.94	65.84	1.90	21615	Siltstone	2.3	4.7	x
2010-67a	23.16	24.60	1.44	21622	Mudstone	3.9	3.9	x
2010-21a	17.59	17.98	0.39	21629	Siltstone	2.2	5.4	x
2010-48a	36.90	38.40	1.51	21635	Siltstone	3.4	7.2	x
2010-48a	38.40	41.45	3.05	21636	Siltstone	3.5	6.7	x
2010-60a	94.79	96.32	1.52	21643	Siltstone	2.0	1.5	x
2010-60a	68.88	71.74	2.86	21650	Mudstone	2.2	5.2	x
2010-60a	46.48	47.28	0.80	21653	Siltstone	2.4	3.8	x
2010-60a	13.41	14.02	0.61	21661	Mudstone	2.1	2.3	x
2010-38a	35.50	36.27	0.77	21676	Siltstone	2.1	6.6	x
2010-38a	27.65	28.69	1.04	21677	Siltstone	2.5	9.6	x
2010-63v	48.16	48.71	0.55	21690	Siltstone	2.0	4	x
2010-63v	42.06	43.85	1.79	21691	Siltstone	3.7	5.3	x
2010-63v	39.01	41.71	2.70	21692	Siltstone	2.0	8.6	x
2010-63v	32.92	34.21	1.29	21693	Siltstone	3.1	8.1	x
2010-63v	21.80	23.77	1.98	21695	Siltstone	2.3	14.2	x
2010-63v	20.73	21.80	1.07	21696	Siltstone	2.2	3.5	x
2010-66a	88.02	89.09	1.07	21702	Siltstone	2.3	6.1	x
2010-66a	38.40	41.45	3.05	21710	Mudstone	2.3	7.4	x
2010-66a	35.91	36.64	0.73	21711	Mudstone	2.2	3.4	x
2010-66a	32.31	33.38	1.07	21713	Mudstone	2.4	5.3	x
2010-66a	10.97	12.60	1.63	21716	Siltstone	2.3	2.5	x

Notes: 12.0 cm to cell rim from top of rocks

Field Cell 5 (Sandstone) - Breakdown of Composition, and Humidity Cell Collection

Holeid	From (m)	To (m)	Interval (m)	Sample ID	Lithology	Se contained (ppm)	Sampled Wt (g)	HC Sample
2011-02a	22.17	22.82	0.65	21512	Sandstone	1.1	3.2	x
2011-01a	18.78	19.73	0.95	21517	Sandstone	1.2	3.4	x
2011-01a	41.76	42.17	0.41	21521	Sandstone	1.2	1.1	x
2011-01a	46.97	47.85	0.89	21523	Sandstone	0.6	2	x
2010-64a	19.73	20.11	0.38	21524	Sandstone	0.4	2	x
2010-64a	20.73	21.41	0.68	21525	Sandstone	0.7	3.1	x
2010-64a	25.30	26.82	1.52	21526	Sandstone	0.3	3.9	x
2010-64a	34.44	35.97	1.52	21527	Sandstone	0.5	6.7	x
2010-64a	42.06	43.59	1.52	21528	Sandstone	0.4	5.2	x
2010-64a	54.25	55.78	1.52	21531	Sandstone	0.9	5.2	x
2010-47a	11.58	12.03	0.45	21544	Sandstone	0.5	2.6	x
2010-39a	56.08	57.61	1.52	21546	Sandstone	1.2	4.9	x
2010-39a	53.04	53.34	0.30	21547	Sandstone	1.0	1.4	x
2010-39a	25.60	27.12	1.52	21552	Sandstone	2.1	5	x
2010-52a	78.33	78.94	0.61	21557	Sandstone	2.3	3.1	x
2010-52a	52.43	53.95	1.52	21563	Sandstone	1.5	4.5	x
2010-52a	34.14	35.66	1.52	21566	Sandstone	1.2	5.2	x
2010-62v	64.01	65.53	1.52	21570	Sandstone	0.3	4.4	x
2010-62v	60.45	60.96	0.51	21571	Sandstone	0.9	2	x
2010-62v	55.20	56.39	1.19	21572	Sandstone	0.7	5	x
2010-62v	47.24	48.77	1.52	21573	Sandstone	0.2	5.3	x
2010-62v	41.90	42.67	0.77	21574	Sandstone	0.3	4.7	x
2010-62v	25.11	25.91	0.79	21577	Sandstone	0.8	3.4	x
2010-42v	56.15	56.66	0.51	21581	Sandstone	1.0	4.8	x
2010-42v	52.73	54.25	1.52	21582	Sandstone	1.4	6	x
2010-42v	25.30	25.69	0.39	21588	Sandstone	1.8	1.65	x
2010-69a	100.20	102.72	2.52	21592	Sandstone	1.6	4.65	x
2010-69a	78.33	79.73	1.40	21598	Sandstone	1.8	4.25	x
2010-69a	10.69	11.28	0.59	21610	Sandstone	1.1	2.5	x
2010-69a	8.23	8.65	0.42	21611	Sandstone	1.4	2.4	x
2010-67a	56.69	59.74	3.05	21616	Sandstone	0.7	8.5	x
2010-67a	53.64	55.76	2.12	21617	Sandstone	0.7	1.8	x
2010-67a	50.60	51.39	0.79	21618	Sandstone	0.7	2.3	x
2010-67a	41.45	42.93	1.48	21619	Sandstone	1.4	6.8	x
2010-60a	113.60	113.90	0.30	21637	Sandstone	0.6	0.8	x
2010-60a	90.22	92.02	1.80	21645	Sandstone	0.4	1.4	x
2010-60a	85.80	87.17	1.37	21646	Sandstone	1.4	2.8	x
2010-60a	81.08	84.12	3.05	21647	Sandstone	0.7	3.4	x
2010-60a	41.45	42.11	0.66	21654	Sandstone	1.3	1.4	x
2010-38a	85.04	86.56	1.52	21663	Sandstone	0.7	5.2	x
2010-38a	53.04	54.56	1.52	21672	Sandstone	0.8	3.7	x
2010-38a	47.70	48.46	0.76	21673	Sandstone	1.0	7.2	x
2010-38a	19.53	21.03	1.50	21679	Sandstone	0.8	4.4	x
2010-63v	81.69	83.04	1.35	21681	Sandstone	1.1	4.3	x
2010-63v	73.50	75.59	2.09	21682	Sandstone	1.1	5.4	x
2010-63v	70.45	71.90	1.45	21684	Sandstone	0.9	1.2	x
2010-63v	10.22	10.90	0.68	21697	Sandstone	0.6	3.4	x
2010-66a	108.51	110.31	1.80	21699	Sandstone	0.7	5.1	x
2010-66a	105.46	106.39	0.93	21700	Sandstone	0.8	2.1	x
2010-66a	95.42	96.32	0.90	21701	Sandstone	0.9	2.2	x
2010-66a	83.07	84.12	1.06	21703	Sandstone	0.8	3.3	x
2010-66a	78.03	78.68	0.65	21704	Sandstone	1.5	1.8	x
2010-66a	70.65	71.93	1.28	21706	Sandstone	0.8	3.3	x
2010-66a	65.84	66.51	0.67	21707	Sandstone	0.6	3	x
2010-66a	53.64	53.87	0.23	21708	Sandstone	0.9	0.5	x
2010-66a	44.50	45.48	0.98	21709	Sandstone	1.5	2.9	x
2010-18a	91.14	92.66	1.52	21718	Sandstone	0.9	7.7	x
2010-18a	19.58	20.13	0.55	21729	Sandstone	1.2	3	x
2010-67a	16.23	16.73	0.50	21623	Sandstone Anderson	1.6	0.6	x

Notes: 12.0 cm to cell rim from top of rocks

Field Cell 6 (Siltstone / Sandstone) - Breakdown of Composition, and Humidity Cell Collection

Holeid	From (m)	To (m)	Interval (m)	Sample ID	Lithology	Se contained (ppm)	Sampled Wt (g)	HC Sample
2011-02a	35.33	35.66	0.33	21509	Mudstone	1.2	0.8	x
2011-02a	29.57	31.17	1.60	21510	Siltstone	1.5	2.4	x
2011-02a	26.77	27.57	0.80	21511	Siltstone	1.9	1.7	x
2011-02a	13.46	14.33	0.87	21513	Siltstone	1.1	3.2	x
2011-02a	8.49	8.80	0.31	21514	Mudstone	2.6	0.6	x
2011-01a	9.85	10.49	0.64	21515	Mudstone	2.5	0.3	x
2011-01a	14.33	14.69	0.36	21516	Mudstone	2.1	0.6	x
2011-01a	23.27	23.47	0.20	21518	Mudstone	3.4	0.6	x
2011-01a	31.46	32.61	1.15	21519	Mudstone	1.6	3.3	x
2011-01a	36.78	37.30	0.52	21520	Siltstone	1.8	2.2	x
2011-01a	43.61	44.81	1.20	21522	Siltstone	1.8	3.7	x
2010-64a	49.87	49.90	0.03	21529	Mudstone	1.0	2	x
2010-64a	51.21	52.73	1.52	21530	Mudstone	1.2	2.7	x
2010-47a	66.45	67.97	1.52	21532	Siltstone	1.1	3	x
2010-47a	51.21	52.73	1.52	21533	Siltstone	1.8	2.8	x
2010-47a	57.30	58.83	1.52	21534	Siltstone	3.9	0.8	x
2010-47a	63.40	64.37	0.97	21536	Siltstone	1.9	1.6	x
2010-47a	46.93	47.27	0.34	21537	Mudstone	3.4	0.7	x
2010-47a	42.06	43.59	1.52	21539	Siltstone	1.0	2	x
2010-47a	27.79	28.35	0.55	21540	Siltstone	1.2	2	x
2010-47a	25.30	25.75	0.45	21541	Siltstone	0.9	1.3	x
2010-47a	19.20	20.45	1.25	21543	Mudstone	2.7	3.1	x
2010-39a	62.94	63.70	0.76	21545	Siltstone	1.2	2.1	x
2010-39a	46.54	46.94	0.40	21548	Siltstone	1.3	2.2	x
2010-39a	42.37	43.34	0.97	21549	Mudstone	2.3	1	x
2010-39a	36.66	37.74	1.08	21550	Siltstone	1.0	4.2	x
2010-39a	28.74	29.19	0.45	21551	Mudstone	2.9	1	x
2010-39a	15.51	16.46	0.95	21553	Siltstone	1.8	3.3	x
2010-39a	13.41	15.03	1.62	21554	Siltstone	1.3	4.2	x
2010-52a	84.43	85.95	1.52	21555	Mudstone	1.7	2.65	x
2010-52a	57.00	58.52	1.52	21562	Mudstone	1.9	1.5	x
2010-52a	47.85	48.45	0.60	21565	Mudstone	1.0	2	x
2010-52a	38.71	40.23	1.52	21567	Siltstone	0.4	0.8	x
2010-52a	29.57	31.09	1.52	21568	Siltstone	0.7	3.6	x
2010-52a	20.42	21.95	1.52	21569	Siltstone	0.9	4.1	x
2010-62v	32.40	32.78	0.38	21575	Mudstone	0.7	1.7	x
2010-62v	29.69	30.48	0.79	21576	Mudstone	1.5	2.95	x
2010-39a	35.17	36.27	1.10	21578	Mudstone	1.1	2.7	x
2010-39a	34.75	34.99	0.24	21579	Mudstone	2.7	0.5	x
2010-42v	57.30	58.83	1.52	21580	Siltstone	1.9	2.7	x
2010-42v	46.33	46.93	0.60	21583	Mudstone	2.4	1	x
2010-42v	42.06	43.59	1.52	21584	Siltstone	2.3	2	x
2010-42v	40.54	40.84	0.30	21585	Mudstone	1.4	2.1	x
2010-42v	31.39	31.65	0.26	21586	Mudstone	2.7	0.5	x
2010-42v	27.34	28.35	1.00	21587	Siltstone	1.1	2.7	x
2010-42v	21.43	22.17	0.74	21589	Siltstone	3.8	0.7	x
2010-42v	11.58	12.50	0.91	21590	Siltstone	1.5	2.2	x

2010-69a	108.81	111.86	3.05	21591	Siltstone	1.6	2.4	x
2010-69a	91.70	92.72	1.02	21594	Siltstone	1.3	1	x
2010-69a	83.26	84.43	1.17	21597	Siltstone	4.1	1.3	x
2010-69a	63.10	65.47	2.37	21599	Siltstone	2.0	1.1	x
2010-69a	61.50	62.02	0.52	21600	Siltstone	2.7	0.8	x
2010-69a	50.19	50.90	0.71	21602	Siltstone	1.4	2.2	x
2010-69a	44.81	45.61	0.80	21603	Mudstone	2.3	0.8	x
2010-69a	43.86	44.32	0.46	21605	Mudstone	2.7	0.5	x
2010-69a	29.57	31.07	1.50	21607	Siltstone	1.6	3	x
2010-69a	20.42	22.17	1.75	21609	Siltstone	2.2	1.9	x
2010-67a	75.96	76.85	0.89	21612	Mudstone	3.2	1.3	x
2010-67a	71.93	73.05	1.12	21613	Mudstone	2.8	0.5	x
2010-67a	67.95	68.88	0.94	21614	Mudstone	1.5	1.35	x
2010-67a	63.94	65.84	1.90	21615	Siltstone	2.3	1.1	x
2010-67a	38.40	38.58	0.18	21620	Siltstone	0.7	0.4	x
2010-67a	29.26	30.28	1.02	21621	Siltstone	1.4	2.2	x
2010-67a	23.16	24.60	1.44	21622	Mudstone	3.9	0.8	x
2010-67a	10.97	12.62	1.65	21624	Siltstone	1.6	3.85	x
2010-21a	3.05	4.27	1.22	21625	Siltstone	1.5	0.8	x
2010-21a	6.52	6.63	0.11	21626	Mudstone	0.6	0.9	X
2010-21a	7.60	7.92	0.32	21627	Mudstone	1.8	0.75	x
2010-21a	11.05	11.15	0.10	21628	Mudstone	1.2	1	x
2010-21a	17.59	17.98	0.39	21629	Siltstone	2.2	1.7	x
2010-21a	33.22	36.27	3.05	21631	Mudstone	1.2	1.7	x
2010-48a	36.90	38.40	1.51	21635	Siltstone	3.4	3.9	x
2010-48a	38.40	41.45	3.05	21636	Siltstone	3.5	1.5	x
2010-60a	111.56	113.39	1.83	21638	Siltstone	1.4	5.3	x
2010-60a	94.79	96.32	1.52	21643	Siltstone	2.0	2	x
2010-60a	76.60	77.09	0.49	21648	Siltstone	1.8	2.5	x
2010-60a	68.88	71.74	2.86	21650	Mudstone	2.2	1.7	x
2010-60a	62.79	63.30	0.51	21651	Mudstone	0.9	1	x
2010-60a	54.87	56.69	1.82	21652	Siltstone	1.6	6	x
2010-60a	46.48	47.28	0.80	21653	Siltstone	2.4	1	x
2010-60a	33.92	35.00	1.08	21656	Mudstone	1.4	2.3	x
2010-60a	15.54	16.44	0.90	21660	Mudstone	1.5	1.55	x
2010-60a	13.41	14.02	0.61	21661	Mudstone	2.1	0.7	x
2010-60a	7.62	7.92	0.30	21662	Mudstone	1.5	1.5	x
2010-38a	81.99	82.94	0.95	21664	Siltstone	1.4	1.7	x
2010-38a	80.47	81.99	1.52	21665	Siltstone	1.1	5.6	x
2010-38a	75.25	76.29	1.04	21667	Siltstone	1.2	2.3	x
2010-38a	72.85	74.37	1.52	21668	Siltstone	1.1	2.1	x
2010-38a	68.66	69.80	1.14	21669	Siltstone	1.2	2.5	x
2010-38a	64.72	65.23	0.50	21670	Siltstone	1.5	1.7	x
2010-38a	56.08	57.61	1.52	21671	Siltstone	1.3	2.8	x
2010-38a	43.17	43.89	0.72	21674	Mudstone	1.7	1.7	x
2010-38a	37.80	39.32	1.52	21675	Siltstone	1.4	3.5	x
2010-38a	35.50	36.27	0.77	21676	Siltstone	2.1	0.7	x
2010-38a	27.65	28.69	1.04	21677	Siltstone	2.5	2	x
2010-38a	17.98	18.73	0.75	21680	Siltstone	1.4	3	x
2010-63v	72.80	73.50	0.70	21683	Siltstone	1.7	0.8	x
2010-63v	67.89	68.19	0.30	21685	Mudstone	1.8	0.8	x
2010-63v	63.40	63.90	0.50	21687	Siltstone	1.9	1.4	x
2010-63v	48.16	48.71	0.55	21690	Siltstone	2.0	0.5	x

2010-63v	42.06	43.85	1.79	21691	Siltstone	3.7	0.5	x
2010-63v	39.01	41.71	2.70	21692	Siltstone	2.0	0.9	x
2010-63v	32.92	34.21	1.29	21693	Siltstone	3.1	1	x
2010-63v	26.10	26.82	0.72	21694	Siltstone	1.4	1	x
2010-63v	21.80	23.77	1.98	21695	Siltstone	2.3	3	x
2010-63v	20.73	21.80	1.07	21696	Siltstone	2.2	1.5	x
2010-63v	5.49	6.69	1.20	21698	Siltstone	1.4	2.7	x
2010-66a	88.02	89.09	1.07	21702	Siltstone	2.3	1.6	x
2010-66a	74.98	75.92	0.94	21705	Siltstone	0.8	2.8	x
2010-66a	38.40	41.45	3.05	21710	Mudstone	2.3	0.6	x
2010-66a	35.91	36.64	0.73	21711	Mudstone	2.2	0.7	x
2010-66a	32.31	33.38	1.07	21713	Mudstone	2.4	1.2	x
2010-66a	26.21	29.26	3.05	21714	Mudstone	1.1	2.7	x
2010-66a	20.12	21.48	1.36	21715	Siltstone	1.9	3.05	x
2010-66a	10.97	12.60	1.63	21716	Siltstone	2.3	1.3	x
2010-66a	7.92	10.11	2.19	21717	Siltstone	1.6	4.1	x
2010-18a	95.71	97.23	1.52	21719	Siltstone	1.1	1.3	x
2010-18a	86.56	87.78	1.22	21721	Mudstone	1.5	5.8	x
2010-18a	63.70	64.40	0.70	21723	Mudstone	0.6	1.5	x
2010-18a	60.95	61.58	0.63	21725	Mudstone	0.8	1	x
2010-18a	23.56	24.21	0.65	21726	Mudstone	1.3	1.1	x

Notes: 11.0 cm to cell rim from top of rocks

Appendix VII

2012 Seismic Reflection Investigation (by Ralf Hansen)

CENTERMOUNT COAL LTD.

REPORT ON

SEISMIC REFLECTION INVESTIGATION

ELK RIVER COAL PROJECT

ELKFORD, B.C.

by

Ralf Hansen, M.Sc.

Cliff Candy, P.Geo.

October, 2012 **PROJECT FGI-1275**

Frontier Geosciences Inc. 237 St. Georges Avenue, North Vancouver, B.C., Canada V7L 4T4
Tel: 604.987.3037 Fax: 604.984.3074

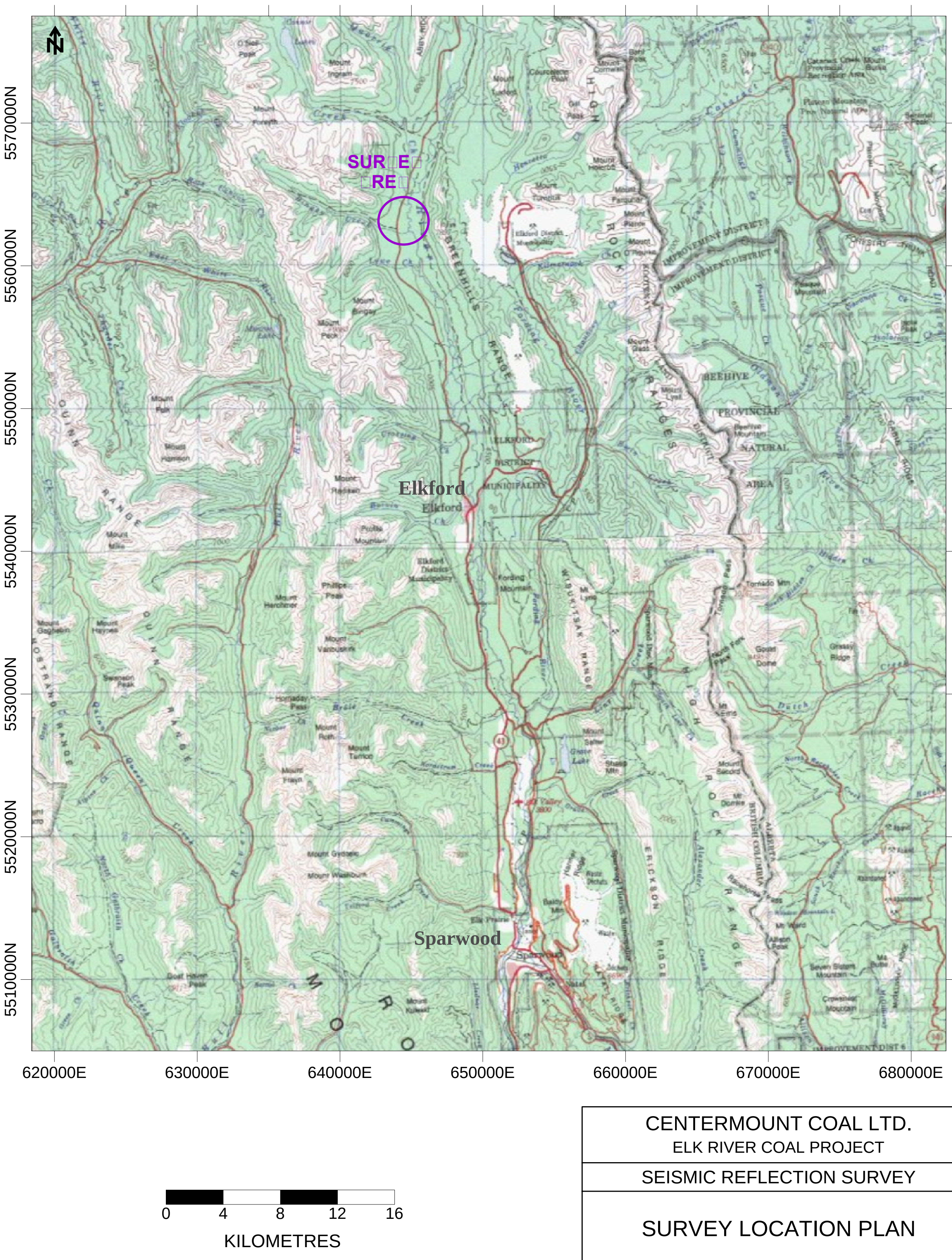
CONTENTS

ILLUSTRATIONS

1. INTRODUCTION

In the period October 16 through October 31, 2012, Frontier Geosciences Inc. carried out a seismic reflection and refraction investigation for Centermount Coal Ltd. at the Elk River Coal Project. The project site is just northwest of the Bingay Creek and Elk River junction, 21 kilometres north of Elkford, British Columbia. A Survey Location Plan of the area is shown at a scale of 1:400,000 in Figure 1.

The purpose of the geophysical surveys was to identify depth to bedrock, classification of overburden material, and structure and faulting at depth. A Site Plan of the survey area is presented at 1:10,000 scale in Figure 2 of the Appendix. In all, four separate seismic traverses were completed in the survey area. A total of approximately 4250 metres of detailed seismic reflection surveying was carried out in the investigation, with additional seismic refraction investigation on sections of the traverses.



CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

SURVEY LOCATION PLAN

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:400,000	FIG. 1

2. THE SEISMIC REFLECTION SURVEY METHOD

The goal of a seismic survey is to provide an image of the subsurface structure that is as detailed as possible, within the limits imposed by the nature of acoustic wave propagation in the earth. The 2D seismic method entails propagation of the acoustic waves through the earth from a sequence of source to receiver points.

2.1 Instrumentation and Field Procedure

The seismic reflection investigation was carried out with four Geometrics, Geode, 24 channel signal enhancement seismographs and Oyo Geo Space, 10 Hz geophones. Energy was provided by small explosive charges detonated in shallow, hand-excavated shotholes and detonated with a Geometrics, HVB-1, high voltage capacitor-type blaster.

In this survey, a ‘split spread’ configuration was used with the energy source located in the middle of an array of 72 geophone receivers. This receiver array spanned a survey line length of 355 metres and captured a broad spatial range of energy reflected from the horizons at depth. The survey procedure entailed collection of a 72 geophone record, then advancing the energy source 5 metres down the survey line and repeating the discharge and record process. This method, known as the common mid-point gather (CMP) technique, provides a very high degree of redundancy of sampling of the energy received from a given reflector at depth. The redundancy is used during the data processing procedure to develop an image of the subsurface reflectors of high fidelity. The seismic data acquired in this survey was generally of good to excellent quality.

Throughout the survey, notes were recorded regarding seismic line positions in relation to topographic and geological features in the area. Individual geophone locations were labelled in the field. Relative elevations on the seismic lines were recorded by chain and inclinometer with absolute elevations provided by Centermount Coal Ltd.

2.2 Data Processing

The data were recorded as a set of 2048 millisecond, SEG2 seismograms. The collected data sets were processed using the Seismic Unix software to provide the final stacked seismic profile and filtered shot gathers. The raw data at the first stage of the processing stand as a set of individual seismograms known as ‘shot gathers’. The first stage of the processing

involves the inspection of each of these records to reject non-relevant seismograms and noisy traces.
The second processing step consists in sorting the seismic traces using the shot and receiver positions to gather together each of the source and receiver pairs that were centered on a common spatial point. This ‘common mid-point’ or ‘CMP gather’ brings together each of the reflection ray paths that redundantly sample a given point on a subsurface reflector. First arrival mute was then applied to prevent first break energy from entering the reflection profile. In these CMP gathers, seismic reflections appear as a series of hyperbolic arcs.

Incoherent and coherent noise were then filtered using a frequency domain, band-pass filter with a lower limit of 20 Hz and an upper frequency of 210 Hz. A 100 millisecond automatic gain control was used to balance the trace amplitudes. Finally, the arrival time was adjusted to a reference datum in accordance with the respective relative elevation at each receiver.

The next stage in the processing flow was a determination of the apparent velocities within the CMP gathers from a semblance velocity analysis with a Constant-Velocity-Stack. Based on this velocity analysis, a normal move out correction was applied to derive CMP gathers with the hyperbolas flattened to the equivalent of zero offset records.

The stacking process then adds together the energy in each of the traces of the CMP gather, improving the signal-to-noise ratio while reinforcing the reflectors energy. The seismic profile was assembled from all the CMP traces.

In the final process, a migration was performed to improve the spatial resolution of dipping reflectors, creating a more accurate image of the subsurface.

3. THE SEISMIC REFRACTION SURVEY METHOD

3.1 Equipment and Field Procedure

Seismic refraction data was collected in conjunction with the seismic reflection data acquisition. For each 24 geophone spread, six separate ‘shots’ are initiated: one at either end of the geophone array, two at intermediate locations along the seismic cable, and one off each end of the line.

3.2 Data Processing

The interpretation of the seismic refraction data was arrived at using the method of differences technique. This method utilises the time taken to travel to a geophone from shotpoints located to either side of the geophone. Using the total time, a small vertical time is computed which represents the time taken to travel from the refractor up to the ground surface. This time is then multiplied by the velocity of each overburden layer to obtain the thickness of each layer at that point.

4. GEOPHYSICAL RESULTS

4.1 General

The results of the four seismic reflection traverses for the Elk River Coal Project Site are illustrated at 1:2000 scale in Figures 3 through 17 in the Appendix. Reflection lines SL-1A, SL-1B, SL-2, SL-3, and SL-4 are shown in final stacked seismic sections in both greyscale amplitude format and color scale amplitude format. Reflector interpretation is represented in a color range for the greyscale section, and for reasons of clarity, presented as uniformly black in the color section. For additional reference, a section without reflector interpretation is shown for each line. Refraction results are overlain as red and purple lines onto seismic traverses were applicable. Both represent velocity interfaces, whereas purple represents where this interface is coincident with the reflector horizon. The results of selected horizon elevations are illustrated in colour contour map display in Figures 18, 19 and 20 of the Appendix.

The seismic reflection program detected eight prominent reflectors in the site area, consistently present in each of the areas of investigation. The configuration of reflectors suggest a complex structural environment with variable geology. A number of faults are interpreted that offset the reflectors. Continuity of deeper reflectors, G and H, may be subject to interference from earlier arrival energy and are displayed as noncontinuous lines to reflect this greater uncertainty. Additional seismic and drillhole investigations would provide the geologic context and continuity to greatly extend and improve the existing interpretation.

4.2 Discussion

4.2.1 Line 1

The geophysical results from seismic line SL-1A are shown in Figures 3 to 5, and SL-1B in Figures 6 to 8 in the Appendix. A greyscale image of the interpreted seismic reflection data for SL-1A and SL-1B is shown in Figures 3 and 6, with interpreted reflectors overlain in Figures 4 and 7, respectively. Similarly, the colour image of SL-1A and SL-1B with interpretation is shown in Figures 5 and 8, respectively.

Refraction velocity analysis of seismic lines SL-1 indicates low compressional wave velocities of approximately 350 to 450 m/s in the upper 15 metres, consistent with loose sands and gravels. Compressional (P) wave velocities increase to 800 to 950 m/s at a depth of between 25 to 40 metres, followed by a layer velocity of 1100 to 1300 m/s. This interpreted shallow refractor is displayed on Figures 4 and 7 as a red horizon. These refraction results represent changes in velocity structure.

The shallowest reflector identified in the data is reflector A, occurring at a two-way time of 0.05 to 0.1 milliseconds (ms). Utilizing a velocity range of 1100 to 1300 m/s, provides a depth of 15 to 25 metres. The reflector is believed to be consistent with a transient of loose to a more stiff horizon. This shallow reflector A is congruent with the seismic refraction basal layer.

Reflector B is the next and strongest reflector identified and appears to represent bedrock transition or possibly an unconformity. Using a velocity range of 1600 to 1800 m/s, we can estimate depths of 20 to 50 m. This greater range an be attributed to the sudden change in depth of this reflector at a prominent fault zone, labeled as Fault 1 in Figures 18 to 20. A fold complex can be found to the east of this fault zone, and a basin-like structure to the west. A series of smaller linear, horizontal reflectors at early times in the basin may suggest more recent sedimentation. Section SL-1B shows greater continuity with lesser undulation and breaks in horizons may indicate possible faults, shown in select reflector elevation maps, Figures 18 to 20.

Several intermediate depth reflectors are observed (shades of blue and yellow) at depths of 100 to 800 meters below ground surface. The interpretation shows these layers to be undulating and crosscut by series of minor faults. The first three of these reflectors, designated reflectors C, D and E, have higher amplitude responses that suggests a significant change in layer density. This may be indicative of a transition to coal is associated with a coal intercept in borehole 2012-06Da. Reflectors C through E may represent approximately three coal seams with horizontally varying thicknesses. The reflector D signal response is more variable and shows interference from overlapping arrival amplitudes.

Three additional deeper reflectors, horizon F, horizon G, and horizon H may represent significant transitions within the deeper sedimentary rocks. The continuity of these can be inferred with limited confidence.

4.2.2 Line 2

The geophysical results from seismic line SL-2 are shown in Figures 9 to 11 in the Appendix. A greyscale section of the interpreted seismic reflection data, with interpreted reflectors overlaid, is shown in Figure 9 and 10, respectively. The colour scale section of seismic line SL-2 is shown in Figure 11.

This line is characterized by a large fault in the west that may indicate continuation of Fault 1 in seismic line SL-1. A number of dipping reflectors is more pronounced here, cross cutting mostly horizontal horizons. Further faults may be present in the eastern part of the seismic profile, shown as dashed lines in Figures 18 to 20, and may be indicative of a complex folding environment. Vertical projection of the folding complex adjacent to Fault 1 coincides with topographic highs at surface.

The high amplitude bedrock transition reflector B and the deeper reflectors C to E are not as continuous and prominent as observed on the eastern section and for seismic line SL-1. Drillhole 2012-01Ra measurements show that Reflector C correlates with a coal seam. Amplitude response may suggest reflectors D and E represent coal interfaces as well. Two possible reflectors F and G are observed at depth of around 550 and 750 metres, respectively. These may represent additional sedimentary horizons. Another deep reflector is evident (black line) which although mostly discontinuous, is associated with a more flat-lying deep transition.

4.2.3 Line 3

The geophysical results from seismic line SL-3 are shown in Figures 12 to 14 in the Appendix. A greyscale section of the interpreted seismic reflection data, with interpreted reflectors overlaid, is shown in Figure 12. Figure 14 depicts a colour image with interpretation. Greyscale images of SL-3 without interpretation is shown in Figure 13.

Refraction velocity analysis of seismic lines SL-3 indicates low compressional wave velocities of approximately 300 to 400 m/s in the upper 15 metres. This is similar to those observed on profiles SL-1 consistent with loose sands and clays. Beneath this shallow layer, P-wave velocities range from 950 to 1100 m/s at depths of between 25 to 40 metres, followed by a layer velocity of 1750 to 2100 m/s.

The western end of the section is characterized by a basin bordered by a fault zone, similar to profile SL-1 and SL-2. This may be indicative of a continuous north to south running fracture zone (Figures 18 to 20) and is further supported by the multiple dipping reflectors, assumed to be faults, evident in this area. Reflectors exhibit greater continuity along the profile when compared to SL-2, shallowing significantly at 300E and 600E along the line. These slightly shallower features represent possible doming due to a compressional environment. In addition, there is subtle indication of two additional fracture zones at 700E and 900E.

The most dominant reflector is the high amplitude bedrock transition reflector A which is clearly observed along the entire profile. A strong second reflector B is equally evident and may indicate an unconformity to more recent basin sedimentation. There are several other intermediate layer reflectors observed below, these are displayed as horizons C through E. Amplitude response and borehole intersections 2012-04Ra and 2012-02Ra indicate that these likely represent coal layering.

Other deep reflectors F and G are partly evident, and represent deeper horizons in the sedimentary sequence. The possible bedrock reflector H (black line) is observed at elevations of 500 to 600 metres over much of the length of line SL-3.

4.2.4 Line 4

The geophysical results from seismic line SL-4 are shown in Figures 15 to 17 in the Appendix. A greyscale section of the interpreted seismic reflection data, with interpreted reflectors overlaid, is shown in Figure 15. Figure 16 depicts the seismic section without interpretation. The colour image of SL-4 with simplified black color interpretation is shown in Figure 17.

SL-4 intersects seismic line SL-3 and there is good agreement in depth between the reflectors observed on SL-3 at the intersection. Layering appears to deepen to the north along the seismic section, with only minor undulation and good continuity when compare to SL-1, SL-2 and SL-3. The section is characterized by considerable compressional folding, evident in a nappe-like structure between 450N and 600N, doming at 400N, and with abrupt breaks in horizontal continuity at 100N, 400N and 550N. These breaks may be indicative of faults, but may also represent overturned layering.

The most dominant reflector is the high amplitude bedrock transition reflector A, which is clearly evident in the profile. A second strong reflector B is observed at 20 to 50 m depth and may represent a discontinuity. Three other intermediate layers, labelled reflector C to reflector E, are observed that may represent variations in coal and sediment layers. Two additional reflectors F and G are evident below and may represent additional sedimentary horizons, above the deeper, more flat-lying reflector H that is observed at an elevation of around 500 metres over much of the length of line SL-4.

5. LIMITATIONS

The depths to subsurface boundaries derived from seismic reflection and refraction surveys are generally accepted as accurate to within fifteen percent of the true depths to the boundaries. In some cases, unusual geological conditions may produce false or misleading readings with the result that computed depths to subsurfaces boundaries may be less accurate.

For seismic reflection, a range of errors from digitising, velocity modelling and data gridding are expected. The lack of sonic log or vertical compressional wave velocities for the overburden layering, places a high reliance on geological information to build a reliable velocity model. Reflections can occur from surfaces not in the plane of the seismic reflection profile. As well, some uncertainty is present in correlating reflectors between profiles where there is a lack of cross points.

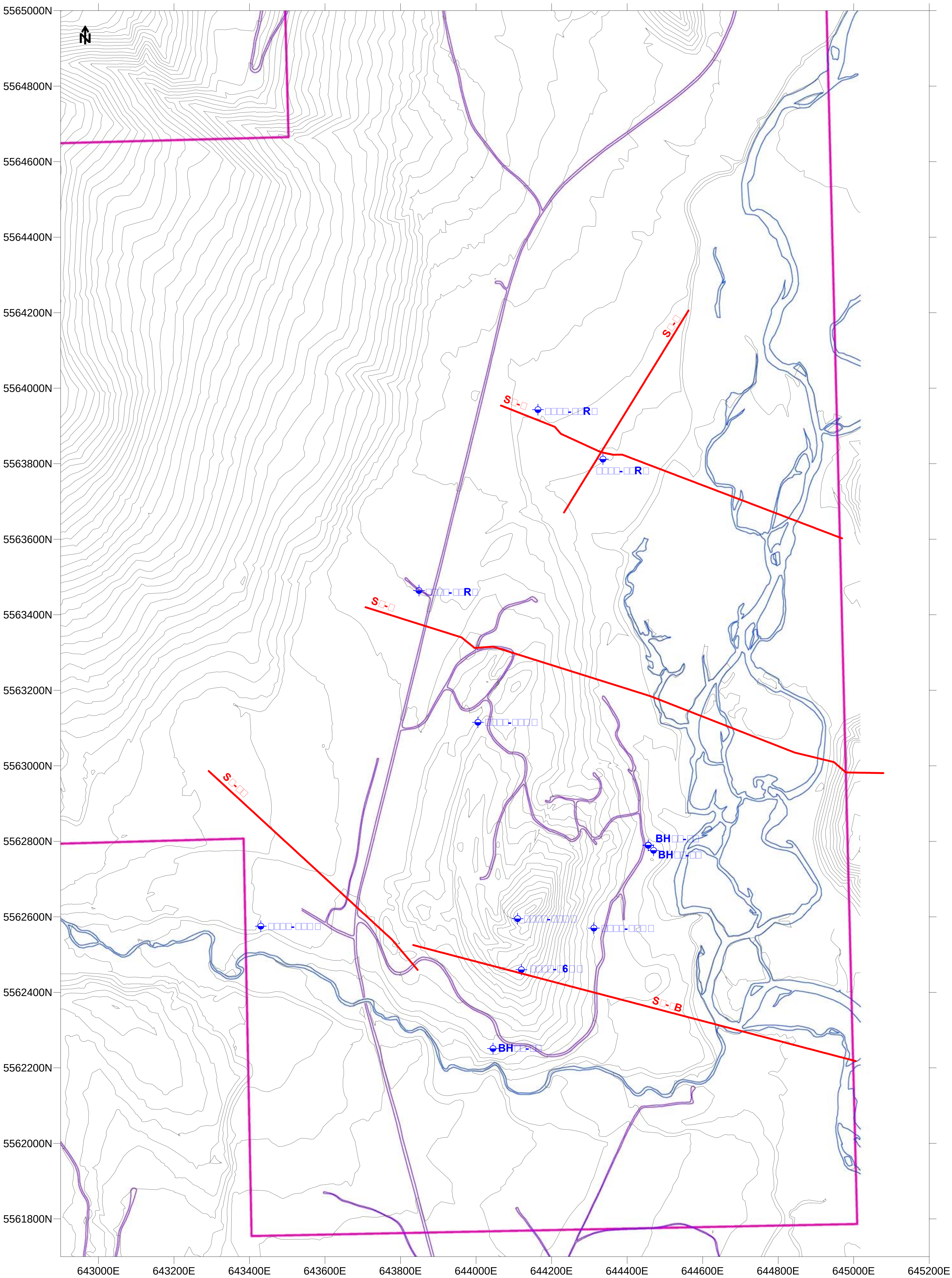
In seismic refraction surveying difficulties with a ‘hidden layer’ or a velocity inversion may produce erroneous depths. This condition is caused by the inability to detect the existence of a layer because of insufficient velocity contrasts or layer thicknesses. A velocity inversion exists when an underlying layer has a lower velocity than the layer directly above it. The interpreted depths shown on drawings are to the closest interface location, which may not be vertically below the measurement point if the refractor dip direction departs significantly from the survey line location.

A range of errors from digitizing, velocity modelling and data gridding are expected. The lack of a sonic log or vertical compressional wave velocities, places a high reliance on limited geological information to build a reliable velocity model in a complex structural environment. Some uncertainty is present in correlating reflectors between profiles where there is a lack of cross points. As well, reflections can occur from surfaces not in the plane of the seismic profile.

The results are interpretive in nature and are considered to be a reasonably accurate representation of existing subsurface conditions within the limitations of the seismic reflection and refraction methods.

For: Frontier Geosciences Inc.

Ralf Hansen, M.Sc. Cliff Candy, P.Geo.



ROADS
WATERWAYS
PROPERTY BOUNDARY
SEISMIC LINES
DRILLHOLES

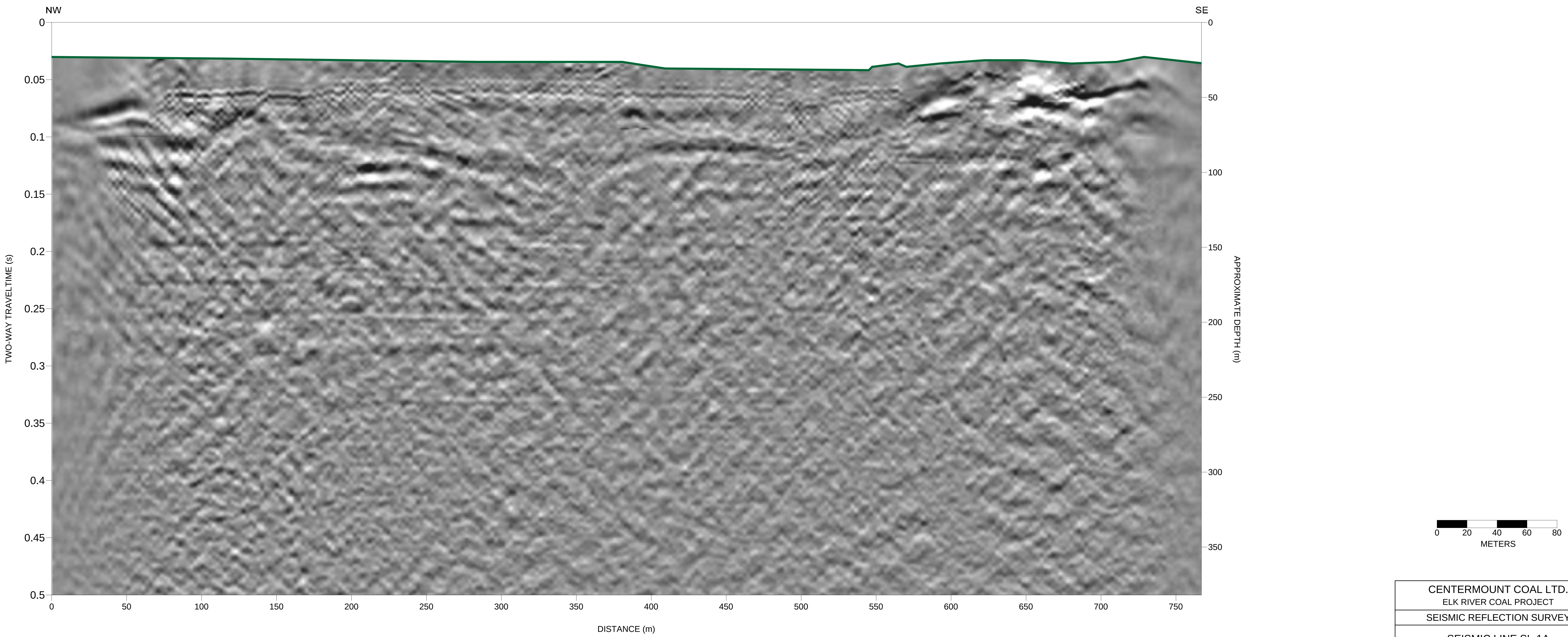
0 100 200 300 400
METRES

CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT
SEISMIC REFLECTION SURVEY

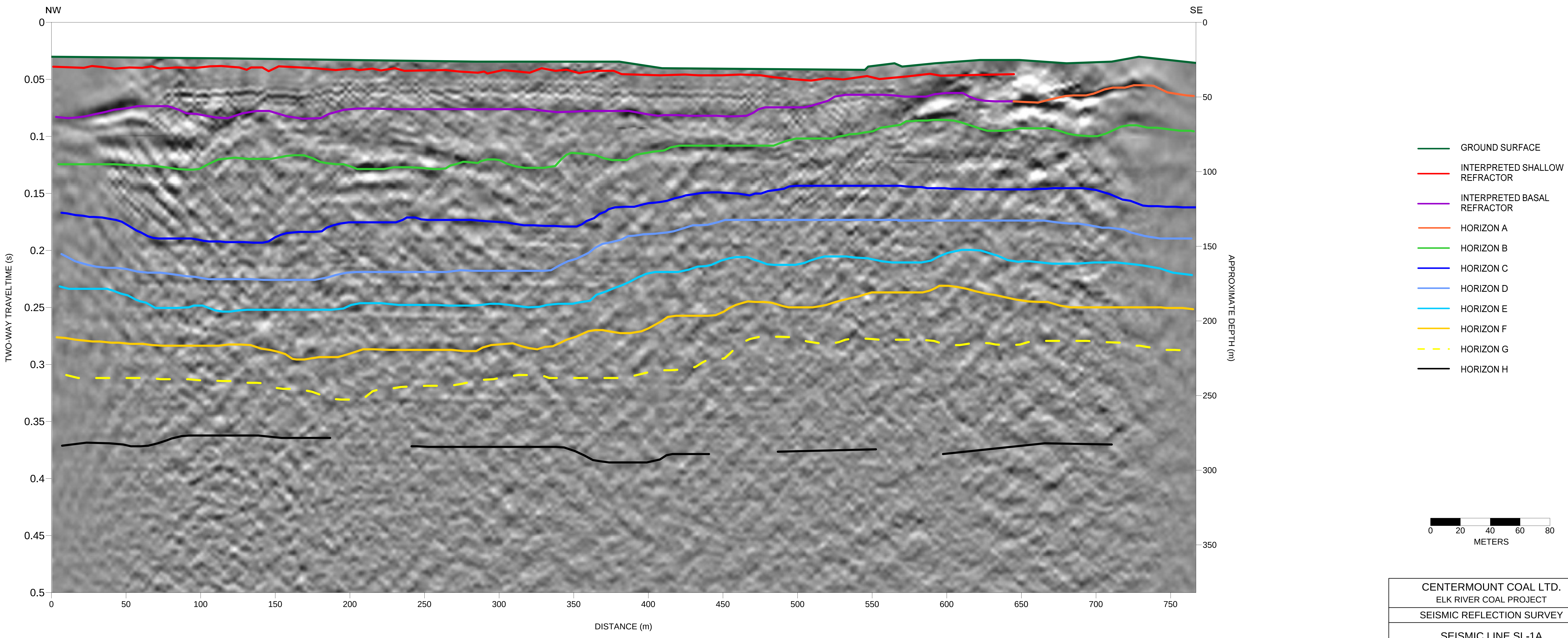
SITE PLAN

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:10,000	FIG. 2



CENTERMOUNT COAL LTD. ELK RIVER COAL PROJECT		
SEISMIC REFLECTION SURVEY		
SEISMIC LINE SL-1A GREYSCALE SECTION		
FRONTIER GEOSCIENCES INC.		
DATE: OCT. 2012	SCALE 1:2,000	FIG. 3



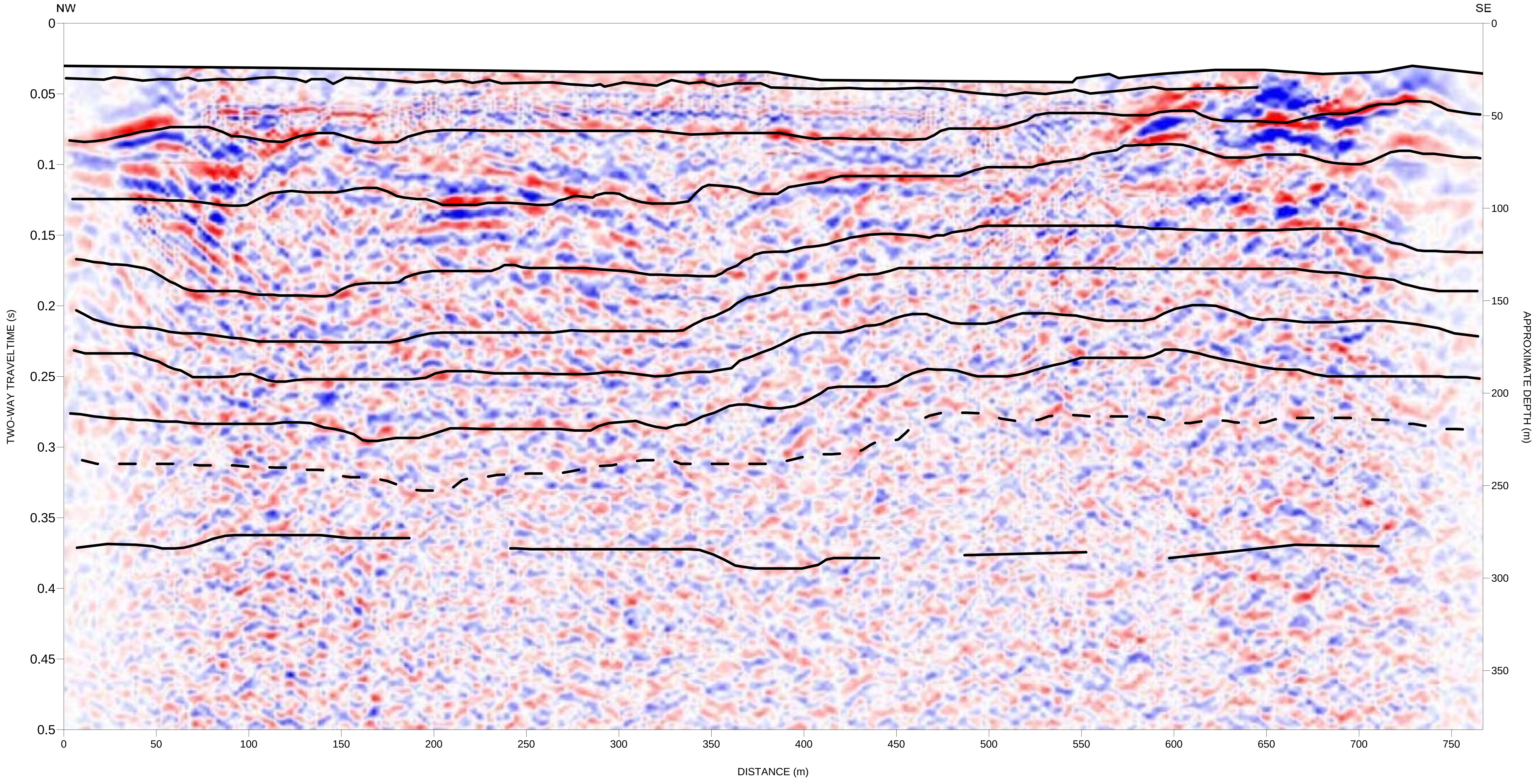
CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

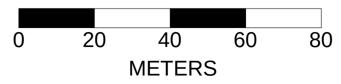
SEISMIC REFLECTION SURVEY

SEISMIC LINE SL-1A
GREYSCALE SECTION - INTERPRETED

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:2,000	FIG. 4





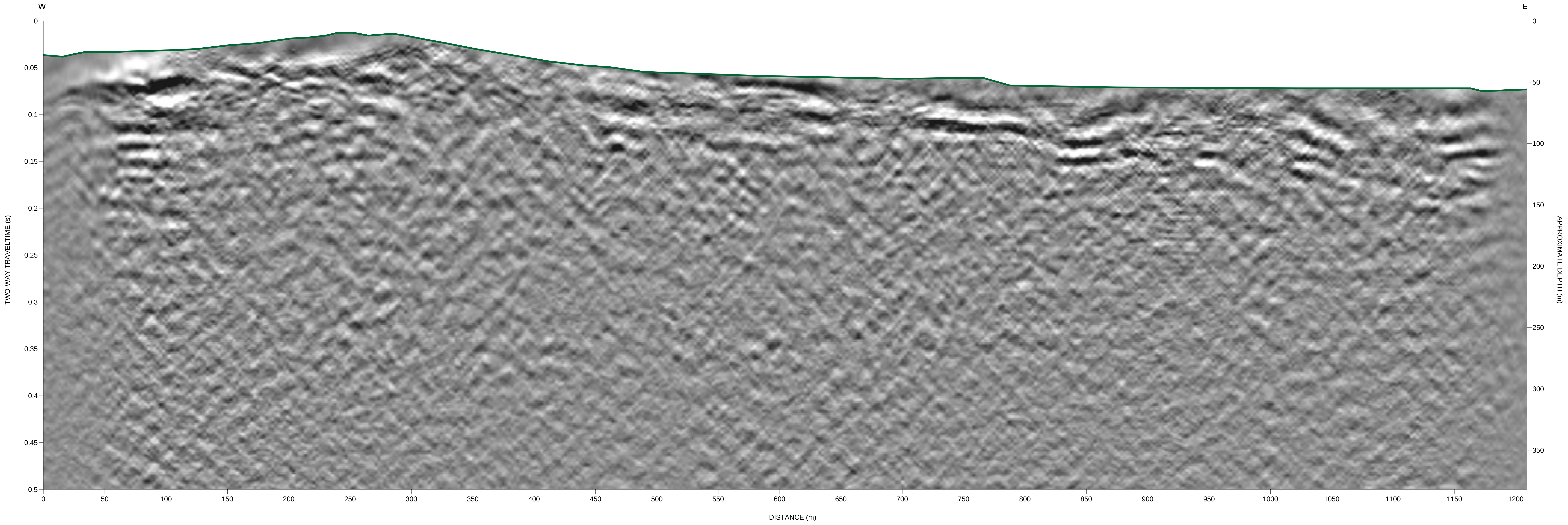
CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

SEISMIC LINE SL-1A
COLOR SECTION - INTERPRETED

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:2,000	FIG. 5



0 20 40 60 80
METRES

CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

SEISMIC LINE SL-1B
GREYSCALE SECTION

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012 | SCALE 1:2,000 | FIG. 6

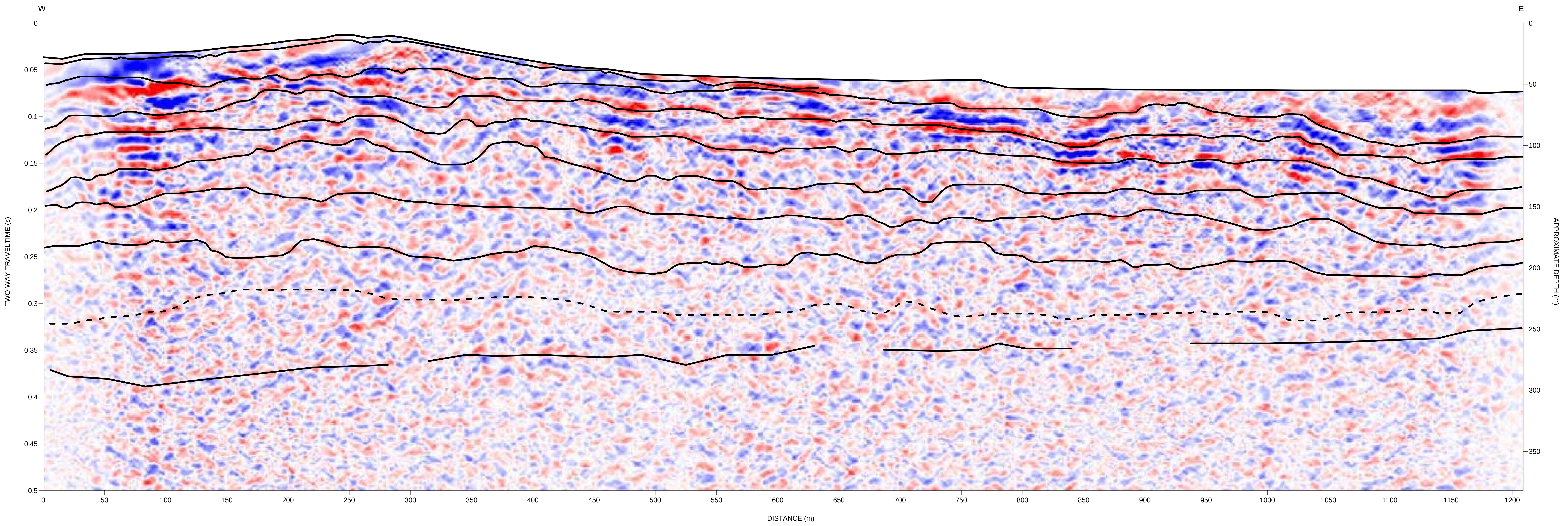
CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

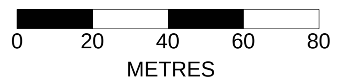
SEISMIC REFLECTION SURVEY

SEISMIC LINE SL-1B
GREYSCALE SECTION - INTERPRETED

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:2,000	FIG. 7





CENTERMOUNT COAL LTD.

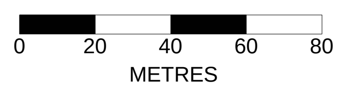
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

SEISMIC LINE SL-1B
COLOR SECTION - INTERPRETED

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:2,000	FIG. 8



CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

SEISMIC LINE SL-2
GREYSCALE SECTION

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:2,000	FIG. 9

CENTERMOUNT COAL LTD. ELK RIVER COAL PROJECT		
SEISMIC REFLECTION SURVEY		
SEISMIC LINE SL-2 GREYSCALE SECTION - INTERPRETED		
FRONTIER GEOSCIENCES INC.		
DATE: OCT. 2012	SCALE 1:2,000	FIG. 10

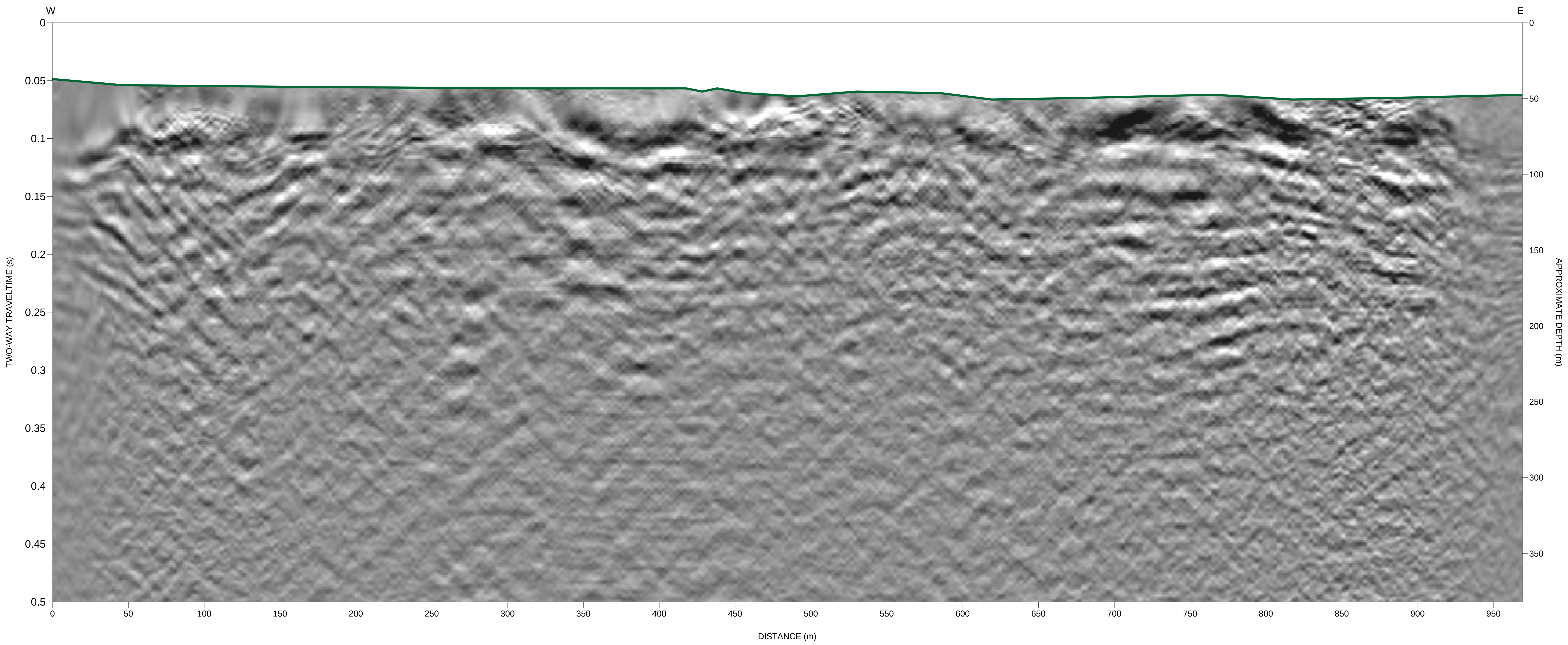
CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

SEISMIC LINE SL-2
COLOR SECTION - INTERPRETED

FRONTIER GEOSCIENCES INC.

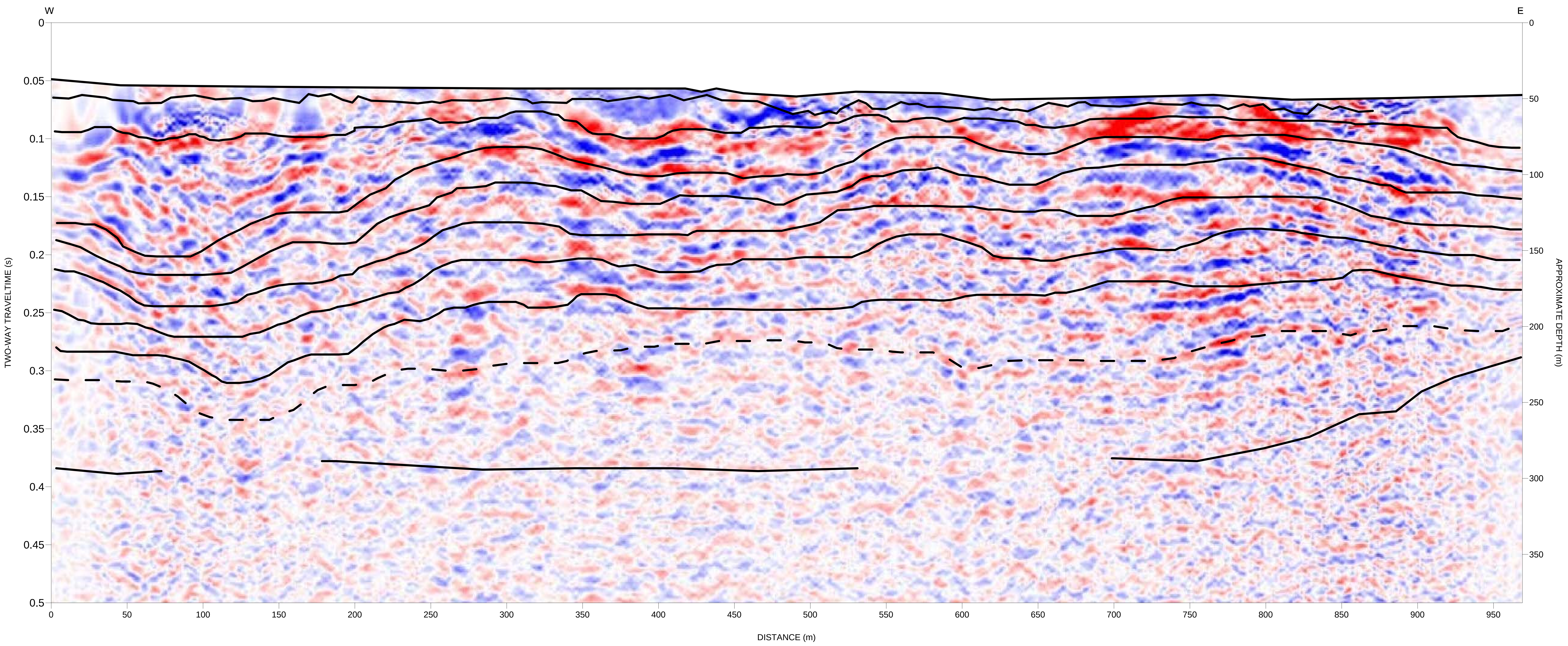
DATE: OCT. 2012	SCALE 1:2,000	FIG. 11

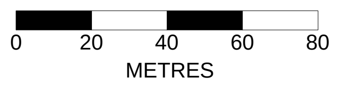


0 20 40 60 80
METRES

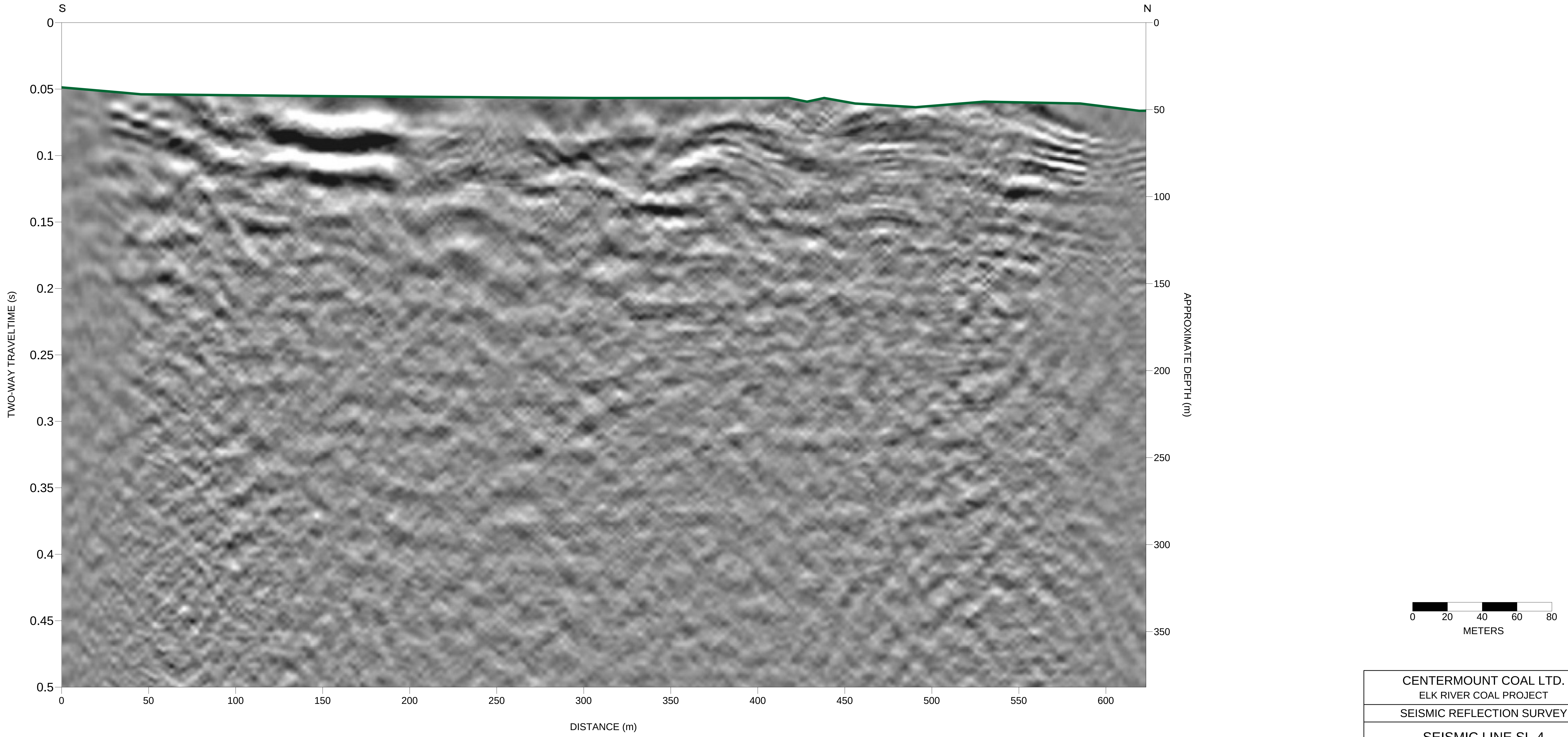
CENTERMOUNT COAL LTD. ELK RIVER COAL PROJECT		
SEISMIC REFLECTION SURVEY		
SEISMIC LINE SL-3 GREYSCALE SECTION		
FRONTIER GEOSCIENCES INC.		
DATE: OCT. 2012	SCALE 1:2,000	FIG. 12


W
E
TWO-WAY TRAVELTIME (s)
APPROXIMATE DEPTH (m)
DISTANCE (m)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950
0 50 100 150 200 250 300 350
GROUND SURFACE
INTERPRETED SHALLOW REFRACTOR
INTERPRETED BASAL REFRACTOR
HORIZON A
HORIZON B
HORIZON C
HORIZON D
HORIZON E
HORIZON F
HORIZON G
HORIZON H
0 20 40 60 80
METRES
CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT
SEISMIC REFLECTION SURVEY
SEISMIC LINE SL-3
GREYSCALE SECTION - INTERPRETED
FRONTIER GEOSCIENCES INC.
DATE: OCT. 2012
SCALE 1:2,000
FIG. 13





CENTERMOUNT COAL LTD. ELK RIVER COAL PROJECT		
SEISMIC REFLECTION SURVEY		
SEISMIC LINE SL-3 COLOR SECTION - INTERPRETED		
FRONTIER GEOSCIENCES INC.		
DATE: OCT. 2012	SCALE 1:2,000	FIG. 14



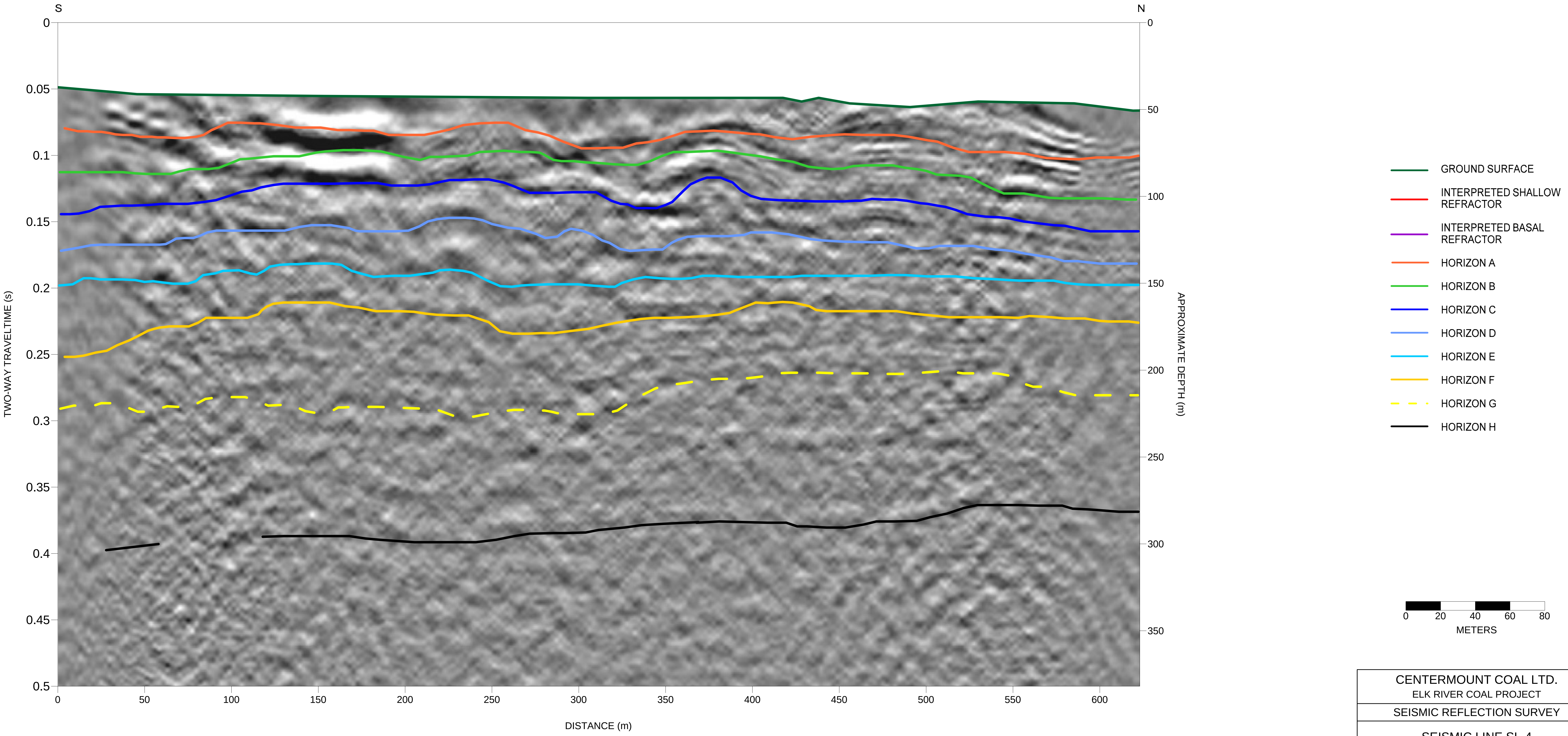
CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

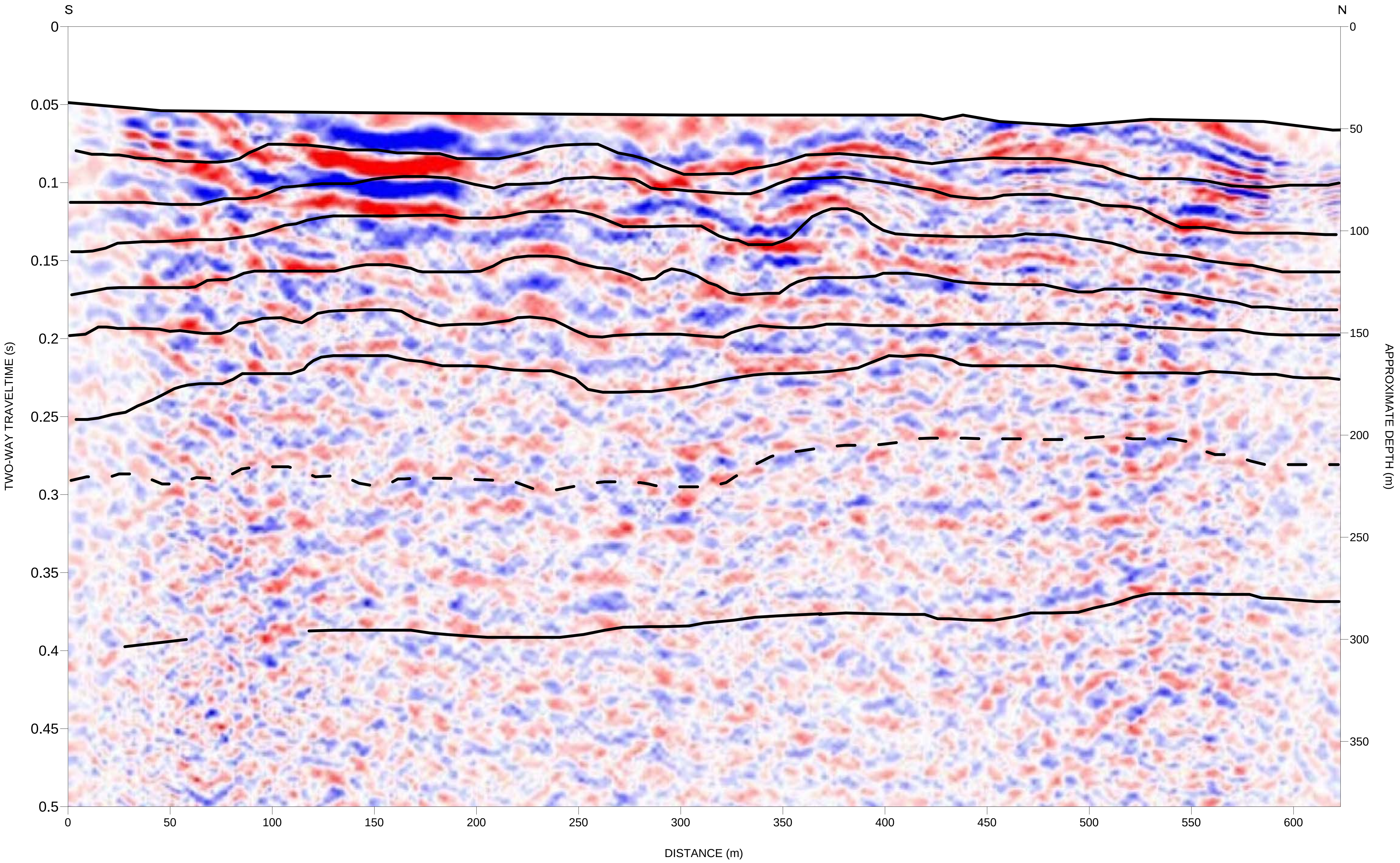
SEISMIC LINE SL-4
GREYSCALE SECTION

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:2,000	FIG. 15



CENTERMOUNT COAL LTD. ELK RIVER COAL PROJECT		
SEISMIC REFLECTION SURVEY		
SEISMIC LINE SL-4 GREYSCALE SECTION - INTERPRETED		
FRONTIER GEOSCIENCES INC.		
DATE: OCT. 2012	SCALE 1:2,000	FIG. 16



0 20 40 60 80
METERS

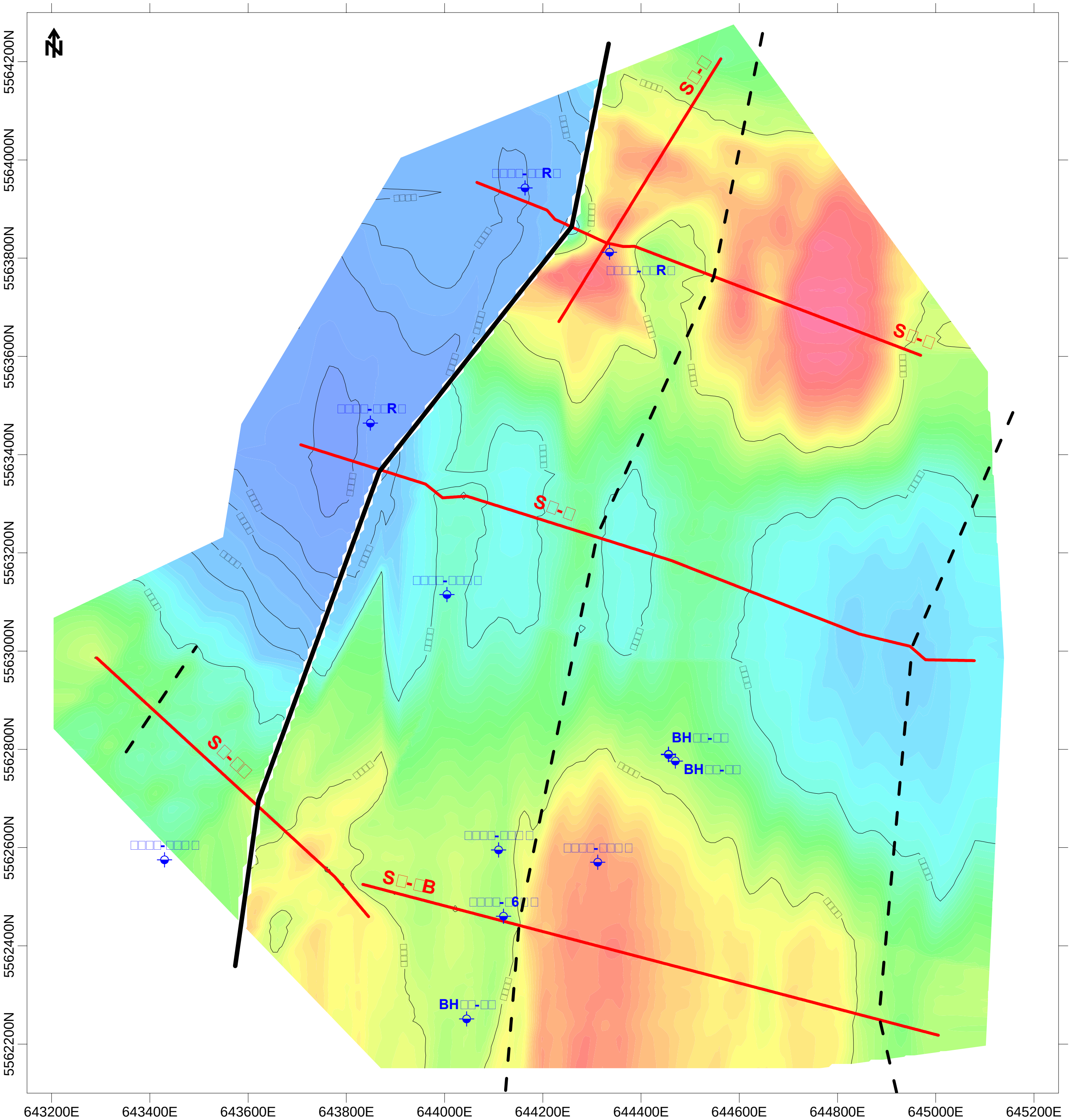
CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

SEISMIC LINE SL-4
COLOR SECTION - INTERPRETED

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:2,000	FIG. 17



1250 1330 1357 1371 1378 1385 1390 1396 1402 1409

REFLECTOR ELEVATION (m)

0 100 200 300 400

METRES

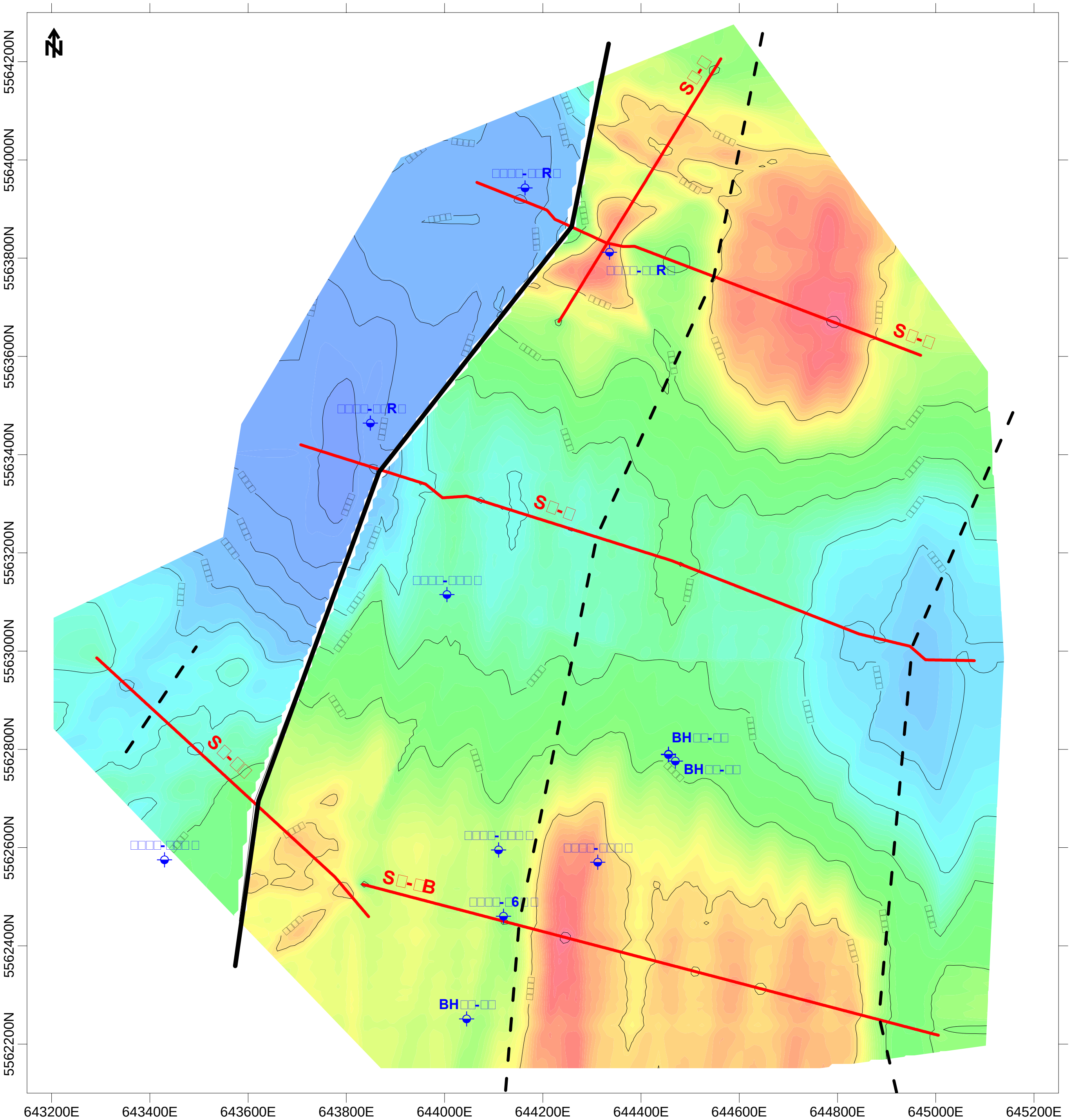
FAULT 1

POTENTIAL FAULTS

SEISMIC LINES

DRILLHOLES

CENTERMOUNT COAL LTD. ELK RIVER COAL PROJECT		
SEISMIC REFLECTION SURVEY		
REFLECTOR B ELEVATION CONTOUR PLAN		
FRONTIER GEOSCIENCES INC.		
DATE: OCT. 2012	SCALE 1:1,000	FIG. 18



1100 1200 1250 1276 1294 1321 1333 1345 1354 1366 1389

REFLECTOR ELEVATION (m)

0 100 200 300 400

METRES

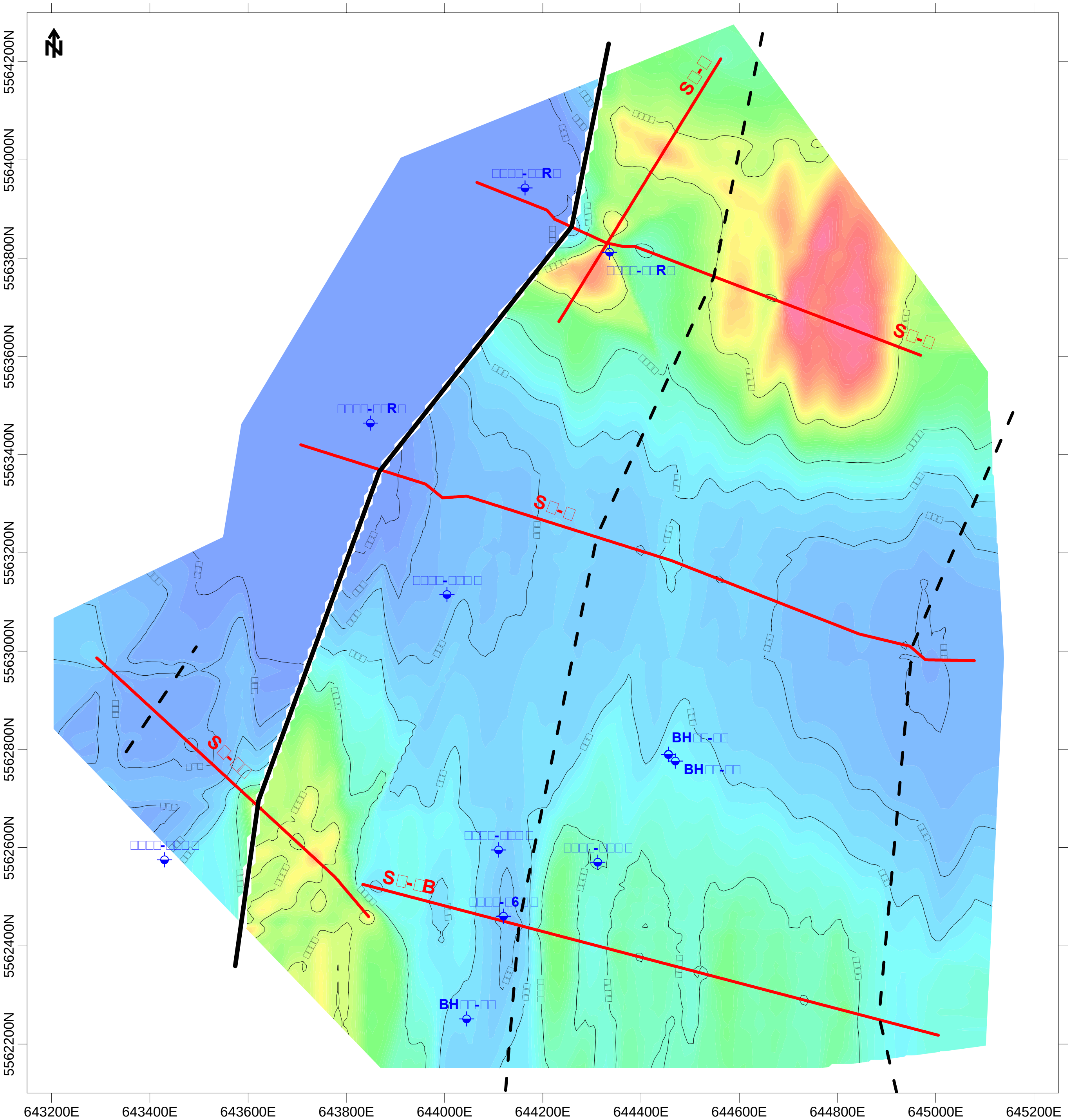
FAULT 1

POTENTIAL FAULTS

SEISMIC LINES

DRILLHOLES

CENTERMOUNT COAL LTD. ELK RIVER COAL PROJECT		
SEISMIC REFLECTION SURVEY		
REFLECTOR C ELEVATION CONTOUR PLAN		
FRONTIER GEOSCIENCES INC.		
DATE: OCT. 2012	SCALE 1:1,000	FIG. 19



800 900 967 1002 1021 1041 1055 1069 1084 1098

REFLECTOR ELEVATION (m)

0 100 200 300 400

METRES

FAULT 1

POTENTIAL FAULTS

SEISMIC LINES

DRILLHOLES

CENTERMOUNT COAL LTD.
ELK RIVER COAL PROJECT

SEISMIC REFLECTION SURVEY

REFLECTOR E
ELEVATION CONTOUR PLAN

FRONTIER GEOSCIENCES INC.

DATE: OCT. 2012	SCALE 1:1,000	FIG. 20

Appendix VIII

2012 Bingay Creek Coal 3-D Geological Block Model (by Norwest)

Appendix IX

Waste Rock Selenium Kinetic Testing (by SGS)