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June 17, 2013

Margot Trembath
EA Coordinator
Alberta Environment and Sustainable
Resource Development
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Edmonton, AB T6B 2X3

Fares Haddad
Coal and Industrial Developments
Energy Resources Conservation Board
Suite 1000, 250 – 5 Street SW
Calgary, Alberta T2P 0R4

Dear Ms. Trembath/Mr. Haddad:

RE: Coal Valley Resources Inc. Robb Trend Project, Environmental Impact Assessment and Mine Permit Application under the *Coal Conservation Act* ("CCA") and Environmental Protection & Enhancement Act (EPEA), ERCB Application 1725257, EPEA -028-00011066, Supplemental Information Request Round 2

In July and September 2012, Alberta Environment and Sustainable Resource Development (ESRD), the Energy Resource and Conservation Board (ERCB) and the Canadian Environmental Assessment Agency (CEAA) completed their initial review of the CVRI mine permit application and each issued a set of Supplemental Information Requests (SIRs). CVRI completed responses to these SIR's and submitted them on December 7, 2013.

On March 26, 2013 CVRI received the final combined version of the second round of SIR's from ESRD, ERCB and CEAA. CVRI has prepared the attached document that fully addresses all issues and questions raised in this second round of SIR's. CVRI believes that all matters with respect to the completion of the environmental assessment review processes have been completed and that the Project authorizations could now proceed.

Of particular note to the reviewers with ESRD, the issue regarding the necessity of a theoretical hydrogeologic model for the Project area, which was the subject of numerous conversations and meetings during the formulation of this document, has been resolved. Within the document, the reviewers are directed to ESRD SIR2 Appendix 11, which provides a detailed discussion of the geologic and hydrogeologic regimes within the Project and previous mining areas of the CVM. CVRI believes that the Project area is sufficiently similar to previous mining areas that an empirical method of impact prediction is the most appropriate means of assessment.

The attention of both ERCB and ESRD reviewers is also directed to ESRD SIR2 Appendix 20, which provides an description of project alternatives now incorporated into the proposed project in order to accommodate reduced environmental impacts associated with water courses and fish habitat. CVRI believes that these minor development modifications provide a reasonable balance between coal recovery and environmental protection thus improving the acceptability of the Project.

All communications in respect to the application and SIR's should be directed to:

Mr. Les Lafleur, Project Manager
Coal Valley Resources Inc. - Coal Valley Mine
Bag Service 5000
Edson, Alberta T7E 1W1
Telephone: (780) 865-8607
Fax: (780) 865-8630
email: llafleur@coalvalley.ca

Yours truly,

COAL VALLEY RESOURCES INC.

<original signed by>

Les, LaFleur
Project Manager
Robb Trend Project

c.c. Brian McKinnon, Sherritt Coal
Blaine Renkas, Sherritt Coal

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June 17, 2013

Susan Tiege, Section Leader
Canadian Environmental Assessment Agency
CDI Building, #425 10115 – 100 A Street
Edmonton, Alberta
T5J 2W2

Dear Ms. Tiege:

RE: Application under the *Canadian Environmental Assessment Act* ("CEAA") for the Coal Valley Resources Inc. Robb Trend Project

An Environmental Assessment Report and supporting information were submitted on April 11, 2012 to CEAA. The same information was also submitted to Alberta Environment and Sustainable Resource Development (ESRD) and the Energy Resource and Conservation Board (ERCB) in satisfaction of their, separate Project approval processes. In July and September 2012, Alberta Environment and Sustainable Resource Development (ESRD), the Energy Resource and Conservation Board (ERCB) and the Canadian Environmental Assessment Agency (CEAA) completed their initial review of the CVRI mine permit application and each issued a set of Supplemental Information Requests (SIRs). CVRI completed responses to these SIR's and submitted them on December 7, 2013.

On March 26, 2013 CVRI received the final combined version of the second round of SIR's from ESRD, ERCB and CEAA. CVRI has prepared the attached document that fully addresses all issues and questions raised in this second round of SIR's. CVRI believes that all matters with respect to the completion of the environmental assessment review processes have been completed and that the Project authorizations could now proceed.

Of particular note to the reviewers with CEAA, there have been modifications made to the mine reclamation plan wherein some of the previously contemplated reclaimed lakes have been subsitutedby restored stream channels and off-stream end-pit lakes. CVRI has met extensively with DFO during development of these options and believes that these minor amendments will satisfy all reviewers.

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All communications in respect to the application and SIR's should be directed to:

Mr. Les Lafleur, Project Manager
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Yours truly,

COAL VALLEY RESOURCES INC.

<original signed by>

Les, LaFleur
Project Manager
Robb Trend Project

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Blaine Renkas, Sherritt Coal

Coal Valley Resources Inc. - Coal Valley Mine

Robb Trend Project
Environmental Impact Assessment and Mine Permit Application
EPEA - 028-00011066; ERCB - 1725257

Supplemental Information Request Responses – Round 2

Submitted to
Alberta Environment and Sustainable Resource Development,
the Energy Resources Conservation Board, and
the Canadian Environmental Assessment Agency

June 2013

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1. ACRONYMS USED IN THIS SUPPLEMENTAL INFORMATION REQUEST

The following acronyms are used in this Supplemental Information Request.

CR	Consultant Report
CVM	Coal Valley Mine
CVRI	Coal Valley Resources Inc.
ESRD	Alberta Environment and Sustainable Resource Development
HHRA	Human Health Risk Assessment
PM	Particulate Matter
TOR	Terms of Reference
TSP	Total Suspended Particulate

2. BOARD

The responses to questions in this Board section will not be considered as part of the EIA completeness decision made by Alberta Environment.

2.1 General

1. Supplemental Information Request Responses, Question 3, Pages 6 to 14.

CVRI provided Tables 3-1 and 3-2 showing the surface and mineral rights holders, respectively.

a. Confirm that all parties listed have been contacted and provided with information on CVRI's proposed project, specifically rights holders directly impacted by the proposed mining.

Response:

CVRI has a robust stakeholder consultation program which has successfully contacted the stakeholders listed in ERCB Tables 3-1 and 3-2. Ongoing consultation continues with regular communication with stakeholders in efforts to provide Project updates as well as CVM updates. All stakeholders are encouraged to contact CVRI if any current or future developments may influence them in any way. ERCB SIR2 Table 1-1 lists the stakeholders that are on the contact lists.

ERCB SIR2 Table 1-1 Disposition Holders		
	Project Mailing List	
Disposition Holder	**Earlier List**	**Current List**
Surface Dispositions		
Mancal Coal Inc.		X
West Fraser Mills Ltd.		X
Altalink Management Ltd.		X
Fortis Alberta Inc.		X
Sundance Forest Industries Ltd.		X
Suncor Energy Inc.		X
Sabre Energy Ltd.		(1)
Harvest Operations Corp.		(2)
Husky Oil Operations Limited		X
Persta Resources Inc.		X
Tourmaline Oil Corp		X
Manitok Energy Ltd.		X
ConocoPhillips Canada Resources Corp.		X
Trident Exploration (Alberta) Corp		(2)
Richards Oil and Gas Limited		(3)
ExxonMobil Canada Energy		X
Yellowhead Gas Co-op Ltd.		X
Britlan Road Maintenance and Repair Ltd.		(4)
Larry Chapman		X
Norman Rooke		X
Ronald Cowles		X
Sidney Tizzard		X
Bill Fehr		X
Mike Naef		X
Mineral Agreements		
Husky Oil Operations Limited		X
Suncor Energy Ltd.		X
Rockford Land Ltd.		(5)
Sabre Energy Ltd.		(1)
Ranger Land Services Ltd.		X
Persta Resources Inc.		X
Manitok Energy Ltd.		X
Scott Land & Lease Ltd.		X
Windfall Resources Ltd.		X
Tourmaline Oil Corp		X
Meridian Land Services (90) Ltd.		X

ERCB SIR2 Table 1-1 Disposition Holders		
	Project Mailing List	
Disposition Holder	**Earlier List**	**Current List**
Surface Dispositions		
Coles Bay Resources Ltd.		(5)
Standard Land Company Inc.		(4)
Metallic & Industrial Minerals		
Athabasca Minerals Inc.		(4)

Footnote
(1) Co-operator with Suncor (Suncor is primary contact)
(2) Outside of proposed disturbance footprint
(3) Contact attempted, mail returned; no current address can be found
(4) No contact with disposition holder
(5) Removed from mailing list due to no further interest in area

Additional clarification of the footnotes listed in ERCB SIR2 Table 1-1 is provided below:

- Richards Oil and Gas Limited.
  - CVRI correspondence to this company has been returned. Following a search, no forwarding address was found.
- Rockford Land Ltd. & Coles Bay Resources Ltd.
  - These two companies have communicated to CVRI that they no longer have interest in the area.
- Sabre Energy Ltd.
  - CVRI has not contacted this disposition holder as it is a joint operator with Suncor. This company operates in the area in co-operation with Suncor. Sabre representatives have been present in ongoing discussions with Suncor regarding Robb Trend Development.
- Harvest Operations Corp.
  - CVRI has not contacted this disposition holder as it is outside the proposed disturbance area.
  - MSL 040660
    Registered 2004/08/26 involving 1.625 ha of land located in W5-18-46-34-SW. The site is located on the edge of the proposed mine permit boundary but remains outside of the proposed mining footprint.
  - LOC 040439
    The disposition was established in 2004 with a 25 year term. This relates to an access road branching from a West Fraser logging road which leads to the above MSL. The road is outside of the proposed mining footprint hence will be left in place.
- Britlan Road Maintenance and Repair Ltd.
  - This is a recent disposition.
  - CVRI has not contacted this disposition holder as the site is believed to have been associated with a pipeline construction in the area.

- MLL 120155
  This was a 2012 application for a 'storage site' within W5-21-49-22-SW covering an area of 0.122 ha.
- Trident
  - CVRI has not contacted this disposition holder as the site is expected to outside the proposed disturbance area.
  - CVRI has observed no activity on this site.
  - MSL 023210
    The disposition was registered in 2002/12/04. This site involves 1.1 ha of area within W5-21-49-31-SE. The site is potentially within a proposed dump footprint of the Robb West project area.
- Standard Land Company Inc.
  - CVRI has not contacted this disposition holder. CVRI has erected signs in the Robb Trend Project (Project) area asking resource companies to contact CVRI regarding coal leases in the area.
  - 055 5511110504
    - The disposition was registered 2011/11/17 for a 5 year term. The area involves 2816 ha of land with only a portion overlapping with the proposed Project.
- Athabasca Minerals Inc.
  - CVRI has not contacted this disposition holder. CVRI understands that these permits cover exploration only.
  - Permits 093 9312030695, 093 9312030696
    - These permits are related to Metallic and Industrial Minerals
    - The 'permit' was registered in 2012/03/06 covering 9,216 ha and 8261 ha respectively for a 14 year term. These areas are within townships W5-20-49 and W5-21-49 respectively.

Engagement Program

The public engagement program methods included distribution of Project information to area residents, interested groups and people, in addition to the CVM employees. The Project was discussed with stakeholders through direct contact, three newsletters and two open houses during the application preparation period from July 2010 to November 2011.

From July 2010 to the end of February 2013 CVRI representatives had made and followed up on over 200 contacts with groups and people with interests representing recreation, trapping, oil and gas development, forestry, Robb residents, Métis people in the region, Government of Alberta regulators and Federal Government regulators.

Personal contact continues to be encouraged and made with numerous people and stakeholder groups to discuss specific mine related activities including off-permit exploration activities, reclamation and lake access considerations.

As part of the mine planning activity for the Project, CVRI representatives have notified all other industrial operators and natural resources rights holders who may be potentially affected. CVRI has been and continues to be in discussion with oil and gas companies regarding pipeline locations and future plans for oil and gas development to ensure that any potential conflicts can be addressed early and collaboratively.

CVRI initiated and continues to engage forest management agreement holders who are operating in the area regarding both current and planned harvest plans and the requirements as the Project mine schedule progresses. CVRI will also be involving forest industry representatives regarding reclamation and end land use planning and requirements.

Contact and discussions have been held with people holding Registered Fur Management Area rights. Where required, agreements have been reached and compensation provided.

More information on the Public Engagement Program including information distribution and opportunities for follow-up with rights holders, is included in the *CVRI Coal Valley Mine Robb Trend Project Environmental Impact Assessment and Mine Permit Application April 2012* in *Section A.7: Summary of Public Engagement*, pages A15 to A16 and in *Section G: Public Engagement* supplemented with detailed information in *Appendix 7: Public Engagement*.

2. Supplemental Information Request Responses, Question 7, Page 19.

CVRI's response regarding the adjacent Mancal permit contains some discrepancies related to the consultation with Mancal. It is unclear if discussions with Mancal are ongoing in order to reach an agreement on mining in this area.

a. Provide an update on CVRI's discussions with Mancal and whether an agreement has been reached.

Response:

The most recent meeting between CVRI and Mancal (April 29, 2013) focused on preliminary features of a future development toward an 'end wall' agreement which would identify operating procedures and limits at the shared boundary in Robb West. It was determined that this situation is many years in the future and that additional drilling would occur and resulting mine plans would then need to be developed. Both companies noted that similar circumstances have occurred in the past and that a mutual co-operation exists to reach a workable solution when it becomes necessary. CVRI noted that the company would request a Mine Permit boundary to coincide with the existing Mancal boundary. The discussions tabled the matter to a future date.

b. Provide a preliminary estimate of the potential coal sterilization volume if an agreement with Mancal is not reached.

Response:

"End Wall"

With the 'irregular' pattern of coal leases in the boundary area it is expected that a mutually defined 'end section' would be defined that would represent an 'even split' through the coal leases. This would allow CVRI to mine to a logical defined boundary edge thus leaving the remaining seam in place for the future Mancal mining. CVRI intends to propose such an arrangement with Mancal in advance of mining in this area.

Coal Sterilization

No coal will be sterilized. CVRI expects to recover the economically viable coal resources within its coal leases. Waste dumps would not be located on leases held by others. Any remaining coal would be available to future mining.

c. Provide site plans and cross sections to show mining scenarios used at the end wall to calculate the coal sterilization volume.

Response:

See response to ERCB SIR2 #2c). No coal sterilization is anticipated. CVRI is confident that an operating agreement with adjoining coal lease holders can be established in advance of mining to enable establishment of a suitable 'end wall' condition.

Section -3,600E (see ERCB SIR2 #3a) is representative of the mining profile in this region. CVRI is planning to recover the Val d'Or, Arbour and Mynheer Seams to an appropriate 'end wall' position. The coal resources remaining westward of this position would be available for future mining by others.

Regarding the 'Mine Permit' boundary in this area, CVRI would accept an amended boundary coincidental with the existing Mancal mine permit.

2.2 Geology

3. Supplemental Information Request Responses, Question 14b, Page 28.

CVRI provided geologic cross sections in Response Appendix 14. These figures are missing the proposed dump design surfaces. The pit designs surfaces are shown at a very conceptual level and, on several of the cross sections, the pits do not coincide with the target coal seams.

a. Resubmit all of these cross sections to show the permit boundary, and accurately depict the proposed preliminary pit and dump design surfaces. Ensure that the cross sections show (or additional cross sections are provided to show) major features such as underground workings, rivers (e.g. Erith and Pembina Rivers), highways, pipelines, and other major features wherever encountered.

Response:

Geology cross-sections previously provided have been modified and are resubmitted as requested (ERCB SIR2 Figure 3-1 to 3-52). Revisions include:

- sections have been expanded to include proposed mine permit boundary;
- additional landmarks (rivers, pipelines) are labeled;
- dump locations have been indicated;
- pit limits have been shifted to coincide with seam interpretations; and

- Bryan Mine underground limits have been illustrated on Section 700E, 1500E, and 1900E. Lakeside Mine underground limits have been illustrated on Section 5900E.

CVRI reminds reviewers that the pit and dump outlines remain 'conceptual'. Additional discussion regarding underground workings and Pembina River are provided in response to other questions (See ERCB SIR2 #6a) and ERCB SIR2 #7a)).

4. Supplemental Information Request Responses, Question 15, Page 30.

CVRI indicated that the highwall dump position chosen for the pit mining depth would be justified by relevant mining economics at the time of mining. It is still unclear how much dump offset from the highwall is required to minimize future potential coal sterilization.

a. Update the Application Appendix 10, Figures 6-3, 6-4, 6-5 to include the associated highwall dump locations for each pit shell scenario presented (ensure that they incorporate the required preliminary geotechnical setbacks), or provide new figures at representative locations that incorporate the required information.

Response:

Other Pit Shells

CVRI has not developed dump configurations for the other 'pit shell' variations. Therefore CVRI is unable to provide the multiple scenarios requested.

Dump Siting

Conceptual dump configurations were developed only for the conceptual plan presented in the application. These dumps have been positioned, sized and sequenced for the specific mine plan presented. However, the plans are still conceptual. Revised cross-sections in response to ERCB SIR2 #3a) identify the dump locations.

With regard to 'dump placement' CVRI has positioned the dumps in relation to the respective 'cut-off' limit utilized in the pit shell determination. This configuration results in dumps located as follows:

- Dumps on the hanging wall side of the pits are positioned corresponding to the expected rim of the 'reclaimed' wall profile. This results in the dump toes being placed 50 to 100 m beyond the mined 'pit rim'. In practice this typically accommodates consideration of the dump influence on the pit wall geotechnical conditions (geotechnical 'setback').
- Dumps on the footwall side of the pits are positioned likewise.
- Backfill is located within the pits as sequencing permits. Generally the bottom benches of deep pits are utilized as in-pit backfill as access ramps permit.
- Dragline pits are planned to accommodate spoiling on either side of the dragline cut (hanging wall or footwall). No extra re-handle was incorporated beyond what was necessary for mining or the proposed pit.

Coal Sterilization

Dumps have not been offset from the highwall to accommodate possible future mining. Likewise, in-pit backfill and reclamation have not been excluded from the proposed development plan to accommodate possible future mining.

2.3 Mining

5. Supplemental Information Request Responses, Question 41a, Page 53.

The original question noted Norwest's statement "*In Section 16.7 of the Technical Report the author concludes that the Robb Trend coal quality dataset **is not** presently strong enough to support reserve designation.*" which did not reconcile with ERCB permitting requirements if reserves estimates are based on a limited dataset.

a. What additional data is required and what is CVRI's current level of confidence with the dataset presently available for supporting the reserves designation.

Response:

Technical Report

CVRI draws attention to several statements within the referenced report (Technical Report, Robb Trend Coal Property, Alberta, November 5, 2010, Norwest Corporation):

- Section 3, Page 3-1
  "It is Norwest's opinion that the exploration on and adjacent to the lease and lease application areas have been sufficiently drilled and otherwise explored for the estimation and classification of coal resources in these areas."
- Section 4, Page 4-2
  "The present report is accordingly designed to comply with the requirements of National Instrument 43-101…"
- Section 10, Page 10-1
  "*This Geology Type is classified as "Moderate."*
  " *The Robb Trend Coal Property is a surface mineable deposit.*"
- Section 12, Page 12-1
  "*It is our opinion that the exploration on and adjacent to the lease and lease application areas have been sufficiently drilled and otherwise explored for the estimation and classification of coal resources in these areas."*
- Section 16.5, Page 16-3
  "*The results show that the thicknesses in the CVRI database are acceptable for resource estimation in this report.*"
- Section 16.7, Page 16.3
  "*This validation process showed that the data are suitable for the estimation of resources …*" "*… additional information is required for the reporting of reserves with respect to coal quality and the geotechnical properties.*"
- "*The recommendations of Item 22 include a proposed drilling exploration program designed to provide the data needed for this issue.*"

- Section 19, Page 19-1
  "*No reserves are estimated and presented in this report as there is additional information that is needed to do this.*"
- Section 19.3, Page 19-3
  "*This estimate does not include the Arbour Seam since exploration work has yet to be completed to demonstrate that this seam is economically mineable.*"
- Section 21, Page 21-1
  "*The density of drilling on this property was adequate for the delineation of in-place coal resources but additional data and testing is required before an estimation of the coal reserve can be made. This additional data relates to the mineability of some of the seams on the deposit …*"
- Section 13, Page 13-1 and 13-2
  Table 13.1 indicates that drillholes from 1981 to 2007 were considered in the database for 'Robb Trend".
  Table 13.2 indicates that drillholes from 1980 to 2010 were considered in the database for 'Robb West".

CVRI notes that the referenced report was undertaken for purposes of Sherritt International Corporation in accordance with the National Instrument 43-101. CVRI further notes that the report was dated November, 2010 making use of a drillhole database generally limited to data prior to 2008.

The report referenced was not prepared for ERCB or meant to address 'ERCB permitting requirements'.

Additional Data Available

Exploration drilling has been continued in the Project area thus adding further definition to the geologic interpretation of the Project. Data available since the Norwest assessment includes the following:

- 2009 exploration programs resulted in 154 holes for a total length of 11,481m.
- 2010 exploration programs resulted in 162 holes for a total length of 12,249m.
- 2011 exploration programs resulted in 139 holes for a total length of 10,830m.
- 2012 exploration programs resulted in 327 holes for a total length of 29,230 m and 18 core holes with a total length of 1,103m.
- 2013 exploration programs resulted in 238 holes for a total length of 19,227 m and 14 core holes with a total length of 1,398m.
- 2013 provided a bulk sample pit in the Val d'Or/Arbour zone.
- The remainder of the 2013 drilling program anticipates an additional 380 holes throughout the Project area. This program is expected to provide drilled sections of at least 400 m throughout the Project area and 200 m spacing for the initial 10 years of mining.

Data Supplied

CVRI has recently supplied an updated drillhole plan and a plan of proposed drilling (See ERCB SIR #13)

Current Status

CVRI is following the recommendations of the Norwest technical report by performing an additional intensive drilling campaign focused on further 'infill' and coal quality sampling. Progress in this program has been significant and is targeted for completion in late 2013 or early 2014. CVRI anticipates undertaking an updated NI 43-101 assessment in early 2014.

CVRI is currently satisfied that sufficient exploration data is available to fully define resources throughout the Project area. A significant portion of the Project can be claimed as proven reserves, including coal quality definition. The Arbour Seam has been sufficiently defined to be included in these same estimates.

6. Supplemental Information Request Responses, Question 45, Page 58.

CVRI states "*The portions of the underground workings which will be intersected by mining will be fully within the proposed mining. No portions will be left below the proposed mining. The 'end walls' of the proposed pits will contain a contact zone with the underground.*" Note that CVRI's licence application will have to include the proposed plans to intersect and abandon the underground workings.

a. Provide site plans and cross sections accurately showing the delineated underground workings which will intersect mining operations.

Response:

Abandoned Mine Workings

CVRI has provided photocopies of mine plans depicting underground workings in the two mines (ERCB SIR2 Figure 6-1 to 6-4). CVRI has added some labeling for clarity.

Lakeside Mine

The Lakeside Mine extracted coal resources from the Val d'Or Seam. Mining was limited to only a portion of the seam thickness. To obtain better quality coal the operation limited itself to the 'best' part of the zone.

The plans for the 'Lakeside Coal Ltd, No 2 Mine' are provided on two pages (See ERCB SIR2 Figure 6-1 and 6-2). CVRI has used the legal grid on these plans to reference the plans to the 'mine grid' for the Project. Please note that the drawings are oriented facing southwest. The left side (east) indicates that mining occurred only in the upper level. The heading to the east is dated Nov. 30, 1932. It is the extreme eastern end that would intersect with the proposed Val d'Or Pit.

Deeper levels were developed afterward with mining concluding in about 1943. The right (west) side of the plan illustrates the deeper levels reaching beneath Bryan Creek. Immediately to the right is illustrated the limit of Bryan Mine. A significant distance separates the two mines. A fault is interpreted within the separation of the two mines. The separation is also evident from the separate leases each company controlled.

Bryan Mine

The Bryan Mine extracted coal resources from the Val d'Or Seam. Mining was limited to only a portion of the seam thickness. To obtain better quality coal the operation limited itself to the 'best' part of the zone.

The plans for the 'Bryan Mine' are provided on two pages (See ERCB SIR2 Figure 6-3 and 6-4). CVRI has used the legal grid on these plans to reference the plans to the 'mine grid' for the Project. Please note that the drawings are oriented facing north.

Cross Sections

CVRI has provided modified cross sections as requested (see ERCB SIR2 #3a). The locations of underground workings have been added to four of these sections. ERCB SIR2 Figure 3-10 (5900E) illustrates the location of the eastern extreme of the Lakeside Mine. ERCB SIR2 Figure 3-6 (1900E), ERCB SIR2 Figure 3-4 (1500E) and ERCB SIR2 Figure 3-2 (700E) illustrate intersections with underground workings associated with Bryan Mine. As noted previously the proposed mining will encompass the whole of the old workings within these sections. This factor was noted to indicate that the workings would not form part of the highwall. Of course, the workings would intersect with the 'end walls'.

2.4 Geotechnical

7. Supplemental Information Request Responses, Question 47, Page 60.

CVRI states "*Abnormal conditions have been identified in the eastern end of the Project. These include steeper dips, over thickened Val d'Or and interpreted faulting…This has resulted in a probable larger and deeper pit which has been truncated due to the location of the Pembina River.*" The currently proposed preliminary mine plan shows mining and dump construction in this area will occur during Stage 8 Development (Year 2034 to 2037). The cross sections provided in Response Appendix 14 did not include this area.

a. Provide cross sections for this area showing the preliminary pit and dump designs that will maximize coal recovery. Ensure the cross sections show the interpreted geological structures and coal seams, subsurface soils and surficial features including the Pembina River valley and other important features (e.g. required geotechnical offsets of pit crest and dump toe from the river valley).

Response:

Appendix 14

ERCB SIR Appendix 14 did include a number of cross sections which illustrate the geology and proposed mining of the eastern end of Robb East up to the Pembina River valley.

Cross sections previously supplied have been modified as requested (See ERCB SIR2 #3a)).

- Section 37200E illustrates the steepening dip of the coal seams toward the eastern portion of the Project. Proposed mining will be limited to shallow pits due to high strip ratios. Reserves in this area are limited.
- Section 38000E illustrates a potential minor thickening of the Val d'Or Seam.
- Section 39000E illustrates a potentially unusual Val d'Or structure displaying thickened coal.
- Section 39800E illustrates return to a normal Val d'Or sequence and a shallower dip.
- Section 40800E illustrates an apparent normal Val d'Or Seam but with a considerable thickness of coal beneath (Arbour).
- Section 41800E illustrates a very thick coal structure nearly 50 m in thickness.
- Section 42000E illustrates continuation of the thick coal 'pod'.
- Section 42800 illustrates continuation of the coal 'pod' but with reduced overall thickness.
- Section 43600E illustrates return to a near normal Val d'Or Seam structure.
- These cross sections, based on current drilling results, indicates a significant and complex geologic structure which results in thickening of the Val d'Or/Arbour zone with potential for a major coal 'pod'. The complex structural zone appears to extend between approximately 38000E to 44,000E, a strike length of 6,000 m. A large coal resource is likely available in this area.
- The conceptual mine plan presented corresponds to the projected coal 'pod' in this area. A large, deep pit is illustrated in the Val d'Or seam. The enlarged development at this point would result in a large end pit lake which has also been illustrated in the conceptual reclamation plan.

Drill Plan

CVRI provides a detailed plan (See ERCB SIR2 Figure 7-1) indicating locations of current exploration drillholes in this area. Cross sections referenced above are labeled on the plan. Current drilling has achieved 200 to 400 m section spacing throughout most of the area.

CVRI anticipates further, future exploration in the area including:

- Additional infill drilling to further refine interpretation of seam structure, faulting and coal quality.
- Additional drilling east of 44000E to further define coal presence nearer to the Pembina River.
- Additional drilling east of the Pembina River to follow strike of the deposit.
- Installation of piezometers between Section 43660E and 44500E for groundwater monitoring.

Additional Features

Additional information related to the pit layout in this area are provided in response to other SIR2 questions (See ERCB SIR2 #3)

2.5 Socio-Economic

8. Supplemental Information Request Responses, Questions 53a and 55c, Pages 68 and 69.

CVRI states "*The majority of onsite construction activities will be handled by the CVM's existing workforce. Some limited contract workforce will be required for some activities. The Project will create approximately 250 PY of employment over the construction period, predominantly for equipment operators, surveyors, carpenters and welders. The onsite workforce is estimated to range between 20 to 30 persons from 2014 to 2016.*" Since there are four phases of the project, it is unclear how many people, or person years, are required for each phase.

a. Provide a chart for the project timeline and corresponding workforce. Show the operations, construction and peak employment for each of the four stages; Robb Centre, Robb Main, Robb East and Robb West on the chart. Highlight any overlaps.

Response:

ERCB SIR2 Table 8-1 presents a preliminary tabulation of the workforce associated with the Project. The table includes the expected short-term construction workforce (see also response to ERCB SIR2 #8b)) as well as the estimated mining and coal processing operations workforce. Both hourly and staff positions are included. Reviewers should note that the initial operation of the Project will be conducted simultaneously with a 'wind-down' of mining in the existing Coal Valley Mine (CVM) area. Only labour numbers directly associated with the Project have been identified. The remainder of the existing workforce would be associated with the CVM operation.

The construction workforce has been broken down by Project area, based on the level of detail currently available. The operations workforce is presented in aggregate form. As many of the employees will be working in the Coal Valley Coal Processing Plant (Plant), maintenance shop and administration offices and not directly associated with any specific Project area, it is not possible to present the operations workforce breakdown by phase or area.

Variations in the annual employment numbers are primarily influenced by changing haulage profiles over time. Longer haulage distances in later years will require corresponding increases in truck operators.

ERCB SIR2 Table 8-1 Project Workforce

WORKFORCE (PERSON YEARS)							
Year	Robb West	Robb Main	Robb Center	Robb East	Robb Trend		
	Construction	Construction	Construction	Construction	Construction	Operating	TOTAL
2013	-	-	-	-	-	-	-
2014	-	-	-	-	-	-	-
2015	-	22	-	-	22	-	22
2016	-	33	-	-	33	231	264
2017	-	22	-	-	22	291	312

ERCB SIR2 Table 8-1 Project Workforce							
WORKFORCE (PERSON YEARS)							
Year	Robb West	Robb Main	Robb Center	Robb East	Robb Trend		
	Construction	Construction	Construction	Construction	Construction	Operating	TOTAL
2018	-	3	5	-	8	411	419
2019	-	1	9	-	10	473	483
2020	-	1	17	-	18	475	493
2021	-	1	19	-	20	477	497
2022	-	1	17	-	18	461	479
2023	-	1	9	-	10	464	474
2024	-	1	7	-	8	469	477
2025	-	1	5	-	6	473	478
2026	-	-	1	-	1	477	477
2027	-	-	1	8	9	482	490
2028	4	-	-	9	13	474	487
2029	10	-	1	8	19	475	494
2030	10	-	-	4	14	473	487
2031	2	-	1	4	7	475	482
2032	3	-	1	2	6	474	480
2033	3	-	-	1	4	461	465
2034	2	-	-	2	4	464	468
2035	2	-	-	-	2	466	468
2036		-	-	-	-	475	475
2037	1	-	-	-	1	411	412
2038	1	-	-	-	1	389	390
2039		-	-	-	-	325	325
2040		-	-	-	-	-	-
TOTAL	**38**	**87**	**93**	**38**	**264**	**10,546**	**10,798**

Notes:
- Peak construction workforce is estimated at 33 PY in 2016, involving activity in Robb Main.
- Peak total workforce, including operations, is estimated at 497 PY in 2021.
- Table reflects early, order-of-magnitude estimates based on information available at the time of submission.
- Actual onsite counts will likely vary from these estimates, but are expected to follow this general distribution by phase/timing.

b. Provide a table with stage name, estimated construction work force and construction time frame.

Response:

Refer to ERCB SIR2 Table 8-1 for the summary of construction workforce by phase and year. The data in the table represents a general estimate of expected construction activity and associated workforce over the life of the Project. These estimates should be considered only as a ‘rough guide’. CVRI reminds reviewers that the Project is the continuation of an existing operation and will maintain the existing operating workforce. Since mining operations involve a continuous advancement through the Project area a number of haulroads and water management structures are built by the operations workforce. Occasionally, additional local construction contractors are utilized for short term construction activities. Therefore, the construction workforce identified with the Project is small and stretches through much of the mine life.

Section 3.2.1.2 of the SEIA (CR #9), stated that on-site construction activity and associated on-site workforce would occur over a six year period, assumed to begin in 2012. Since submission of the original application, CVRI has determined that initial development would involve only the Erith Corridor and that the Halpenny haulroad corridor will be delayed by five years. The effect of this change is a continuation of an on-site workforce, in the range of 20 PY for, for an additional five years beyond what was estimated in the SEIA. The total required on-site labour remains at 250 PY, the only difference being a minor shifting of on-site resources on an annual basis over the Project timeframe. From a socio-economic perspective, this change is negligible, with essentially no measureable effect in the regional study area.

The construction positions presented in ERCB SIR2 Table 8-1 reflect the updated planned on-site construction labour. These positions, presented as person-years, represent multiple jobs, each of which of short term duration (typically a few weeks), expected to be filled predominantly by local contractors. They represent additional work beyond what the CVRI operating workforce completes on their own. It should be noted that the use of a construction workforce, such as proposed for the Project, is normal operating practice, and has been done by CVRI multiple times over the life of the current mine to-date.

2.6 Groundwater

9. Supplemental Information Request Responses, Questions 59 and 60, Page 73.

CVRI did not identify hydrostratigraphic units in the proposed development area and assessed them in regards to the specifics of the hydraulic properties and groundwater chemistry of each unit. Also, the response to Question 64, Page 76 indicates that CVRI did not conduct a public record’s search to review the domestic water supply in the development area.

a. Provide descriptions of the major hydrostratigraphic units in the project area, and identify the units that are the most likely pathways for the contaminants, such as nitrates and selenium and will impact the dewatering activities.

Response:

Hydrostratigraphic Units

The stratigraphic units involved are as follows (see ERCB SIR2 Figure 9-1):

- The Paskapoo Formation;
- The Coalspur Formation:
  - The "coal zone";
  - The "non-coal" (lower portion); and
- The Entrance Conglomerate.

Additional description of these stratigraphic units is available in Section B (Geology) of the Application.

Pathways for Contaminants

CR# 3 provided information on selenium concentrations in toe springs and in natural situations. The data indicates that there is no difference between concentrations of selenium in potentially-impacted situations, such as toe springs, and in background groundwater. Selenium has not been established as a potential contaminant on the basis of information provided in the application.

CR#3 provided information on nitrate concentrations in toe springs and in natural situations. The conclusion was stated that nitrate contamination to groundwater or surface water is not significant.

Dewatering Procedures

Groundwater flow into the pit is not a significant factor in the dewatering activities at the CVM. In-pit water management is predominantly dictated by local precipitation. In-pit water management activities at the CVM have been accomplished by simply pumping from sumps located within the operating pit(s).

The units that support groundwater flow into the pits, and hence may potentially contribute to dewatering are the same throughout the existing mines and the Project area:

- On the hanging wall it is the Paskapoo Formation;
- On the footwall it is the lower (non-coal) portion of the Coalspur Formation; and
- At the un-mined end of the pit it is the Coalspur Formation.

Groundwater quality, both in pre-mine and post-mine locations across the CVM clearly show no appreciable change from baseline groundwater quality conditions.

b. Based on the collected data, identify which monitoring well listed in Tables 3.4-1 and Table 3 (Appendix B) are screened in each of the hydrostratigraphic units identified in part a).

Response:

ERCB SIR2 Table 9-1 provides the stratigraphic units in which the monitoring wells in Tables 3.4-1 and Table 3 of CR #3 are screened.

ERCB SIR2 Table 9-1 Identification of Stratigraphic Units for Monitoring Wells

Mine Area Section Piezometer Name	Screened Interval (depth (m))	Stratigraphic Unit
Mine Area:		
Coal Valley Mine:		
Pit 25 East #20	28-31	ND
Pit 34 #6024	17-29	ND
West Extension:		
Coalspur		
YT-14	22-25	P
8,000 E		
YT-05A	30	P
YT-05	60	P
10,000 E		
YT-01	58-59.5	P
YT-01A	17-19.4	P
16,300 E		
YT-10A	28.4-29.9	P
Yellowhead Tower:		
Coalspur		
YT-13	22-25	ND
1,800 E		
YT-15	70.4-75	P
YT-16	70.4-75	P
YT-17	70.4-75	LCS
YT-18	70.4-75	LCS
YT-19	70.4-75	LCS
4,200 E		
YT-20A	15	LCS
YT-20B	55	LCS
YT-21A	15	ND

ERCB SIR2 Table 9-1 Identification of Stratigraphic Units for Monitoring Wells

Mine Area Section Piezometer Name	Screened Interval (depth (m))	Stratigraphic Unit
YT-21B	55	ND
South Extension:		
4,000 E		
MER 14.1	34-35.5	CS
MER 14.2	18-20	CS
MER15.1	53.5-55	LCS
MER15.2	23-25	LCS
6,075 E		
MER 10.1	60-65	LCS
15,000 E		
MER 1.2	30-35	P
MER 4.1	10-15	LCS
MER 4.2	30-35	LCS
22,300 E		
FH-02A	12-15	CS
FH-03	43-45	LCS
Mercoal West:		
-7,534 E		
MERWS 01	112-119	P
MERWS 02	43-50	CS
-2,175 E		
MERWS 03	89-102	CS
MERWS 05	32-44	CS
Robb Trend		
-2,450 E		
RW-11-01A-30	27-30	P
RW-11-01B-75	72-75	P
RW-11-02A-30	27-30	p
RW-11-02B-75	72-75	p
RW-11-03A-30	27-30	CS
RW-11-03B-75	72-75	CS
RW-11-04--30	27-30	CS
3,000 E		
RW-11-05A-30	27-30	P
RW-11-05B-75	72-75	P

ERCB SIR2 Table 9-1 Identification of Stratigraphic Units for Monitoring Wells		
Mine Area Section Piezometer Name	**Screened Interval (depth (m))**	**Stratigraphic Unit**
RW-11-06A-30	27-30	CS
RW-11-06B-75	72-75	CS
RW-11-07A-30	27-30	LCS
RW-11-07B-75	72-75	LCS
6,000 E		
RT-01-30	27-30	P
RT-01-75	70-75	P
RT-04-20	17-20	LCS
RT-04-45	41.9-45	LCS
11,000 E		
RT-26-50	47-50	P
RT-25-50	47-50	P
RT-06-50	47-50	CS
RT24-50	47-50	LCS
18,125 E		
RT-07-20	17-20	P
RT-07-70	66-70	P
RT-08-60	56.5-60.5	CS
RT-09-15	11-15	CS
RT-09-60	56-60	CS
RT-11-10-20	17-20	P
RT-11-10-70	67-70	LCS
26,600 E		
RT-11-20-40	37-40	CS
RT-11-21-40	37-40	CS
RT-11-40	35-40	P
RT-11-22-40	37-40	P
RT-11-23-40	37-40	P
34,000 E		
RT-14-15	10-15	CS
RT-14-70	67-70	CS
RT-13-50	47-50	CS
RT-12 -15	11.5-15	CS
RT-12-70	66-71	CS

ERCB SIR2 Table 9-1 Identification of Stratigraphic Units for Monitoring Wells		
Mine Area Section Piezometer Name	**Screened Interval (depth (m))**	**Stratigraphic Unit**
40,000 E		
RT-15-20	12.3-15	P
RT-15-70	67-71	P
RT-16-25	23.2-26	CS
RT-17-25	23.3-26	CS
RT-17-90	87.5-90	CS
RT-18-50	27.3-30	CS
RT-19-15	12.5-15	LCS
RT-19-70	67-70	LCS
Robb Hamlet		
UR 1	91-97	P
UR 2	51-54	P
LR 1	58-61	LCS
LR 2	28-31	LCS

Key to stratigraphic units:
P= Paskapoo
CS=Coalspur coal zone
LCS= lower Coalspur – non-coal
Peat= recent peat deposits
ND= not determined

c. Provide groundwater chemistry and hydraulic conductivity for each unit identified in a). Update the cross-sections in Figures 3.4-1 through 3.4-6 to reflect the data.

Response:

ERCB SIR2 Table 9-2 provides a comparison of ranges and means of hydraulic conductivity observed in all operating areas. Values are labeled as “less than” because slug tests responded too slowly to provide an interpretable value – this affects the minimum and geometric mean values.

ERCB SIR2 Table 9-2 Statistical Parameters of Hydraulic Conductivity			
Mine Trend /Stratigraphic unit	**Maximum Value (m/s)**	**Minimum Value (m/s)**	**Geometric Mean Value (m/s)**
Robb Trend			
Paskapoo	8×10^{-5}	6×10^{-8}	3×10^{-6}
Coalspur	5×10^{-5}	5×10^{-8}	1×10^{-6}
Lower Coalspur	ND	ND	ND
West Ext - YHT			
Paskapoo	3×10^{-6}	$< 3 \times 10^{-7}$	$< 9 X 10^{-7}$
Coalspur	$5 X 10^{-6}$	$5 X 10^{-7}$	$2 X 10^{-6}$
Lower Coalspur	ND	ND	ND
South Ext - Mercoal			
Paskapoo	ND	ND	ND
Coalspur	$6 X 10^{-6}$	$3 X 10^{-6}$	$4 X 10^{-6}$
Lower Coalspur	$3 X 10^{-6}$	$4 X 10^{-7}$	$1 X 10^{-6}$

Key: ND= not determined

There is no significant difference between these values across trends given that the hydraulic conductivity is fracture-based and may be expected to vary widely.

ERCB SIR2 Table 9-3 presents statistics of major ions in the three mining trends arranged by stratigraphic unit.

The requested update of Figure 3.4-1 through 3.4-6 of CR #3 are presented as ERCB SIR2 Figure 9-1 through ERCB SIR2 Figure 9-6.

ERCB SIR2 Table 9-3 Comparison of Groundwater Chemistry by Stratigraphic Unit

Paskapoo Fm

Parameter	Mining Trend	TDS	Calcium	Magnesium	Sodium	Potassium	Carbonate	Bicarbonate	Sulphate	Chloride	pH	Number
Maximum	Robb Domestic	1026	86	22	227	3.3	33	492	419	104	9.6	19
	Robb Trend	1020	82.3	21.2	346	2.67	51	614	489	196	9.4	35
	CVM-West Ext	2380	72.8	32.1	1060	4.39	79	2520	103	151	9.3	57
	South-Mercoal	507	5.7	6.5	225	1.32	77	456	15	3	9.2	27
Minimum	Robb Domestic	208	0	0.0	8	0.4	6	208	10	1	7.2	19
	Robb Trend	257	0.6	0.0	46	0.51	5	218	2.59	0.56	8.1	35
	CVM-West Ext	175	0.5	0.1	9	0.4	7	210	0.3	0.6	7.7	57
	South-Mercoal	167	0.8	0.2	68	0.58	11	139	0.6	1	8.8	27
Average	Robb Domestic	451	25	8.0	128	1.2	17	381	52	16	8.5	19
	Robb Trend	425	16.8	4.3	149	1.45	26	373	28	46	8.7	25
	CVM-West Ext	742	10.7	4.2	298	1.63	39	724	12	35	8.7	57
	South-Mercoal	290	2.3	1.3	124	0.81	33	257	5	2	9.1	27

Coalspur Fm

Parameter	Mining Trend	TDS	Calcium	Magnesium	Sodium	Potassium	Carbonate	Bicarbonate	Sulphate	Chloride	pH	Number
Maximum	Robb Trend	943	82	18.1	375	7.3	62.1	860	139	181	9.2	42
	CVM-West Ext	1500	2	0.7	621	2.8	84	**1570**	3.6	71	8.9	6
	South-Mercoal	575	98	17.3	244	3.5	28	558	7.8	22	9.2	38
Minimum	Robb Trend	245	0.8	0.2	0	0.8	5.4	299	0.8	1	7.8	42
	CVM-West Ext	1230	1.6	0.4	504	1.7	43	1200	0.8	22	8.5	6
	South-Mercoal	90	1.9	0.2	5	0.5	6	108	0.8	0	7.1	38
Average	Robb Trend	479		21.6	6	163	2	488	9.4	33	8.5	42
	CVM-West Ext	1377	1.8	0.6	575	2.2	60	**1393**	2.6	49	8.7	6
	South-Mercoal	202	38.6	7.2	34	1.4	14	234	3.1	3	8.2	38

ERCB SIR2 Table 9-3 Comparison of Groundwater Chemistry by Stratigraphic Unit

Lower Coalspur

Parameter	Mining Trend	TDS	Calcium	Magnesium	Sodium	Potassium	Carbonate	Bicarbonate	Sulphate	Chloride	pH	Number
Maximum	Robb Trend	889	149	13	332	12.2	51	701	219	66.7	9.6	21
	CVM-West Ext	1200	70	27	475	3.62	47	928	8.9	203	8.7	12
	South-Mercoal	1040	86	4.3	457	2.3	72	1040	18.9	4	9.0	38
Minimum	Robb Trend	234	0.6	0.1	43	0.5	0	1.6	0.7	0.128	8.2	21
	CVM-West Ext	343	2.1	0.5	48	1	37	412	0.9	1	7.8	12
	South-Mercoal	24	0.8	0.1	13	0.5	5	96	0.7	0.9	7.6	38
Average	Robb Trend	433	22	3.4	162	2.7	28	340	37.6	24.0	8.9	21
	CVM-West Ext	519	53	20.0	128	2.4	42	549	3.8	86.8	8.2	12
	South-Mercoal	293	25	2.0	101	1.1	41	308	3.4	1.6	8.3	38

d. Provide a summary of the domestic water use in the impacted area, including a map showing the locations of all the water wells in the 3 km radius and a table summarizing completion and use details for all the water wells from the publicly available sources (such as the ESRD Water Well Database) and identify the main domestic use aquifers in the project area.

Response:

Water Wells in Area of Robb Hamlet

CVRI has assumed that this question refers to the Robb Hamlet and surrounding area hence has focused on this area rather than a 3 km radius of the entire Project area.

A search of the ESRD Water Well Database was conducted through The Groundwater Centre (TGWC). The search function allows a radius-type query based on quarter section and since the Hamlet of Robb is located in several quarter sections, the radius of the query was selected to be 4 km rather than 3 km. The tabulated results of the search are presented in ERCB SIR2 Appendix 9.

This search identified 145 entries in the ESRD Water Well Database within 4 km of NW-15-49-21W5. This is consistent with the estimate of 150 water wells in Robb made in CR#3.

ERCB SIR 2 Figure 9-7 provides a plan view of the location of these wells. It should be noted that wells in the ESRD Database are located to quarter section only. Therefore, the locations shown on ERCB SIR2 Figure 9-7 may represent a number of entries in ERCB SIR2 Appendix 9.

Regional Stratigraphy

The stratigraphic units used for these wells are:

- Glacial drift;
- Paskapoo Formation; and
- Coalspur Formation.

CVRI notes that the majority of the Robb Hamlet domestic wells are developed within the coal bearing structure which will be mined on either side of the community. Several of the northeast wells are situated above the Val d'Or Seam and the abandoned underground workings. Wells in the central part of the community are developed below the Val d'Or Seam. Wells to the south are situated well below the coal bearing strata. CVRI also notes that the Embarras River flows through the community hence is likely responsible for recharge to some of the shallow wells developed in the river floodplain.

CVRI has developed monitoring wells within the community and on both sides of the community within similar horizons in order to obtain baseline conditions and for future monitoring of potential mining effects.

Domestic Water Use

Domestic water wells are limited to wells established within the hamlet boundary. These include 6 municipal wells. None of the outlying wells are used as domestic supplies. All of these wells are outside of the proposed Mine Permit.

The domestic wells are typically older being established in 1970's and 1980's. All the wells are < 100 m in depth with the majority in the 40 m depth range.

CVRI has established 'monitoring wells' at two sites within the community in order to obtain water level and water quality readings. Results from this ongoing baseline monitoring have been reported in the application documents. Typical water quality is described by these results.

e. Based on the site-specific details in 9-d) substantiate that:

   i. the monitoring network is installed in the hydrostratigraphic units critical for monitoring the migration of the contaminants from the development area to the water users,

Response:

General Comments

CVRI has anticipated groundwater monitoring will be necessary in and around the community or Robb. CVRI has established a 'phased approach' to this element of monitoring:

- A series of monitoring wells have already been established in and around the community of Robb in order to provide baseline conditions and assist in predicting potential Project impacts. This work has been provided in the Project documents. CVRI believes that this information adequately covers the requirements of the EIA.
- Closer to the date of physical mining activity in proximity of the community of Robb an expanded monitoring program would be established. CVRI has previously indicated the elements that would be considered in such a program. CVRI believes that this level of detail would be provided when the CVM seeks operating approvals for these specific areas.

Description of Current Monitoring Capability

The monitoring network currently in place (ERCB SIR2 Figure 9-8), for the purposes of this impact assessment, reflect CVRI's three-stage approach to protecting water supplies in Robb. Generally, this approach is as follows:

- An early-warning set of monitoring wells at distance from the hamlet;
  - Four monitoring wells are currently in use east of the hamlet at 6,000E
  - Six monitoring wells are currently in use west of the hamlet at 3,000E
  - Four monitoring wells are currently in place within the hamlet (UR1/2; LR1/2).
- A local set of monitoring wells with the hamlet; and

- The recognition that additional monitoring wells will be necessary when mining approaches the community of Robb with regard to observations in the early-warning or local wells.

Currently, the early-warning and local monitoring wells consist of the following (ERCB SIR2 Figure 9-8):

- Early-warning
  - Hydrogeological cross section 6000E
    - This section is located east of the community of Robb, thus providing a 'sounding post' for mining approaching from the east.
    - Currently contains 4 wells at depths up to 75 m
      - Please refer to Table ERCB SIR2 9-1 above for the stratigraphic units in which these wells are completed.
    - Water levels have been measured annually since 2009
    - Water level recorders will be installed once operations commence in Robb Trend and data will be initially assessed twice per year
    - These will provide water level data as mining moves north-westward along Robb East toward the hamlet.
  - Hydrogeological Cross section 3000 E
    - This section is located west of the community of Robb, thus providing a 'sounding post' for mining approaching from the west.
    - Currently contains 6 wells at depths up to 75 m
      - Please refer to ERCB SIR2 Table ERCB 9-1 above for the stratigraphic units in which these wells are completed.
    - Water levels have been measured annually since 2011
    - Water level recorders will be installed once operations commence in Robb Trend and data will be initially assessed twice per year
    - This will provide water level data as mining moves:
      - South eastward along Robb West toward the hamlet of Robb.
- Local
  - Upper Robb Site
    - This site currently consists of 2 wells at depths of 54 and 97 m. These cover the range of depths of water wells in Robb.
      - Please refer to ERCB SIR 2 Table 9-1 above for the stratigraphic units in which these wells are completed. The wells are established stratigraphically above the Val d'Or Seam and the underground workings in the area.

    - Water level recorders have been operating in these wells since 2010 (CR #3, Figure 3.4-7)
  - Portal Drainage
    - CVRI has noted seepage from the underground workings. A 'spring' is evident on the east side of the Embarras River in line with an abandoned mine portal. Evidently this is an outlet from the flooded workings. CVRI has monitored water quality from this seepage as part of the baseline data gathering.
  - Lower Robb Site
    - This site currently consists of 2 wells completed at depths of 31 and 61 m respectively. These are slightly shallower because of the elevation difference between upper and lower Robb but cover essentially the same elevation interval used by water wells in the hamlet.
      - Please refer to ERCB SIR2 Table 9-1 above for the stratigraphic units in which these wells are completed. These wells are established stratigraphically below the Val d'Or Seam and the underground workings in the area.
    - Water level recorders have been operating in these wells since 2010 (CR #3, Figure 3.4-8).

Background conditions relative to the future goal of protection of water wells in Robb are adequately understood with respect to expectations at the assessment-stage of the approval process. Additional information will be gathered, as detailed in the application, when mining operations move into closer proximity to the Hamlet of Robb. Depending on future mining and development circumstances, the additional information could include:

- Detailed geological information;
- Water well survey;
- Proximity of domestic wells to the underground mines;
- Additional monitoring wells:
  - In appropriate units; and
  - In the underground mine(s);
- Determination of local hydraulic parameters; and
- Additional experience with distance drawdown around mine pits.

Summary

Therefore CVRI presents that an appropriate monitoring network has been started, will be maintained and will be supplemented when necessary to provide monitoring of groundwater conditions in the area of the Robb community.

ii. sufficient data has been accumulated to establish the pre-development groundwater quality in the development area, and

Response:

There are 42 monitoring wells in the Project area which have provided over 100 water analyses through 2012. Considering that:

- additional pre-development water samples will continue to be collected into the future; and
- it has been demonstrated that there is little possibility of impact on groundwater quality.

Sufficient data has been accumulated to establish the range of groundwater chemistry in the proposed development area.

CVRI points out that an ESRD approved monitoring network assessment of groundwater monitoring information from throughout the existing CVM area has not revealed any significant adverse impact on groundwater quality. The established similarity of these areas to the Project area means that this lack-of-impact will probably occur there as well. There is no compelling reason to anticipate impacts in the Project area that were not observed elsewhere.

ERCB SIR2 Table 9-3 (included in the response to ERCB SIR2 #9c)) provides updated groundwater chemistry information organized by stratigraphic unit and mining trend.

Summary

Therefore CVRI presents that an appropriate monitoring network has been started, will be maintained and will be supplemented when necessary to provide monitoring of groundwater conditions in the area of the Robb community.

iii. CVRI's statement in response to **Question 62, Page 75** that the seepage contribution is an order of magnitude or less than the storm run-off based on the hydraulic conductivity of the units that will be dewatered.

Response:

This statement is based on long term observation of mining within the area and ERCB SIR2 Table 9-2 which provides hydraulic conductivities for the various stratigraphic units. Groundwater seepage into pits is very limited. Fresh mining faces are commonly dry with only occasional accumulation of seepage. Pumping from the pits is necessary during the rainy season to accommodate surface runoff.

10. Supplemental Information Request Responses, Question 61, Page 74.

CVRI states *"The practice of CVM is to treat all water (groundwater and precipitation) accumulating in the mine pit and to release it to the adjacent surface water body."* In response to Question 62, CVRI estimated that the release of the pumped water could be 10% of the Erith River water flow.

a. Confirm that CVRI will seek EPEA approval to release the collected and treated water into any surface water body.

Response:

CVRI has indicated that additional future applications will be required before mine operation in Robb Trend can begin (see Section A.4.3.4, Page A-10). Some of these approvals will involve amendments to existing approvals (see Section A.4.2, Table A.4-1 and Appendix 6).

Subsequent to receiving ERCB Mine Permit Approval, CVRI will continue the two-staged regulatory review process with applications for the initial mine development. This stage includes applications for EPEA and Water Act operating approvals.

Such applications and approvals will include plans and commitments related to diversion, containment, treatment and release of water in the mine area.

11. Supplemental Information Request Responses, Question 64, Page 76.

CVRI states *"Multiple wells have been established on both sides of the hamlet located between the proposed mining area and the community wells. Water levels and water quality for these wells are being monitored as a baseline."*

a. Specify the number of the monitoring wells and provide a figure showing the baseline network described in the response to Question 64.

Response:

Please refer to CR #3:

- Figure 1.4-1 shows a plan view of the two monitoring sites in Robb;
- Figure 4.2-1 show a cross-sectional view of the depths of the two individual wells at UR; and
- Figure 4.2-2 shows a cross-sectional view of the depths of the two individual wells at LR.

Please also refer to the response to ERCB SIR2 #9b.

There are fourteen monitoring wells currently within and near the hamlet of Robb:

- four wells along hydrogeological cross section 6,000E east of the hamlet;
- four wells in the hamlet; and
- six monitoring wells along hydrogeological cross-section 3,000 E west of the hamlet.

ERCB SIR2 Figure 9-8, as referred to in response to ERCB SIR2 #9e), illustrates the wells surrounding the hamlet of Robb and ERCB SIR2 Table 9-1, as referred to in response to ERCB SIR 2 #9b) provides additional detail regarding depth of these wells.

2.7 Terrestrial

12. Supplemental Information Request Responses, Question 69c, Page 92.

CVRI states *"Habitats #8, 9, and 10 containing mixedwood forests will decrease both in the RSA and in the LSA by Year 50 (ERCB Table 69-3). CVRI's proposed reclamation plan (Table F.4-4) indicates that mixed wood forest types will increase from 21.4% of the Project Area pre mine to*

25.2% of the Project Area post mine." and "By Year 50 habitats containing dense conifer (Habitat 12 and 13) will increase in the RSA and LSA. CVRI's proposed reclamation plan will reduce the amount of coniferous habitat on the Project Area from 62.3% to 47.2%."

a. Explain these apparent discrepancies.

Response:

CR #14 identifies the following terms that were used to denote the various components of the Project (CR #14, page 1):

Regional Study Area - A Regional Study Area (RSA) has been identified for the purposes of cumulative effects assessment (CR #14, Figure 1.1).

Local Study Area - The Local Study Area (LSA) is the mine permit area which includes the Project and the three access corridors joining the Project to the CVM. The total proposed mine permit area is approximately 10,113 ha.

Disturbance Area - The disturbance area is 5,728 ha or about 57% of the permit area. Mining and reclamation activities in the Project are planned to begin 2014 and will continue until 2045.

Table F 4.4, Section F refers to the disturbance area which is the portion of the LSA that will be disturbed and ultimately reclaimed. The deciduous forests on the LSA that will not be disturbed by mining will continue to age and be naturally replaced by coniferous forest during the period of mining, reclamation and after mine closure.

The deciduous forest on the LSA that will be disturbed by mining will be reclaimed to deciduous forest throughout the mining cycle therefore the trend to coniferous forest on the disturbed part of the LSA will lag behind the overall trend on the RSA and the undisturbed portion of the LSA. Younger deciduous forests will be present for some period of time on the reclaimed areas at the same time that older deciduous forests in the undisturbed part of the LSA are decreasing and being replaced by coniferous forest.

b. Explain the basis on which habitat groupings in Table 69-3 were formed and why several habitat grouping seem to contain a mix is conifer dominated, mixedwood, and open habitats.

Response:

Habitats in ERCB SIR Table 69-3 represent the land cover types that fulfill primary habitat requirements identified for each species in ERCB SIR Table 69-2, (*e.g.,* Osprey require water for foraging habitat, Common Yellowthroat requires shrubby vegetation for nesting habitat which is associated with shrub and treed wetland land cover types). Habitat requirements for species were identified from:

- peer reviewed literature (*e.g.,* The Birds of North America Online, A. Poole, ed.);
- species accounts (CR #14, Section 13.4.1 and Appendix III);
- habitat models prepared for FRI for use in the West Fraser FMA if available; and

- the wildlife inventory of the LSA (CR #14, Section 13.4.1, pages 125-139, CR #14, Appendix IV, pages 210 and 211).

Some wildlife species are relatively specialized and can fulfill particular life functions in one habitat; other species use particular structures or features associated with several habitats.

c. Explain how these groupings were related to habitat supply for species of management concern. As originally requested, provide an assessment of habitat supply for species of concern, as listed in Table 69-1, prior to mining, during mining, and after mine closure and reclamation.

Response:

ERCB SIR Table 69-2 lists habitat assemblages and identifies species associated with those habitats. ERCB SIR2 Table 12-1 uses the same data in ERCB SIR Table 69-2 but is reorganized by species of management concern (*i.e.*, the federally and provincially listed species) and identifies the amount of habitat (Habitat Supply) associated with each species. ERCB SIR2 Table 12-1 is derived from the time step modeling of 17 Land Cover classes that was used for the assessment of cumulative effects for the 27 listed bird species in CR #14 (Section 13.4) and to produce the 112 maps already submitted.

ERCB SIR2 Table 12-1 Changes in Habitat Supply (ha) and Habitat Effectiveness (%) for 32 Sensitive Species in the Robb Trend Regional Study Area (RSA) and the Robb Trend Local Study Area (LSA), Prior to Mining (Year 0), During Mining (Year 10 and 25) and After Reclamation and Mine Closure (Year 50)

	Species with Status	Type of Habitat	Year 0	Year 10 RSA		Year 10 RSA + LSA		Year 25 RSA		Year 25 RSA + LSA		Year 50 RSA		Year 50 RSA + LSA	
			ha	ha	% Effective	ha	% Effective	ha	% Effective	ha	% Effective	ha	% Effective	ha	% Effective
1	Western Toad	Breeding	737	905	123%	938	127%	797	108%	1566	212%	940	128%	1566	212%
2	Green-winged Teal	Nesting	737	905	123%	938	127%	797	108%	1566	212%	940	128%	1566	212%
3	Lesser Scaup	Nesting	737	905	123%	938	127%	797	108%	1566	212%	940	128%	1566	212%
4	Great Blue Heron	Foraging	737	905	123%	938	127%	797	108%	1566	212%	940	128%	1566	212%
5	Osprey	Foraging	737	905	123%	938	127%	797	108%	1566	212%	940	128%	1566	212%
6	Bald Eagle	Foraging	46949	73482	157%	72701	155%	63006	134%	64533	137%	17237	37%	16991	36%
7	Northern Harrier	Nesting	46949	73482	157%	72701	155%	63006	134%	64533	137%	17237	37%	16991	36%
8	Northern Goshawk	Nesting	9049	7108	79%	6719	74%	4815	53%	4723	52%	4815	53%	4723	52%
9	Broad-winged Hawk	Nesting	8269	6419	78%	6030	73%	4136	50%	4044	49%	4136	50%	4044	49%
10	Golden Eagle	Foraging	46949	73482	157%	72701	155%	63006	134%	64533	137%	17237	37%	16991	36%
11	American Kestrel	Foraging	6738	4773	71%	4718	70%	4775	71%	6158	91%	4775	71%	4673	69%
12	Sora	Nesting	737	905	123%	938	127%	797	108%	1566	212%	940	128%	1566	212%
13	Sandhill Crane	Nesting	8857	8841	100%	8784	99%	8847	100%	8747	99%	8844	100%	8747	99%
14	Upland Sandpiper	Nesting	6738	4773	71%	4718	70%	4775	71%	6158	91%	4775	71%	4673	69%
15	Northern Pygmy-Owl	Nesting	8269	6419	78%	6030	73%	4136	50%	4044	49%	4136	50%	4044	49%
16	Barred Owl	Nesting	9049	7108	79%	6719	74%	4815	53%	4723	52%	4815	53%	4723	52%
17	Great Gray Owl	Nesting	66709	56323	84%	55854	84%	69698	104%	68736	103%	99171	149%	100503	151%
18	Black-backed Woodpecker	Nesting	57660	49215	85%	49135	85%	64883	113%	64013	111%	94356	164%	95780	166%
19	Pileated Woodpecker	Nesting	9049	7108	79%	6719	74%	4815	53%	4723	52%	4815	53%	4723	52%
20	Olive-sided Flycatcher	Nesting	144088	147078	102%	145095	101%	105911	74%	105576	73%	88082	61%	86755	60%

ERCB SIR2 Table 12-1 Changes in Habitat Supply (ha) and Habitat Effectiveness (%) for 32 Sensitive Species in the Robb Trend Regional Study Area (RSA) and the Robb Trend Local Study Area (LSA), Prior to Mining (Year 0), During Mining (Year 10 and 25) and After Reclamation and Mine Closure (Year 50)

	Species with Status	Type of Habitat	Year 0	Year 10 RSA		Year 10 RSA + LSA		Year 25 RSA		Year 25 RSA + LSA		Year 50 RSA		Year 50 RSA + LSA	
			ha	ha	% Effective	ha	% Effective	ha	% Effective	ha	% Effective	ha	% Effective	ha	% Effective
21	Western Wood-Pewee	Nesting	38288	66657	174%	65934	172%	56169	147%	56247	147%	10403	27%	10190	27%
22	Least Flycatcher	Nesting	29197	22586	77%	21445	73%	16291	56%	15935	55%	16290	56%	15935	55%
23	Barn Swallow	Foraging	737	905	123%	938	127%	797	108%	1566	212%	940	128%	1566	212%
24	Brown Creeper	Nesting	57660	49215	85%	49135	85%	64883	113%	64013	111%	94356	164%	95780	166%
25	Black-throated Green Warbler	Nesting	57660	49215	85%	49135	85%	64883	113%	64013	111%	94356	164%	95780	166%
26	Common Yellowthroat	Nesting	19191	19661	102%	19490	102%	19649	102%	19332	101%	19101	100%	18791	98%
27	Western Tanager	Nesting	8269	6419	78%	6030	73%	4136	50%	4044	49%	4136	50%	4044	49%
28	Rusty Blackbird	Nesting	8857	8841	100%	8784	99%	8847	100%	8747	99%	8844	100%	8747	99%
29	Little Brown Myotis	Foraging	737	905	123%	938	127%	797	108%	1566	212%	940	128%	1566	212%
30	Northern Myotis	Roosting	113301	104596	92%	103915	92%	107196	95%	105942	94%	123363	109%	122716	108%
31	Silver-haired Bat	Roosting	132120	118554	90%	117125	89%	117142	89%	115559	87%	133312	101%	132333	100%
32	Hoary Bat	Roosting	132120	118554	90%	117125	89%	117142	89%	115559	87%	133312	101%	132333	100%

Note: Areas extracted from time steps mapping of 17 Land Classes (LC 17; Millennium 2011)

2.8 Errata

13. Supplemental Information Request Responses, Question 49, Page 62.

CVRI refers to CSA 4(1) and CSA (8).

a. Confirm that these are typos and should have been referring to the CCR Clauses 4(1) and 8(1).

Response:

CVRI is referring to the *Coal Conservation Regulations* or ‘CCR’ rather than the stated ‘CSA’. The reference to ‘CSA’ was a typo.

3. ALBERTA ENVIRONMENT AND SUSTAINABLE RESOURCE DEVELOPMENT

3.1 Public Engagement and Aboriginal Consultation

1. Supplemental Information Request Responses, Question 5c, Page 10

Coal Valley Resources Inc. states that ….since the EIA was prepared, the Sunchild First Nation has provided two brief reports as a result of traditional studies of the Project area.

a. Describe how Coal Valley intends to discuss and avoid or mitigate the concerns brought forward by Sunchild First Nation in the reports

Response:

CVRI and Sunchild First Nation continue to discuss the scope of the Project and potential impacts. The most recent meetings between the parties occurred in early 2013 focused toward completion of an agreement regarding the Project. Mitigation opportunities which CVRI have incorporated into the Project plan are identified in response to the following question (See ESRD SIR2 #2a).

2. Supplemental Information Request Responses, Question 10, Page 14

Coal Valley was asked to provide a table similar to the table found in Volume 1, Section G, Appendix 7 Public Engagement, Appendix 4 Public Engagement Report, with potential impacts to treaty Rights and Traditional uses by First Nation, proposed avoidance and/or mitigation, and First Nations response to proposed avoidance/mitigation. Table 10-1 found in SIR Responses provided a summary of all potential impacts and avoidance/mitigation.

a. Provide an expanded table that categorizes this information for each First Nation along with their responses to proposed avoidance/mitigation plans, any outstanding concerns that could not be avoided/mitigated and a listing of ESRD approvals and disposition types that were consulted on.

Response:

ESRD SIR2 Appendix 2 explains all the First Nation consultation that has occurred with the 12 identified groups.

Approvals and Disposition Listing

The entire Application, including the SIR's has been the focus of all consultation. The Application deals with the construction, operation and reclamation of the Robb Trend Project over the entire life of the Project. Section A.4 (Pages A-5 to A-11) addresses 'scope' of the application. The application was provided to satisfy requirements of:

- Coal Conservation Act:
  - covering requirements for an application for Mine Permit;
  - pre-requisite for subsequent applications;

        - Pit Licences; and
        - Dump Licences.
- Environmental Protection and Enhancement Act:
    - covering requirements for an Environmental Impact Assessment;
    - pre-requisite for subsequent operating approvals;
        - EPEA;
        - Water Act;
        - Public Lands Act;
        - Historical Resources Act;
        - Municipal Government Act; and
        - Electrical Utilities Act.
- Canadian Environmental Assessment Act:
    - covering requirements for an environmental assessment;
    - Pre-requisite for subsequent applications;
        - NRCan;
        - Fisheries Act; and
        - Navigable Waters Protection Act.

Section D.2 (Pages D-2 to D-8) describes the scope of the assessment:

"*The scope of the Project for the purposes of the EIA includes all phases (construction, operation, and reclamation and closure) of the Project and the associated facilities and infrastructure required to carry out these activities*".

3.2 Air

3. Supplemental Information Request Responses, Question 24, Page 53

CVRI has reconfirmed the assumption of 90% dust control during the winter even though the data they present from Grande Cache Coal and from unpaved Highway 40 clearly do not justify it. CVRI seem to be discounting their cited dustfall measurements. Environment Canada guidance is cited stating that there should be no dust emissions on days with measurable precipitation and snow depth of 1 cm or greater; however, the Environment Canada suggestion is a very approximate, 1st order approach with high uncertainty, that should not be relied upon when reasonable field data are available. The field data indicate that a 90% assumption is unrealistic. Even the Environment Canada approach would show that 90% is not appropriate for the early winter (November) and late winter (March). The field data presented by CVRI in their response are consistent with other data for other locations, all suggesting that 90% control throughout the winter period is an extremely over optimistic approach.

The Smoky River dustfall data indicated a reduction on the order of 43% for winter dustfall compared to summer. CVRI presents data from Grande Cache indicating that winter dustfall levels are anywhere from 5% to 43% lower than summer levels. After removing what they identify as outliers, they conclude that the winter levels are about 62% lower than summer.

CVRI goes on to show data from Coal Valley and indicate that the data support a winter reduction in the range of 23% to 43% for the median values. All of these data sets present a consistent story, which is also consistent with other data that can be found in published research. CVRI then goes on to identify some factors that affect dustfall measurements; however, none of these support an assumption of 90% control rather than the observed 5% to 62% levels control. In the presence of uncertainties, the normal industry approach is to err on the high side to as to offset the uncertainties. CVRI also notes that the assumption of 90% has been used elsewhere, but nowhere has this assumption been backed up by field data. The available field data show something quite different.

General Comments

CVRI notes the following:

- CVRI is not aware of the level of mitigation on which the Grande Cache Coal measurements near the Sheep Creek haul road are based. The level could have ranged from zero if no mitigation was applied during the measurement program to 80% if a well implemented plan such as that proposed by CVRI took place. As a minimum, it is expected that the Grande Cache Coal data reflect the mitigating effects of precipitation.
- The level of additional winter mitigation the reviewer is proposing (40-60%) is similar to the value CVRI used in the assessment (50%).
- The issue of the precise start data of winter as it pertains to mitigation levels is re-examined in the response to ESRD SIR2 #7 below.

Based on visual observations of dust at its mining operations, CVRI asserts that winter emissions from haul roads are not higher than summer emissions. Thus, the winter reduction of 50% relative to summer is consistent with CVRI's operational experience. Furthermore, as indicated in the response to ESRD SIR #24, on dry days in early fall and late winter (November & April), watering can be conducted on dry roads provided it is safe to do so.

a. Provide CALPUFF model sensitivity runs for the Robb Trend Project showing what results would look like if a reduction in the range of 40-60% was assumed (which is consistent with the available field data) rather than 90%.

Response:

A set of CALPUFF sensitivity runs were made that assumed no additional winter mitigation on haul roads (*i.e.,* winter mitigation was the same as in summer). All fugitive dust sources subject to winter mitigation near the Robb West mine (soil hauling, overburden, and first 18 km of the haul road from the Robb West mine toward the plant) were modeled with a reduction of 90% (50% additional winter mitigation) and 80% (no additional dust reduction in winter). This approach provides the contribution of haul roads to MPOI predictions and provides the MPOI with no additional winter reduction.

Results of the sensitivity runs are summarized in ESRD SIR2 Table 3-1. The 2nd highest daily concentrations of $PM_{2.5}$, PM_{10}, and TSP for the assessment case (50% increase in winter dust mitigation compared to summer) were predicted west of the Robb West mine area, along the public gravel road from Robb to Hinton. These MPOI values are dominated by gravel road emissions which were assumed to be un-mitigated in summer. The contribution from haul roads at those MPOI locations is about 2 to 5%.

The 2nd highest daily concentrations for the sensitivity runs (no increase in winter mitigation) were predicted near the haul road about 3 km south of the Robb West mine area. The new MPOI is dominated by the contribution of haul road emissions (42% to 90% in ESRD SIR2 Table 3-1) as the location of the MPOI has shifted from the regional gravel road to the haul road.

ESRD SIR2 Table 3-1 Daily 2nd Highest Predictions at the MPOI for Haul Road Dust Emission Reduction in Winter (Natural Background Included)

Compound	50% Additional Reduction for Winter Haul Road Emissions (90% Overall Reduction)		No Additional Reduction for Winter Haul Road Emissions (80% Overall Reduction)	
	MPOI Prediction (μg/m^3)	Haul Road Contribution (%)	MPOI Prediction (μg/m^3)	Haul Road Contribution (%)
Unmitigated by Vegetation Cover				
$PM_{2.5}$	22	2	26	73
PM_{10}	117	3	162	88
TSP	294	3	388	90
75% Mitigation due to Vegetation Cover				
$PM_{2.5}$	10	5	11	42
PM_{10}	41	2	53	68
TSP	98	4	121	72

With 75% mitigation for vegetative cover and no additional winter haul road mitigation, exceedances are introduced for PM10 (two days in five years or 0.11% of the time) and TSP (three days in five years or 0.16% of the time); whereas, no exceedances were predicted with additional winter mitigation. No exceedances were predicted in either case for PM2.5, which is more closely associated with health impacts than PM10 or TSP. Thus the impact of no additional winter haul road mitigation at the MPOI is to slightly increase the nuisance aspect of dust with a negligible increase in PM2.5 concentrations which contribute most to health effects.

4. Supplemental Information Request Responses, Question 36, Page 77

With respect to making an assumption for coarse coal rejects, CVRI does not adequately justify the assumption of 27% moisture in the calculation of emissions. Based on the description given of the rejects, the real moisture content of this material should be used.

a. Provide physical data on the coarse rejects to show that it compares well with fly ash, and confirm that it is handled in a high moisture form.

Response:

Coarse Reject Samples

CVRI has recently tested three 'coarse reject' samples from the CVM Coal Processing Plant (Plant). Results are provided in ESRD SIR2 Table 4-1. Please note that coarse reject would include material +6 inch in size but that the +1.5 inch material has been removed from the sample. This coarser material represents a large fraction, by weight, of the reject material.

The laboratory analysis indicates the moisture content of these samples to be between 9.99 to 11.20%. The Plant manager noted that these values are lower than normal due to the coal blend being processed. Apparently, little reject was reporting from the spiral circuit which would have been wet.

A sieve analysis of a composite sample was also provided. This information shows that the material is coarse and that silt content would be minimal.

CVRI believes that this data adequately substantiates the projection that dust emissions from coarse reject would be expected to be low. The coarseness of the material would not contribute to dust generation. Any fine fraction added would be produced from the wet processing spiral circuit hence would have a high moisture content.

ESRD SIR2 Table 4-1 Coarse Reject Sampling – March 2013			
Moisture Content			
Sample	**Total Moisture (%)**		
1	10.59		
2	11.20		
3	9.99		
Size Distribution			
Size	**Weight (kg)**	**Weight (%)**	**Cumulative Passing %**
1.5 in.	11.34	37.41	65.59
1.5 in. x 1.0 in.	1.82	6.00	56.58
1.0 in. x 0.5 in.	5.57	18.37	38.21
0.5 in. x 1mm	7.81	25.77	12.44
1mm x 100 mesh	2.15	7.10	5.34
-100 mesh	1.62	5.34	0

Air Quality Analysis

The estimate of 27% moisture content was based on assumption that coarse reject is as wet as fly ash produced in power plants. The actual data shown above confirms that the moisture content of coarse reject is approximately 10%.

As a result, CVRI has undertaken an examination of the emissions from loading and unloading of coarse rejects under the assumption of moisture contents of 27%, 13.4%, and 8.7%. ESRD SIR2 Table 4-2 provides a summary of the results.

ESRD SIR2 Table 4-2	Loading & Un-Loading Emissions (kg/day) Obtained Using Alternative Coarse Reject Moisture Contents			
Compound	Moisture Content (%)			Total Plant Emissions[1]
	27	13.4	8.7	
TSP (kg/day)	29	36	41	923
PM_{10} (kg/day)	10.3	12.7	14.4	380
$PM_{2.5}$ (kg/day)	0.60	0.73	0.82	31

[1] Total Plant Emissions are calculated from adding the TSP stack emissions and TSP fugitive emissions form the Plant.

The coarse reject emissions remain a small fraction of the total emissions from the Plant. TSP stack emissions from the Plant are 514 kg/day (Table 4.1-10 in CR#1) and TSP fugitive emissions at the Plant had been 409 kg/day (Table 4.1-9 of CR#1). Therefore, decreasing the moisture content of the coarse reject from 27% to 8.7% increases the contribution to total plant TSP emissions from 29 kg/day to 41 kg/day. Coarse reject emissions remain less than 4.5% of the total Plant TSP emissions.

5. Supplemental Information Request Responses, Question 38, Page 79

The reported silt loading of 0.17 g/m^2 is extremely low for a paved road with access from unpaved areas and with significant heavy truck traffic. This silt loading value represents an annual average value for urban highways.

a. Provide the original data with details of where they were obtained.

Response:

The silt loading measurements by Cirrus were made on paved Highway 47 near its junction with unpaved Highway 40.

The original silt load data measured on Highway 47 are not available. Information was obtained by Cirrus Consultants which is no longer an active consultancy. CVRI maintains that the work of Cirrus Consultants was reputable and that the measured silt loading values are reasonable and obtained by credible methods.

b. Define ‘typical’ road surface material and how that relates to heavy truck using this road.

Response:

See response to ESRD SIR2 #5e).

c. The single particle size analysis indicates 43% silt and 15% clay content. Using a hand calculation, indicate how these high values relate to the silt loading value of 0.17 g/m^2.

Response:

The sample referenced related to a mine haul road not a paved highway. See the response to ESRD SIR2 #5d) for an appropriate value.

d. Provide a more extensive set of field data to justify this value.

Response:

CVRI based its assessment on the available, locally measured information. There is no additional dataset to provide.

Further justification for using the 0.17g/m^2 value are as follows:

- emission estimates are based on US EPA standards from mines in SW USA;
- the numbers from the US EPA standards were modified to more accurately represent the CVM;
- the value is not the most conservative value possible but the use of it was based on years of experience, other mines in the Coal Branch area and personal experiences/observations; and
- the model that was used and that is available is suited for stack emissions not dust sources.

In addition, Cirrus indicates (Luscar, 1999) they followed sampling and calculation methods to determine the silt content of a road surface (paved or unpaved) that are published in the U.S. EPA (2006, 2011). CVRI believes the Cirrus results remain valid.

e. Provide CALPUFF model sensitivity tests to show what the results would look like with a more realistic average silt loading value.

Response:

Silt Loading Emissions

CVRI contends that the silt loading value is realistic and based on a local paved road measurement. The measurement was made using U.S. EPA methodology, about 200 m from the junction of the paved and unpaved portions of Highway 47. The method collected fines across both lanes of the roadway and is meant to measure the steady state loading between contribution from the unpaved road portion and removal by vehicle traffic. The measurement is expected to be representative of intersections of paved and unpaved roads such as that at Robb and that of Highway 40 (gravel road). It is expected to be an overestimate of loading at other locations.

Furthermore, the contribution of Highway 47, based on the measured silt loading, to regional particulate emissions, is negligible. ESRD SIR 2 Table 5-1 summarizes emissions from fugitive dust sources in the RSA and indicates that Highway 47 emissions are 0.13% (PM_{10}) to 0.32% ($PM_{2.5}$) of total roadway emissions in summer (0.34% to 0.78% in winter) and 0.13% (PM_{10}) to 0.29% ($PM_{2.5}$) of total dust emissions in the RSA in summer (0.29% to 0.60% in winter).

ESRD SIR2 Table 5-1 Summary of Road Emissions (kg/day)				
No.	Description	Emissions (kg/day)		
		TSP	PM_{10}	$PM_{2.5}$
Summer Conditions				
1.	**Paved Highway 47 - 28 km**	**83**	**16**	**4**
2.	Total emissions from all Public Roads, Plant, and Mine Haul Roads	44,852	11,943	1,244
3.	TOTAL RSA Emissions	46,647	12,767	1,395
Winter Conditions				
1.	**Paved Highway 47 - 28 km**	**83**	**16**	**4**
2.	Total emissions from all Public Roads, Plant, and Mine Haul Roads	**17,388**	4,727	514
3.	TOTAL RSA Emissions	19,162	5,542	664

According to U.S. EPA (2011), the default base silt loading value is 0.2 g/m^2 for highways with traffic counts higher than 500 vehicles a day (similar to Highway 47). Using the default instead of the locally measured value would increase the dust from Highway 47 by 16%. The use of the default increases the contribution of Highway 47 to 0.16% (PM_{10}) to 0.37% ($PM_{2.5}$) of total roadway emissions in summer and 0.39% to 0.90% in winter. Thus, with the U.S. EPA default rather than locally measured values, the contribution of paved roads in the RSA remains negligible.

Sensitivity Modeling

By examination of Figures 5.6-1, 5.5-1, and 5.4-1 in CR#1, it is seen that the maximum predicted TSP, PM_{10} and $PM_{2.5}$ concentrations near Highway 47 are approximately 35 µg/m^3, 18 µg/m^3, and 6.6 µg/m^3, respectively. Increasing the contribution of paved road fugitive emissions by 16% for the U.S. EPA default and taking into account natural background values (32, 16, and 6.4 µg/m^3, for TSP, PM_{10}, and $PM_{2.5}$, respectively) would result in negligible increase in predicted concentrations.

To test this assertion, sensitivity modeling with CALPUFF has been undertaken with a range of paved road silt loadings. According to Table 13.2.1-2 from U.S. EPA (2011), the default silt loading for paved road with average daily traffic (ADT) count of less than 500 is 0.6 g/m^2. The same silt loading value is recommended for ADT > 500 during winter months with frozen precipitation and road sanding. Since the average measured ADT on the paved portion of Highway 47 is about 512, a silt loading of 0.6 g/m^2 is reasonable but conservative. The extreme value listed in Table 13.2.1-2 (U.S. EPA, 2011) is 4 times higher (2.4 g/m^2) for ADT < 500 in winter months with sanding. CVRI expects this would represent an extreme condition.

ESRD SIR2 Table 5-2 compares emissions for these three silt loading values. Emissions with the extreme loading value are more than ten times higher than the measured value.

ESRD SIR2 Table 5-2	**Summary of Road Emissions from Paved Highway 47 (kg/day)**		
Silt Loading (g/m^2)	**Emissions (kg/day)**		
	TSP	**PM_{10}**	**$PM_{2.5}$**
0.17	83	16	4
0.60	260	50	13
2.40	918	177	43

ESRD SIR2 Table 5-3 summarizes results of CALPUFF sensitivity modeling of Highway 47 emissions with U.S. EPA default and measured silt loading values. Predictions are presented for paved road emissions only with three levels of loading (first three columns) and the full model Application and Planned Development (PDC) scenarios in the EIA (last column). Predictions are presented at the location of the maximum prediction near the paved road for paved road emissions only, at the regional MPOI and in the community of Robb. For example, for the first row of the table, the maximum prediction for paved road emissions only was obtained, and then PDC case results at the same receptor were presented in the last column.

The following is an example of the interpretation of the information in the table for mitigated TSP concentrations in Robb (the last row of the table). In Robb, the maximum predicted 2nd highest TSP concentration in the Application/PDC scenario was 55 µg/m^3 of which the Highway 47 contribution was 34 µg/m^3 minus the background of 32 µg/m^3, or 2 µg/m^3. If the silt loading was 0.6 g/m^2, the roadway contribution (including background) would increase to 37 µg/m^3 and therefore the Application and PDC prediction would increase to approximately 58 µg/m^3. For extreme loading, the highway contribution (including background) could increase to 50 µg/m^3 with the Application and PDC prediction would become approximately 71 µg/m^3.

ESRD SIR2 Table 5-3	**Summary of CALPUFF Paved Highway 47 Modelling for Three Silt Loading Values (Natural Background Included)**			
Description	**Predictions (µg/m^3) for Three Silt Loadings with Highway 47 Emissions Only**			**Application and PDC Case Prediction (µg/m^3)**
	0.17 g/m^2	**0.60 g/m^2**	**2.40 g/m^2**	
Unmitigated				
2nd Highest Daily $PM_{2.5}$				
Maximum for Highway 47 Sources	7.1	8.5	14	8.3
MPOI for Application and Planned Development	6.4	6.5	6.6	22
Maximum at Robb	7.0	8.1	12	15
2nd Highest Daily PM_{10}				
Maximum for Highway 47 Sources	18	23	40	23

ESRD SIR2 Table 5-3 Summary of CALPUFF Paved Highway 47 Modelling for Three Silt Loading Values (Natural Background Included)

Description	Predictions (µg/m³) for Three Silt Loadings with Highway 47 Emissions Only			Application and PDC Case Prediction (µg/m³)
	0.17 g/m²	0.60 g/m²	2.40 g/m²	
MPOI for Application and Planned Development	16	16	16	117
Maximum at Robb	18	22	36	61
2nd Highest Daily TSP				
Maximum for Highway 47 Sources	41	59	126	73
MPOI for Application and PDC	32	32	33	294
Maximum at Robb	38	52	103	123
Mitigated				
2nd Highest Daily $PM_{2.5}$				
Maximum for Highway 47 Sources	6.6	6.9	8.2	6.9
MPOI for Application and PDC	6.4	6.4	6.5	10
Maximum at Robb	6.5	6.9	7.9	8.5
2nd Highest Daily PM_{10}				
Maximum for Highway 47 Sources	17	18	22	18
MPOI for Application and PDC	16	16	16	41
Maximum at Robb	16	17	21	27
2nd Highest Daily TSP				
Maximum for Highway 47 Sources	34	39	56	42
MPOI for Application and Planned Development	32	32	32	98
Maximum at Robb	34	37	50	55

All predictions include background concentrations of 6.4 µg/m³ for $PM_{2.5}$; 16 µg/m³ for PM_{10}; and 32 µg/m³ for TSP. The results indicate:

- Changes in paved road silt loading, even with an increase by a factor of ten over measured values, have a negligible impact at the MPOI with or without additional vegetative mitigation.
- There are no predicted exceedances of air quality objectives near the paved road even with extreme loading and the unmitigated case.
- Mitigated predictions in Robb are all below AAAQO's, even with extreme silt loading.

References:

Alberta Transportation. 2011. *Traffic Data Mapping*. (http://www2.infratrans.gov.ab.ca/mapping/). Accessed October 2011.

Luscar Ltd. 1999. Air Quality Evaluation of the Proposed Mine Permit Extension. Luscar Ltd. – Coal Valley Mine. Prepared by Cirrus Consultants.

U.S. EPA. 2006. Compilation of Air Pollutant Emission Factors: Volume I Stationary Point and Area Sources. Part 13.2.2 Unpaved Roads, Fifth Edition (AP-42). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

U.S. EPA. 2011. Compilation of Air Pollutant Emission Factors: Volume I Stationary Point and Area Sources. Part 13.2.1 Paved Roads, Fifth Edition (AP-42). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (updated January 2011).

6. Supplemental Information Request Responses, Question 41, Page 83

a. Provide the moisture content and drop height values that were used in the calculations shown.

Response:

Moisture content was summarized in Table A2-2 (Appendix A, CR #1). This table is copied below as ESRD SIR2 Table 6-1 for clarity:

ESRD SIR2 Table 6-1 Material Moisture Content

Material	Moisture Content (%)
Raw Coal	13.4
Clean Coal	8.7
Overburden	5.6
Soil	14.0
Coarse Plant Reject	27

Drop heights were summarized in Table A3-1 (Appendix A, CR#1) and is provided here as ESRD SIR2 Table 6-2. A drop height 1.0 m was also used for raw coal and overburden loading onto trucks (as it was stated in Appendix A, Section 3.2, CR #1).

ESRD SIR2 Table 6-2 Drop Height from Conveyors and onto Trucks

Operation	Drop Height (m)
Raw Coal unloading from trucks at ROM pile (loading on Grizzly)	1.0
Conveyor drop at Clean Coal Pile	1.5
Clean Coal loading on train	1.0
Clean Coal drop inside silos	1.0
Coarse Plant Refuse loading on truck	1.0
Coarse Plant Refuse unloading on coal processing facility refuse pile	2.5

7. Supplemental Information Request Responses, Question 43, Page 88

The assumption of snow cover from November through March is not appropriate. Climate norms for Edson indicate that November has historically had only 18.9 days with snow depth greater than 1 cm and only 14.6 days with snow depth greater than 5 cm. Similarly, March has only 9 days with snow depth greater than 1 cm and only 6.5 days with snow depth greater than 5 cm. During November and March, therefore, there will be little or no snow cover most of the time. With global warming considerations and the recent update to climate norms, the days with snow cover during these months may be even fewer in future. It would be more realistic to assume that the snow covered period extends only from December through February.

Given that traffic areas may be cleared of snow, snow cover is not necessarily a good indicator of dust potential on those traffic areas. If using snow cover data, it would also be important to consider the statistic available in the Climate Norms indicating the mean number of days/month when the ground is relatively free of snow cover (*e.g.,* days/month with less than 10 cm of snow). However, when field monitoring data are available to give an indication of natural dust control during winter, such as those from Smoky River, Grande Cache and Coal Valley, CVRI should rely on the field data, as they are a direct indicator.

a. Provide model sensitivity runs showing the implications of assuming a level of natural dust control consistent with the reported dustfall measurements.

Response:

For reasons stated below, CVRI believes that the assessment provided remains appropriate and presents a conservative estimate. No further sensitivity calculations should be necessary.

The reviewer correctly stated that, according to Climate Normals (1971-2000: http://climate.weatheroffice.gc.ca/climate_normals), November has 18.9 days with snow cover above 1.0 cm and 14.6 days with snow cover above 5 cm in Edson. However, our reading of this data source indicates there are 9 days with snow cover above 1 cm in April as identified in the response to ESRD SIR #3.

In addition to parameters summarized in ESRD Table 43-1, ESRD SIR2 Table 7-1 below summarizes days with temperatures above and below zero and the soil temperature at depth 5 cm. The ground starts to thaw in April and freezes in November. Frozen ground has less potential for dust emissions. Snow cover extends from November to March, but there are snow days in April and October.

In summer months, about half the days have measurable precipitation. According to U.S. EPA (2006), days with measurable precipitation should be used to reduce proportionately annual dust emissions. In modeling, the natural mitigation of precipitation was ignored as mining was assumed to occur on dry days, and thus the model results are expected to be conservative.

In our view, the information in ESRD SIR2 Table 7-1 supports our observation that winter conditions in the Project area exist in the November to March time frame. In particular, snow remains on the ground, on average, from the end of October to early April (see first line under "Snow Depth" in ESRD SIR2 Table 7-1). The ground remains frozen in the November to March period. In CVRI's experience, the snow that is not completely removed by grading remains on the ground to effectively bind dust material together. This observation, coupled with the CVRI experience of mining in the area when the ground is frozen, led to the field-based observation of dust control in winter.

ESRD SIR2 Table 7-1 Temperatures, Rain, Snow Fall, and Snow Cover as Recorded at Edson (1971-2000)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Soil Temperature at 5 cm Depth (°C)												
AM Obs.:	-2.8	-2.7	-1.5	0.7	6.6	11.8	14.0	13.7	9.1	3.9	-0.4	-2.1
PM Obs.:	-2.8	-2.6	-1.3	2.3	9.7	14.9	17.3	16.3	10.8	5.0	-0.2	-2.0
Days with												
Snow Depth ≥1 cm	30.3	28.0	25.3	9.0	0.58	0	0	0	0.65	3.8	18.9	29.4
Snow Depth ≥5 cm	29.6	27.5	22.1	6.5	0.25	0	0	0	0.57	2.7	14.6	26.3
Precipitation ≥0.2 mm	10.4	8.4	9.0	8.5	12.6	16.7	16.4	14.8	13.2	8.2	8.3	9.5
Maximum Temperature ≤ 0°C	20.7	14.2	8.4	1.7	0	0	0	0	0.22	2.5	13.1	21.7
Snow Depth (cm)												
Ave. 1971-2000	28	28	20	4	0	0	0	0	0	1	7	17
At Month- End 1971-2000	32	24	13	0	0	0	0	0	1	3	10	21
At Month- End 2010	36	38	-	1	0	0	0	0	0	0	11	20
At Month- End 2011	40	50	41	0	0	0	0	0	0	0	11	17
At Month- End 2012	13	21	12	0	0	0	0	0	0	18	27	36
At Month- End 2013	29	23	-	-	-	-	-	-	-	-	-	-

Data source: http://climate.weatheroffice.gc.ca/climate_normals/

In its assessment of periods of winter and summer conditions, CVRI has not placed an over reliance on the Grande Cache Coal dustfall data. The dustfall data do not reference snow cover, precipitation amounts, road condition, application of mitigation, etc. CVRI has used it to provide an indication of dust reduction in winter relative to summer, which is supplemented by its experience of mining operations in the area.

References:

U.S. EPA. 2006. Compilation of Air Pollutant Emission Factors: Volume I Stationary Point and Area Sources. Part 13.2.2 Unpaved Roads, Fifth Edition (AP-42). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

8. Supplemental Information Request Responses, Question 45, Page 90

The AP-42 methods in Chapter 11.9 and 13.2.5 both may significantly underestimate wind erosion from coal piles. The method for AWMA (1992) will underestimate by significantly more. No substantive justification for use of AWMA (1992) has been provided. CVRI indicates that there are significant uncertainties and their only justification for AWMA (1992) is that it appears to be based on credible measurements and organizations. However, this is also true of AP-42, Ch. 13.2.5.

It is clear that quantification of wind erosion has large uncertainties and, under that circumstance, the appropriate approach is to err on the high side in an effort to offset the uncertainties.

a. Provide justification for use of AWMA (1992) which, based on the SIR response from CVRI, indicates the least conservative option for estimating dust emissions.

Response:

Coal stockpile emissions at the Plant are part of the baseline case, common to all emission scenarios. Predictions at the MPOI, which is near the CVM (Robb West is about 22 km from the Plant) will not be affected by emissions from stockpiles.

The method used in the assessment is wind-speed independent and for that reason emissions from stockpiles may contribute to high concentration predictions on days with light winds, when there are poor dispersion conditions. Thus, the AWMA (1992) approach used in the assessment was considered to be a conservative assumption.

Other methods used to estimate wind driven emissions have a number of factors which have uncertainty (active area of stockpile, wind gust determination, factors dependent on shape of pile in relation to highest mile wind speed are among them). CVRI believes that the AWMA (1992) approach used in the assessment is more appropriate.

b. Provide CALPUFF model sensitivity runs showing how use of AP-42, Ch. 13.2.5 would affect the dispersion model results for the proposed project.

Response:

CALPUFF model sensitivity runs were completed as requested.

The wind speed dependent emissions were estimated using AP-42, Ch. 13.2.5 (U.S. EPA, 1996). For wind speed dependent emissions, average wind speed categories defined by CALPUFF model were used: 5.14 – 8.23 m/s; 8.23 – 10.8 m/s. For wind speeds above 10.8 m/s, the average from 10.8 m/s and 16.88 m/s was used. As in the assessment, it was assumed that the ROM active pile area is 0.415 ha, the clean coal active pile area is 0.256 ha and the refuse active pile area is 0.0738 ha.

ESRD SIR2 Table 8-1 summarizes calculated emissions (the sample of calculation for these emissions is given in ESRD SIR #45). For comparison, there are also listed emissions used in the assessment, which are independent of wind speed and applied even in calm hours. The table demonstrates the wind-speed independent approach over-estimates emissions in light winds (poor dispersion conditions) and under-estimates them in high winds (good dispersion conditions), compared to the AP42 approach.

ESRD SIR2 Table 8-1 Wind Speed Dependent Emissions (g/s) from AP42 and AWMA (1992)

Compound	Wind Speed Range (m/s)			AWMA Emissions (g/s)
	5.14 – 8.23	8.23 – 10.80	>10.8	
ROM Pile				
$PM_{2.5}$	0	0.54	3.3	0.0025
PM_{10}	0	3.5	21.7	0.0164
TSP	0	7.1	43.3	0.0328
Clean Coal Pile				
$PM_{2.5}$	0	0.34	2.0	0.0008
PM_{10}	0	2.2	13.4	0.0051
TSP	0	4.4	26.8	0.0101
Plant Refuse Pile				
$PM_{2.5}$	0	0.096	0.59	0.0004
PM_{10}	0	0.6	3.9	0.0029
TSP	0	1.3	7.7	0.0058

Using either approach, wind driven emissions from stockpiles are minor compared to haul road or mine operations. As summarized in response to ESRD SIR2 #5e) (ESRD SIR2 Table 5-1), total TSP emissions from haul roads and public roads are about 44,467 kg/day. Total TSP emissions from the Plant are around 923 kg/day (ESRD SIR2 Table 4-1).

ESRD SIR2 Table 8-2 summarizes the results of sensitivity modelling using wind-speed dependent emissions and the AWMA (1992) emissions used in the assessment. Since natural background is high (TSP - 32 µg/m^3, PM_{10} -16 µg/m^3, and $PM_{2.5}$ -6.4 µg/m^3) compared to model predictions, it was not added to ESRD SIR2 Table 8-1 results.

From ESRD SIR2 Table 8-2, wind-speed dependent emissions can cause higher predictions near the Plant. However, near the community of Robb, and at the MPOI in the application and planned development cases, the contribution of predictions from windblown dust are consistently lower for the AP42 wind speed dependent emission approach. Therefore, the emissions approach used in the air quality assessment provided a conservative prediction of concentrations in the community and for application and planned development case MPOI predictions.

ESRD SIR2 Table 8-2 Results of Sensitivity Modeling ($\mu g/m^3$) using AP42 and AWMA Stockpile Emissions Approaches – Windblown Component Only						
Case	Windblown MPOI		Robb Area (Maximum Windblown Contribution)		Application and Planned Development MPOI (Maximum Windblown Contribution)	
	AP-42 Ch. 13.2.5	AWMA (1992)	AP-42 Ch. 13.2.5	AWMA (1992)	AP-42 Ch. 13.2.5	AWMA (1992)
TSP 2nd Maximum Daily	21	9	0.005	0.11	0.003	0.073
TSP Maximum Annual	0.51	0.63	0.0001	0.006	0.0002	0.0079
PM_{10} 2nd Maximum Daily	11	6.0	0.005	0.090	0.028	0.106
$PM_{2.5}$ 99.9th Percent Hourly	6.8	1.6	0.021	0.058	0.012	0.025
$PM_{2.5}$ 2nd Maximum Daily	2.66	0.35	0.005	0.010	0.011	0.013

References:

Air & Waste Management Association. 1992. *Air Pollution Engineering Manual*. Anthony J. Buonicore and Wayne T Davies (eds). Van Nostran Reinhold.

U.S. EPA. 1996. AP 42 - *Compilation of Air Pollutant Emission Factors: Volume I Stationary Point and Area Sources* Section 13.2.5, Industrial Wind Erosion. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

9. Supplemental Information Request Responses, Question 46, Page 96

Contrary to what is stated by CVRI, the papers cited do not support the claims of Pace. CALPUFF can inherently compute deposition processes as a function of the surface roughness, and therefore, already inherently estimates the effects of particle removal effects by the canopy. Applying a further reduction factor result in a double counting of deposition. The factor of 4 reduction mentioned in the context of CMAQ does not apply to dispersion models such as CALPUFF or ISC3 which compute deposition in an integrative fashion that is independent of receptor spacing, rather than explicitly on the grid as in the case of CMAQ, which tends to underestimate deposition when the grid is coarse.

Many published papers can be found that discuss the effect of vegetation on airborne emissions of particulate matter and other pollutants. When trees are sufficiently close to an emission source and are present in sufficient size and density, they can produce significant reductions in concentrations downwind of the trees; however, the magnitude of the effect is highly variable, being dependent on the type, size and density of the tree belt and on wind speed. In light of this variability and the high uncertainty, a blanket assumption of 75% reduction is not appropriate. In areas where the trees are relatively sparse or there is a large separation distance between the emission sources and the trees, the level of control will be much less. For a blanket approach, a much more moderate assumption should be adopted that errs on the safe side (e.g., 25%).

Dispersion models and, in particular CALPUFF, frequently underestimate downwind concentrations of particulate matter rather than overestimate. Therefore, no emphasis should be placed on the tendency of dispersion models to over predict. CALPUFF has inherent deposition and depletion calculations that at least partially account for the effect of trees. Before applying a further 75% reduction factor to account for trees, it is necessary to provide strong evidence that CALPUFF's deposition/depletion calculations do not adequately represent the full effect of the trees. CVRI cites a paper by Malone (2004) that only considers the effects of trees, but does not delve into whether deposition algorithms within CALPUFF or other dispersion models account for it. The same is true for Zhu et al. (2012) and Cowherd et al. (2006). Also, all of these studies found reductions that were less than 75%.

CVRI reports one study of nighttime stable conditions and indicates that a Gaussian model (ISC3, not CALPUFF) overpredicted the transportable fraction of PM10. The study did not address daytime neutral or unstable conditions. There is also no indication of whether ISC3 was run with deposition and depletion and, if so, what parameters were used.

CVRI then goes on to identify various problems with dispersion models and, in particular, with modelling of dust from roads. The comments made here point to significant uncertainties in modelling of fugitive dust sources. This is true and, in fact, dispersion modelling for fugitive dust sources has often been found to underestimate actual measurements, even when no reduction factor is applied for the effect of trees.

a. Provide CALPUFF model sensitivity runs that show what the model results would look like with trees accounted for only by the deposition/depletion algorithms built into the model. In light of the significant uncertainties this would provide something closer to an upper bound estimate of what the actual concentrations and deposition rates might be like.

Response:

While there are limitations to the approach used here, CVRI is unaware of an alternative approach using CALPUFF that simply accounts for the enhanced removal effects of vegetation. CVRI recognizes that reduction is a function of vegetation size and density and the depth of the vegetation belt, and that it is not equal in all directions from all sources. At the same time, CVRI asserts that it is a first effort at more accurately estimating these effects at locally important receptors like the residents at the community of Robb. CVRI has proposed a monitoring plan to confirm its assumptions as identified in the response to ESRD SIR #34.

With respect to upside impacts that do not account for the effects of vegetative mitigation, CVRI has included unmitigated results in Tables 5.4-1, 5.5-1 and 5.6-1 in the air quality assessment (CR #1) that provide a theoretical upper bound.

CVRI maintains it assessment approach is reasonable given the literature review provided in response to ESRD SIR #46, the density of vegetation and the fetch over which vegetation will act, especially for predictions near Robb. According to Pace (2005) composite fugitive dust capture fractions (CF) for forest land should be from 80% to 100% (CR#1, Appendix A, Table A3-4). The recommended value is 100% (ESRD Table 46-1).

ESRD SIR #46 reviewed the problems associated with modeling haul roads with moving vehicles as stationary area sources. Cowherd (2009) presents two additional processes not accounted in models that affect dust deposition:

- particle agglomeration and deposition near the point of release, and
- particle capture on irregular surfaces and in stilling zones associated with flow obstacles and upward slopes downwind of the source.

In areas with dense vegetation and rolling terrain, these processes enhance deposition, selectively on larger particle sizes. Zhu et al., 2012 and Cowherd et al. 2006 confirm the rapid depletion of the dust plume with distance from the source. ESRD SIR2 Figure 9-1 (from Zhu et al. 2012) shows that for bare land, there is about 75% PM_{10} depletion within 250 m from the haul road source. For tall grass, the depletion is about 90% within 100 m from the haul road.

ESRD SIR2 Table 9-1 summarizes study of Cowherd (2009) (also in Cowherd at al. 2006). According to this study, dust depletion is 29% to 67% within 10 to 20 m from the source with tall trees intervening. For tall grass, the depletion is 35% to 45% (also within 10 to 20 m from the source).

ESRD SIR2 Table 9-1 Summary of MRI Test Results on Near-Source Plume Loss - Table 1 from Cowherd (2009)

Type of Vegetation	PM_{10} Plume Loss*
Tall Grass	35% to 45%
Tall Cedar Trees	45% to 67%
Short Cedar Trees	29%
Tall Oak Trees**	41% to 50%

20 to 30 m from source
** Light winds (< 1.3 m/s)

Effect of CALPUFF Deposition

To determine the impact of the additional vegetative reduction assumed by CVRI, a sensitivity model run was performed for all area sources (three stockpiles: ROM, Clean Coal Pile and Refuse Coal Pile) at the existing Plant. In the run, deposition was turned off, chemistry was turned off, and there was no secondary particulate generation. Therefore, this sensitivity run compares CALPUFF model predictions, with and without deposition, and without the enhanced effects of vegetation used in the assessment. In both cases emissions included loading, unloading, bulldozing and constant wind driven emissions.

Results with and without deposition are presented in ESRD SIR2 Figure 9-2. TSP and PM_{10} predictions without deposition are higher than predictions without deposition. However, $PM_{2.5}$ concentrations with deposition are higher than predictions without deposition because the effects of secondary particulate generation more than offset the deposition.

ESRD SIR2 Table 9-2 shows the 2nd highest daily predictions (at the MPOI) for stockpile emissions with and without CALPUFF deposition. If it was assumed, as suggested by the reviewer, the 0.75 reduction of emissions should be applied to results of modeling without deposition, then the adjusted ratio for TSP should be 0.40 (instead 0.25), and the Capture Fraction is 0.60 rather than 0.75). For PM_{10} the adjusted ratio is 0.30 (instead 0.25) and the

Capture Fraction is 0.70 rather than 0.75). This analysis assumes the natural background is added after adjustment of predictions.

ESRD SIR2 Table 9-2 Comparison of 2nd Maximum Daily Predictions Results Obtained at MPOI for Test Runs of Stockpiles Emissions with and Without Deposition in CALPUFF

Compound	Prediction Without Deposition (µg/m³)	Prediction With Deposition (µg/m³)	¼ of Predictions Without Deposition (µg/m³)	Enhanced Ratio for Vegetation Effect Applied to Predictions With Deposition
TSP	15.1	9.35	3.77	3.77/9.35 = 0.40
PM_{10}	7.08	5.98	1.77	1.77/5.98 = 0.30
$PM_{2.5}$ (µg/m³)	0.30	0.35	0.075	0.075/0.35 = 0.22

ESRD Table 9-3 summarizes predictions of TSP and PM_{10} (2nd maximum daily averages) for results unmitigated, mitigated with 75% reduction due to vegetation, and with ratios estimated by using CALPUFF runs with and without deposition. Natural background is included (32 µg/m³ for TSP and 16 µg/m³ for PM_{10}). With mitigation effectiveness adjusted downwards, maximum predicted TSP concentrations are higher than the AAAQO (100 µg/m³). However, predictions at Robb remain below the AAAQO. Predictions for PM_{10} remain below BC guidelines (50 µg/m³) with adjusted mitigation of 70% rather than 75%. Predictions in ESRD Table 9-3 are provided for comparison purposes only.

CVRI maintains its approach to enhanced reduction due to dense vegetation cover and rolling terrain should be within the 80-100% range suggested by Pace (2005).

ESRD SIR2 Table 9-3 Comparison of 2nd Maximum Daily Predictions Unmitigated (No Reduction, Due to Vegetation), Mitigated 75%, Mitigated 60% (TSP), and Mitigated 70% (PM_{10}) – Application and Planned Development Case

Case	Unmitigated (µg/m³)	Mitigated 75% (µg/m³)	Mitigated 60% (TSP) or 70% (PM_{10}) (µg/m³)
TSP			
MPOI	294	98	137
Maximum at Robb	132	57	70
PM_{10}			
MPOI	117	41	46
Maximum at Robb	67	29	31

Effect of Enhanced Deposition on Vegetative Capture Fractions

According to Pace (2005), the recommended CF value for predicted particulate reduction due to dense forest cover is 100% (1.0) and the range of acceptable values is 80 to 100% (Pace in his Table 1 commented: "Forested areas will capture dust efficiently").

Capture fractions were developed using measurements for vegetation near the dust source (distances within 1 km). The effect of atmospheric stability on the capture fractions is also mentioned by Pace (2005). Very stable conditions may enhance deposition of particles, and very unstable conditions may elevate the plume quickly and decrease deposition. However, Pace wrote: "In general, one would expect the role of atmospheric stability in near source particle removal to be less important when vegetation or structures are tall and/or are located near the dust source (Etyemezian 2003)." Vegetation around the Plant and the Project consists mainly of tall and dense coniferous trees.

ESRD SIR2 Figure 9-3 compares CALPUFF model results using only the internal deposition algorithm to those with the enhanced vegetative depletion used in the assessment for TSP and PM_{10}, and presents them in terms of vegetative capture efficiency. Model predictions are shown in the 1 km to 15 km distance range from the stockpiles at the Plant. The figure indicates:

- Use of the internal CALPUFF model deposition algorithm results in capture fractions from 0.4 to 0.7 for TSP and 0.1 to 0.4 for PM_{10}. These values do not reach the range suggested by Pace (2005) even with 15 km of intervening forest. As previously mentioned, all studies for enhanced dust deposition due to vegetation cover relied on measurements within 20 to 200 m from the source.
- The enhanced deposition approach used in the assessment results in CF values of about 0.85 to 0.93 for TSP and 0.78 to 0.85 for PM_{10}. These values are within the range suggested by Pace (2005) but do not reach the recommended value of 1 within 15 km from the stockpile source.

CVRI has included unmitigated results in Tables 5.4-1, 5.5-1 and 5.6-1 in the air quality assessment (CR #1) that reflect the effects of the internal CALPUFF algorithms. As indicated by the comparison of model predictions to the CF ranges suggested by Pace (2005) in ESRD SIR2 Figure 9-3, unmitigated results should be considered as very conservative estimates of predicted particulate concentrations because the results fall well below the capture fraction of 0.8 to 1.0. Even the mitigated (enhanced deposition) predictions approach but do not meet the recommended vegetation and terrain capture effectiveness of 1.0.

References:

Cowherd, C. Grelinger, M.A. and Gebhart, D.L. (2006): Development of an emission reduction tern for near-source depletion. 15th International Emission Inventory Conference, New Orleans.

Cowherd, C. 2009. Transportability Assessment of Haul Road Dust Emissions Sent to U.S. EPA, August 21, 2009).

Etyemezian, V., 2003. Personal Communication to T.G. Pace, June 2003.

Pace, T.G. 2005. Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses. EPA Publication: http://www.epa.gov/ttn/chief/emch/invent/transportable_fraction_080305_rev.pdf

Zhu D., J. Gillies, H. Kuhns, J. Engelbrecht, V. Etyemezian, and G. Nikolich. 2012. Influence of Surface Roughness on Particle Deposition. Proceedings of Air & Waste Management Association (AWMA) 105th - Annual Conference and Exhibition, San Antonio, Texas.

10. Supplemental Information Request Responses, Question 64, Page 125

The choice of TERRAD by CVRI is still of some concern. Model guidance is that TERRAD should be some multiple of the horizontal grid spacing. If TERRAD is the same size as the grid spacing, the effect is to minimize (if not remove) the terrain effect. In fact, with TERRAD = grid size, in computing HMAX for a given grid cell, the grid cells on the diagonal will be ignored as the centre to centre distance will be SQRT(2), and thus bigger than TERRAD. Only the cells immediately east-west or north-south will be considered as only they will lie within the TERRAD radius. To be physically meaningful, TERRAD should be at least big enough that all adjoining grid cells will be examined.

There is no physical reason to use 15 km, so comparison to a run using this value is of little value. As the response states, the terrain in the region suggest that TERRAD should be on the order of 5 km. This is consistent with a grid resolution of 1 km. A value of TERRAD consistent with the physical features in the domain should be the starting point and it can be adjusted accordingly, within the physical meaning of the parameter. As the response states, this is likely somewhere in the range of 3-6 km.

Also, because TERRAD determines the influence of terrain on the CALMET winds and, more specifically, the influence of spatial variation of terrain on the CALMET wind fields, it is important to examine the spatial wind patterns produced by CALMET throughout the domain, rather than at just a single point in space. The evaluation of the representativeness of the CALMET fields should include snapshots of wind vectors that show influence (or lack) of terrain drive flows. Further, the response to this question contradicts the statement addressed in SIR# 62.

a. If data from Suncor Hanlan Robb Gas Plant are available for model evaluation, include these in a model run.

Response:

Data from the Suncor Hanlan Robb Gas Plant are not available for the 2002-2006 period. Data was provided to CVRI from September 4, 2007 to September 14, 2011. For that reason this data set was not used in CALMET modeling.

Wind roses based on observations at the Suncor Hanlan Robb Gas Plant and CALMET data were presented in ESRD Figure 54-1 (response to ESRD SIR #54d)).

The CALMET wind rose near Robb, from the assessment, is shown in ESRD SIR2 Figure 10-1, bottom.

b. Provide results for values of TERRAD in the range of 3-6 km and show that they are similar to what was used in the modelling.

Response:

As a means to compare the CALMET predictions using TERRAD = 5 km and the assessment approach with TERRAD = 1 km, ESRD SIR2 Figure 10-1 presents wind roses and wind speed distributions at the CALMET grid point nearest the community of Robb.

Based on the comparison of wind roses at Robb, the use of TERRAD = 5 results in a very similarly shaped windrose to the use of TERRAD=1. TERRAD=5 winds are slightly stronger which would generally result in increased dispersion from low-level sources and lower concentrations.

c. Provide spatial wind vector plots to demonstrate terrain influences.

Response:

ESRD SIR2 Figures 10-2 to 10-6 provide spatial wind vector plots in the CALMET model domain for five hours in 2002. Most hours are after sunset in mountainous areas when terrain effects on flows would be expected to begin.

In the comparison of these hourly wind vectors over the study area at different times of day, it is evident that the differences between the two TERRAD predictions are very minor in the mountainous terrain in the extreme southwest of the model domain and are negligible in the vicinity of proposed mining operations near Robb.

Therefore, the effect of changes in TERRAD, in the range from 1 to 5 km, is expected to have no impact on model predictions.

3.3 Water

11. Supplemental Information Request Responses, Question 70, Page 131 and 132 Supplemental Information Request Responses, Question 71a, Page 132 - 133

In response to requests for a numerical groundwater models to illustrate baseline hydrogeological conditions and to provide site specific hydrogeological data and analysis, CVRI states *CVRI has chosen to use the substantial volume of hydrogeological information collected over the course of mining in the precisely similar hydrogeological regimes as evidence of the probability and nature of impact. This substantial body of knowledge is more valid as a predictor of future impacts in the Project than any computer model.*

The information does not provide site specific analysis or modelling scenarios for an area that is not necessarily of a precisely similar hydrogeological regime.

CVRI has extensive experience and history in the exploration, development and operation of coal projects within the immediate area of the CVM. Past Permit and EIA level applications from CVRI in this area have relied on this experience and history, particularly in the area of hydrogeologic similarities between the various mining areas. As discussed in several meetings with the review team, CVRI is supporting this position by additional information provided in

ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* which details and compares the hydrogeologic regimes of the main CVM-Yellowhead Tower, the South Extension-Mercoal West and the Robb Trend mining areas.

a. Provide site specific hydrogeological data and analysis, taking into account the variability in hydrogeological parameters to:

ESRD SIR 2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* demonstrates that the hydrogeological regime in the Robb Trend is similar to those of the trends lying to the southwest (existing mine). This similarity allows the use of monitoring and operating data from those trends as an empirical model for the response of the groundwater system to mining in the Robb Trend.

i. quantify the amounts of water that are anticipated to be required to be removed during mining operations.

Response:

Operating experience is that a typical in-pit pumping system capacity may vary from 300gpm to 500gpm. A large, deep pit will typically contain three drainage sumps, each with an independent pumping system. Therefore, the pumping capacity for such a pit could have a maximum pumping output of 1500gpm. This water would be routed by pipeline out of the pit and into wastewater treatment ponds. These ponds would provide an appropriate storage volume and water treatment capability to ensure that any discharge would meet regulatory approval standards.

It should be noted, that these rates and volumes are for a combined groundwater and precipitation influx into the sump. The sumps themselves would provide some storage capacity to accommodate high rain fall events. These pumping arrangements result in a regulated withdrawal of pit water over a daily period.

CR #3 describes the dewatering process in active pits. All water entering an operating pit, consisting of both groundwater and precipitations, is directed to sumps. Pumping takes place from these sumps until the operations are sufficiently distant for new sumps to be necessary. At that time, pumping in the older sumps is discontinued and the older portion of the pit begins to accumulate water. Berms may be placed to prevent this water from affecting the operations farther along the pit. Within the shallow pits the cycle time from opening of a sump until abandonment can be several months depending on such factors as pit depth and equipment sequencing. Larger, deep pits may extend over several years in order to reach the bottom most benches. In these pits, multiple sumps are established throughout the pit.

As an estimate of the flows involved the following calculation is provided. Lohman (1972) provides an analytical calculation to determine the amount of groundwater flowing to an open pit:

- The equation is: Q= 2 x L x s(0) x square root (S x b x K/3.14 x t)

  - Where Q is flow from both sides of the pit
- Hydraulic conductivity range = K=2 x10^{-8} to 3 x 10^{-8} m/s
- Aquifer thickness b= 40 m (for a typical pit)
- Initial drawdown = s(0)= 40 m (for a typical pit)
- Length of pit being pumped = L= 1,000 m
- Length of time that the 1,000 m long pit is open = t= 200 days
- Storativity = S = 0.05 (unsaturated conditions)
- Length of time of flow to the pit t= 200 days
  - 200 day is used because 1,000 m of pit typically takes 6 months to complete

The above parameters applied to the Lohman equation predict a range of pit water volumes of:

- 55,000 cubic metres per day

Reference:

Lohman, Stanley W. (1972): Ground-water Hydraulics; USGS Professional Paper 708, 70 pages

ii. quantifying the drawdown of groundwater during mining operations at the site and in adjacent areas.

Response:

Section 5, ESRD SIR 2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* provides an assessment of drawdown adjacent to pits.

The conclusions in are pit dewatering shows a consistent trend in two key areas. Groundwater levels show a natural variation of up to 5 m as shown in the Project groundwater level data (Table 3; CR#3). The distance from a pit dewatering event that the drawdown of the groundwater level begins to exceed the natural variation is generally less than a few hundred meters. It is important to recall that the edges of a pit out to this distance is usually disturbed as there are requirements for storing of overburden material, haul routes and other operational mining activities.

The extent of the drawdown from a pit is controlled by the topography, geologic structure and the lithology.

Groundwater levels in the aquifer return to pre-disturbance levels within approximately one year after pit dewatering activities have ceased.

b. Provide an analysis of potential error in the prediction.

Response:

As it is CVRI's position that the experience and data are a better predictor of effect than a modelling exercise, the potential for error is related only to the potential that decades of monitoring has consistently been wrong. With the rigour of the review that this data has been subjected to through significant regulatory applications and approval compliance, it is believed that the potential for error is insignificant.

12. Supplemental Information Request Responses, Question 71b, Pages 132

In response to question 71b, CVRI used information observed in the area of the Mercoal West mine permit area and not data specific to the proposed Robb Trend Project. CVRI also state *As the impact is insignificant, no mitigation is required and the overall water balance/interaction between ground and surface water is unaffected. This assertion is not based upon site specific data.*

a. Based upon site specific information, provide a balanced water budget quantifying the groundwater contribution to streamflow in the pit footprint, and adjacent areas where groundwater drawdown is predicted.

Response:

CVRI has stated that it returns the diverted groundwater to the adjacent water course. Intuitively, this means that the net of the water balance remains at no loss with respect to the water course. ESRD SIR2 Figure 12-1 illustrates this water balance.

CVRI maintains that this request is not required for the assessment of impact since none is logically anticipated.

b. Provide the balanced water budget for time periods prior to, during and after mining operations are completed.

Response:

Please refer to the response to ESRD SIR2 #12a).

c. Define the length of time from the end of active mining operations until static groundwater conditions are re-established.

Response:

CR#3 provided the assessment that groundwater levels would be re-established within twelve months of the end of active mining operations. “Re-establishment” may not however mean return to pre-mining levels. The landscape of the approved reclamation will determine the final configuration of the water table adjacent to a reclaimed pit.

CVRI has provided data from previous mining development to illustrate the magnitude of changes to the groundwater levels surrounding active mining and the ‘rebound’ after mining. The water table drawdown is limited in distance around the excavated pits. After mining a stable static water table is quickly redeveloped in the reclaimed terrain.

CVRI has demonstrated that the hydrogeological regime in the Robb Trend is similar to those of the trends lying to the southwest. This similarity allows the use of monitoring and operating data from those trends as an empirical model for the response of the groundwater system to mining in the Robb Trend.

13. Supplemental Information Request Responses, Question 71c-e, Page 133

In response to 71c, CVRI state *CR #3, Section 4 summarizes the known effects and necessary mitigation associated with the groundwater effects of the Project. Tables 4.2-1 and 4.3-1 of CR #3 outline that no significant impacts are predicted.* This information does not quantify the effects requested.

a. Quantify stream, wetland and peatland water levels during the time of reductions in groundwater levels in the mine pit footprint and adjacent areas where groundwater drawdown is predicted.

Response:

Section 5, ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley mine"* provides an assessment of drawdown adjacent to pits.

The conclusions in are pit dewatering shows a consistent trend in two key areas. Groundwater levels show a natural variation of up to 5 m as shown in the Project groundwater level data (Table 3; CR #3). The distance from a pit dewatering event that the drawdown of the groundwater level begins to exceed the natural variation is generally less than a few hundred meters. It is important to recall that the edges of a pit out to this distance is usually disturbed as there are requirements for storing of overburden material, haul routes and other operational mining activities.

The extent of the drawdown from a pit is controlled by the topography, geologic structure and the lithology.

Several points need to be made in addition to responding to ESRD SIR2 #13a):

- CR#3, Appendix C provides analysis of two examples of drawdown adjacent to operating pits as follows:
  - drawdown of the water table declined rapidly with distance from the pit;
  - the magnitude of this drawdown approximated that of natural annual fluctuations at distances of several hundred metres from the pit; and
  - the water table recovered from drawdown within a time frame of less than one year after mining ceased.
- The response to ESRD SIR2 #31 in this package provides an additional assessment of drawdown adjacent to pits. In this case the assessment involves the South Extension Wetland with pits at both ends.

The conclusions in ESRD SIR2 #31 are:

- Although the natural downward hydraulic gradient was increased by mining activities, the downward flow of water from the Wetland did not increase sufficiently to cause any measureable change in the water table within the peat deposits.
- A drawdown of hydraulic head of as much as 40 m in the bedrock produced no demonstrable impact on the Wetland. This lack of impact occurred despite the fact that

pits were present on two ends of the Wetland and that the lowering of the water level in the pits has been present since 2006.

- It has been pointed out that the area up to approximately 200 m from the mine pit proper is subject to extensive disturbance such as spoiling and clearing for temporary mine infrastructure. Ecosystems, including streams, wetlands and peatlands within this area of disturbance will be subjected to extensive disturbance which are the subject of the reclamation plan. The issues of impact via water table decline are simply not relevant in this area and quantifying serves no useful purpose to the assessment process.

Considering the above points, the issues of water level declines relative to streams, wetlands and peatlands at distances greater than several hundred metres remains to be addressed. At these distances, the probable drawdown of the water table has been empirically-predicted to be small. At these distances, the magnitude of this drawdown has been shown to be approximately the range of natural water table fluctuations. It has also been demonstrated that the length of time of the drawdown would be approximately one year after nearby mining ceases.

Under this situation the impact is assessed to be insignificant.

b. Quantify the groundwater contributions to streamflow (before, during and after mining) for streams in the area where drawdown is predicted (and anticipated) due to dewatering of the mine pit footprint and adjacent affected areas.

Response:

Section 5, ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley mine"* provides an assessment of drawdown adjacent to pits.

The conclusions in are pit dewatering shows a consistent trend in two key areas. Groundwater levels show a natural variation of up to 5 m as shown in the Project groundwater level data (Table 3; CR #3). The distance from a pit dewatering event that the drawdown of the groundwater level begins to exceed the natural variation is generally less than a few hundred meters. It is important to recall that the edges of a pit out to this distance is usually disturbed as there are requirements for storing of overburden material, haul routes and other operational mining activities.

The extent of the drawdown from a pit is controlled by the topography, geologic structure and the lithology.

c. Quantify the percent reductions in streamflows that will result from the reductions in groundwater levels.

Response:

Stream flows are not anticipated to be reduced because CVRI returns the diverted groundwater to the adjacent stream that would have experienced that diversion. There will be no net loss.

d. Quantify the anticipated effects on streamflow associated with reduced groundwater recharges to the streams in the areas affected by the groundwater level declines.

Response:

Stream flows are not anticipated to be reduced because CVRI returns the diverted groundwater to the adjacent stream that would have experienced that diversion. There will be no net loss.

14. Supplemental Information Request Responses, Question 72a to 72d, Pages 134-136

In Section 3.3 of CR # 3 (Page 24), CVRI indicate that groundwater is anticipated to be drawn down in the area of the abandoned Lakeside and Bryan underground mines. As a consequence, CVRI anticipates that groundwater levels will decline to 1,050 m on the southeast side of the Hamlet of Robb and to 1,040 m on the northwest side of the Hamlet of Robb.

CVRI was requested to provide site specific hydrogeological data and analysis, taking into account the variability in hydrogeological parameters, to quantify the drawdown of groundwater anticipated during these dewatering operations in the area of the abandoned Lakeside and Bryan underground mines and adjacent affected areas (SIR 72a). CVRI was requested to provide additional information related to the issue of groundwater level decline to 1,050 m on the southeast side of the Hamlet of Robb and to 1,040 m on the northwest side of the Hamlet of Robb (SIR 72b to 72d).

CVRI's response was a qualitative discussion acknowledging that drawdown would occur and that at a later time, the effects would be confirmed and a mitigation strategy would be developed. The discussion did not provide the quantitative analysis requested.

CVRI state "*It is anticipated that water levels will recover approximately nine months after dewatering ceases" without providing any site specific quantitative analysis."*

CVRI also state "*Dentherm (1982) undertook a computer model of the drawdown adjacent to the dewatered Lakeside and Bryan Mines. The amount of drawdown of the water level in the workings was similar to that anticipated for this proposed Project – approximately 60 m."* Section 3.4.8.3 (page 3.4-27-28) states as follows:

> *"Computer simulation of groundwater flow around the final pit was conducted using a transient finite element model.*
>
> *It is predicted that the pit will not affect bedrock flow systems beyond a distance of a few tens of metres from the pit walls due to the presence of low permeability and anisotropic rock formations."*

Considering the large scale of the proposed Robb Trend Project and associated possible significant impacts, it is considered necessary to conduct a new phase of computer modelling to assess effects and provide a mitigation strategy, rather than rely on modelling conducted 31 years ago.

CVRI also describe information provided in regards to drawdown observed in the area of the Mercoal West mine permit area which is not specific to the proposed Robb Trend Project. It is noted that the Mercoal West mine permit area is located 5-10 km west of the proposed Robb Trend Project.

a. Provide site specific hydrogeological data and analysis, taking into account the variability in hydrogeological parameters, to quantify the drawdown of groundwater anticipated during these dewatering operations in the area of the abandoned Lakeside and Bryan underground mines and adjacent affected areas.

Response:

CVRI has extensive experience and history in the exploration, development and operation of coal projects within the immediate area of the CVM. Past Permit and EIA level applications from CVRI in this area have relied on this experience and history, particularly in the area of hydrogeologic similarities between the various mining areas. CVRI accepts the reviewer's lack of history with previous applications within the coal mining industry in this area and has provided ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* which details the hydrogeologic regimes of the main CVM-Yellowhead Tower, the South Extension-Mercoal West and the Robb Trend mining areas.

General Comments Regarding Underground Workings

CVRI would like to draw attention to several considerations regarding the underground workings in the area of the Robb community:

- The mine on the east side and under the Embarras River is the Lakeside Mine. Seepage from a portal on the east side of the Embarras River suggests that the mine is likely flooded to approximately 1110 m elevation.
  - Therefore, the existing groundwater levels have been already been effected by the Lakeside underground mine workings and the community wells existing in that area have already accommodated the influence of that drawdown.
- The Bryan Mine is located on the west side of the community is not directly beneath any residential areas. The flooded level in these workings is not known but is expected to be influenced by seepage observed into Bryan Creek. This level would appear to be somewhat higher in elevation than the Lakeside Mine.
  - Therefore, the existing groundwater levels have responded to the drawdown imposed by the Bryan underground workings.
- The two underground mines are not physically connected. In fact a barrier zone was maintained between the two operations (ERCB SIR2 Figure 6-2).
- Neither mine was reported to operate with significant water make. Apparently small sumps at depth were adequate to collect groundwater seepage and pumps where able to satisfactorily remove water from underground. Occasional minor 'flooding' was reported (Lakeside Mine) which was identified as surface water entering via mine openings. Seepage in the Val d'Or Seam from Bryan Creek and Embarras River were suspected as probable contributors.
- Underground development beneath the creeks and rivers would have carefully avoided potential for infiltration from surface water courses. Appropriate barriers in the form of buffer pillars and physical separation would have been maintained during mining. Therefore, it is reasonable to assume that direct connection to surface watercourses does not exist.
- The CVRI development proposal results in open pit mining that intersects the Lakeside Mine only at the higher levels of underground development (proposed to be at the 1050 m elevation). Underground workings below this level will remain flooded and unaffected by the Project.
- Intersection with the Lakeside workings will not result in drainage of the Bryan Mine. The reverse would also be true.

- Mining, reclamation and lake filling in the east side (Lakeside Mine) will be completed prior to mining interesting the Bryan Creek mine. Therefore, rebound of the groundwater levels on the east side would be expected before any drawdown on the west side.
- Mining on the west side (Bryan Mine) would occur at the higher elevation first and progress downward in time into the lower working levels.
- Monitoring wells established in the vicinity of the community and within the residential areas are already reporting groundwater drawdown imposed by the underground workings to their level of flooding. Likewise, community wells must already accommodate this pre-disturbed state of drawdown.
- Therefore, any assessment of groundwater impact due to open pit mining should only have to address the incremental lowering of the underground water levels and could separate the east and west sides due to the proposed timing of activity.

CVRI Assessment of Groundwater Impact

CVRI has extensive experience and history in the exploration, development and operation of coal projects within the immediate area of the CVM. Past Permit and EIA level applications from CVRI in this area have relied on this experience and history, particularly in the area of hydrogeologic similarities between the various mining areas. CVRI accepts the reviewer's lack of history with previous applications within the coal mining industry in this area and has provided ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* which details the hydrogeologic regimes of the main CVM-Yellowhead Tower, the South Extension-Mercoal West and the Robb Trend mining areas. Notwithstanding the conclusion that the probability of impact on wells in Robb might be minor, the consequences are too great to leave to even a low probability of occurrence. Therefore CR#3 examined mitigation and determined that deepening of wells in Robb was feasible as mitigation. Having determined that mitigation was feasible then it was necessary to consider whether a detailed assessment, including a well survey and a computer model, was appropriate to the assessment process. It was stated that the detailed assessment was not appropriate to the assessment process at this time for the following reasons:

- lowering of water levels in the first underground mine (Lakeside) would not potentially begin until approximately 2027;
- the water supply scenario in Robb could potentially change significantly over the intervening 14 years:
  - for instance, a municipal water supply system could be installed;
  - even without the implementation of a municipal supply system, many existing wells could be abandoned and replaced over that period of time. Any 2013 survey of water wells would simply need to be done again; and
  - groundwater monitoring in the vicinity of Robb and the Robb Trend in general over the 14 years will provide valuable information for the future assessment.

CVRI acknowledges that the issue of impact on wells in the hamlet of Robb is very important. Having determined that at least one mitigation strategy is readily available CVRI has suggested that the best course of action is to have a plan which, subject to monitoring results in the interim, should commence approximately 5 years before lowering of water levels in the underground mines is to begin.

Summary

CVRI believes that groundwater drawdown in the Robb community area will be insignificant. Drawdown of the underground mines will be limited in extent and duration. The two mines are independent of each other and would not be worked in the same timeframe. The presence of the two mines have already 'depressed' the local water levels so that domestic wells have accommodated the current situation.

Regardless, CVRI has identified a 'mitigation' plan that would resolve drawdown impacts should they occur.

b. Provide site specific hydrogeological data and analysis quantifying the lateral extent of the drawdowns of groundwater anticipated during these dewatering operations.

Response:

CVRI accepts the reviewer's lack of history with previous applications within the coal mining industry in this area and has provided ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* which details the hydrogeologic regimes of the main CVM-Yellowhead Tower, the South Extension-Mercoal West and the Robb Trend mining areas.

c. Provide a site specific quantitative analysis indicating how long will it take, following the completion of mining operations, for the water levels to recover to static levels observed before the beginning of mining operations. For this analysis, illustrate, for monthly time increments, the extent of the maximum drawdown, to full recovery, in the area of the abandoned Lakeside and Bryan underground mines and adjacent affected areas.

Response:

CVRI accepts the reviewer's lack of history with previous applications within the coal mining industry in this area and has provided ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* which details the hydrogeologic regimes of the main CVM-Yellowhead Tower, the South Extension-Mercoal West and the Robb Trend mining areas.

d. For a) to c) above, use the numerical model previously generated to confirm the predicted drawdowns and recovery times.

Response:

CVRI accepts the reviewer's lack of history with previous applications within the coal mining industry in this area and has provided ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* which details the hydrogeologic regimes of the main CVM-Yellowhead Tower, the South Extension-Mercoal West and the Robb Trend mining areas.

e. Provide an analysis of potential error in the predictions.

Response:

CVRI accepts the reviewer's lack of history with previous applications within the coal mining industry in this area and has provided ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* which details the hydrogeologic regimes of the main CVM-Yellowhead Tower, the South Extension-Mercoal West and the Robb Trend mining areas.

15. Supplemental Information Request Responses, Question 73a to 73c, Pages 136 and 137

CVRI state *they have proposed a plan of action with respect to the situation surrounding the mine plans and the underground mines. CVRI also state CVRI will commit at this time to transporting water diverted from watercourses through groundwater back to the adjacent watercourse. This will effectively mitigate the issues pointed out above."*

This does not answer the question presented to CVRI.

a. For streams in the affected areas, provide a balanced quantitative water budget that quantifies stream input and output parameters prior to, during and after mining operations. Provide this quantitative analysis for each stream that transects the mining footprint, and including adjacent affected areas.

Response:

ESRD SIR2 Table 15-1 summarizes the pit footprints within the various streams. The stream basin areas downstream of the pits are shown in CR #6, Figure 3 and in ESRD SIR Figure 183-1 following mining. All pit footprints represent less than 10% of the basin areas except in the smaller basins of Hay Creek and Unnamed Creek.

ESRD SIR2 Table 15-1 Pit Footprint Area versus Drainage Basin Areas

Drainage Basin	Pit Area (ha)	Basin Area (ha)	Pit Area as % of Drainage Basin
Bacon Creek	56.9	967	5.9%
Bryan Creek	80.2	2,484	3.2%
Bryan Creek	118.3	2,484	4.8%
Erith River	466.3	7,428	6.3%
Halpenny Creek	9.9	3,118	0.3%
Halpenny Creek	107.1	3,118	3.4%
Hay Creek	207.2	781	26.5%
Lendrum Creek	83.5	2,920	2.9%
Lendrum Creek	99.8	2,920	3.4%
Lund Creek	26.8	5,776	0.5%
Lund Creek	6	5,776	0.1%
Lund Creek	80.9	5,776	1.4%
Lund Creek	182.7	5,776	3.2%

ESRD SIR2 Table 15-1 Pit Footprint Area versus Drainage Basin Areas			
Drainage Basin	**Pit Area (ha)**	**Basin Area (ha)**	**Pit Area as % of Drainage Basin**
Mitchell Creek	29.3	1,764	1.7%
Pembina River Tributary	17.0	865	2.0%
Pembina River Tributary	46.8	865	5.4%
Unnamed Creek	109.8	946	11.6%
White Creek	3.1	9961	0.0%
White Creek	37	9961	0.4%

ESRD SIR2 Table 15-2 provides a quantitative estimate of the maximum expected contribution of groundwater from pits to streams intersected by the pits. This estimate is based upon the following assumptions:

- Average annual water balance parameters are used (see CR #6, Section 4.2.5, page 40) as follows:
  - average annual surface runoff from streams in the area = 233 mm (May-October runoff with winter runoff as negligible and mainly a groundwater baseflow);
  - average annual precipitation = 619 mm;
  - average annual areal evapotranspiration = 327 mm; and
  - groundwater = 59 mm.
- Water enters the pit from direct precipitation, minor localized surface runoff from pit edges and groundwater inflow /seepage.
- All water entering the pit is collected at sumps in the pit and pumped to sediment control facilities which release the water to the stream.
- 90% of precipitation on the pit areas is captured and pumped to the sediment control facilities (*i.e.*, 10% is lost to evaporation and evapotranspiration)
- The predicted area of groundwater influence (drawdown) extends 200 m beyond the pit footprints (see ESRD SIR #71 and Appendix C, CR #3). All groundwater from this perimeter and the pit area enters the pit at 58 mm per year as the contributing groundwater component. A large portion of this is actually direct precipitation into the pit that is assigned to the groundwater component for the purposes of this assessment.
- All pits are fully open at the same time within the basin for the entire year. In actual fact, pits are rarely left open for large areas with sumps typically moved after 3 to 9 months. Further, groundwater drawdown effects are expected to be negligible within 4 to 9 months (ESRD SIR #71 and Appendix C, CR #3) after mining and pit filling.

The estimated combined (surface and groundwater) impact on streamflows from conditions prior to, during mining, during lake filling, and after mining, is summarized in CR #6, Table 14.

ESRD SIR2 Table 15-2 Average Annual Water Budget and Groundwater Contribution from Pits - Maximum Case with Entire Pit Areas Open

Column	1	2	3	4	5	6	7	8	9
Drainage Basin	Pit Area Plus 200 m Perimeter (ha)	Drainage Basin Area (ha)	Total Pit Area Plus Perimeter Zone of Influence as % of Basin Area	Pit Surface Runoff or Direct Precipitation (dam³)	Pit Groundwater Contribution (dam³)	Average Annual Pumped Volume from Pit (dam³)	Average Annual Natural Stream Runoff Volume (dam³)	Pit Groundwater Contribution as % of Streamflow	Pump Volume as % of Streamflow
White Creek	91.5	9,961	0.9%	202	53	255	23,209	0.2%	1.1%
Erith River	939.2	7,428	12.6%	2,350	545	2,895	17,307	3.1%	16.7%
Lund Creek	840.7	5,776	14.6%	1,494	488	1,981	13,458	3.6%	14.7%
Halpenny Creek	411.0	3,118	13.2%	590	238	828	7,265	3.3%	11.4%
Lendrum Creek	620.9	2,920	21.3%	924	360	1,284	6,804	5.3%	18.9%
Bryan Creek	426.1	2,484	17.2%	596	247	843	5,788	4.3%	14.6%
Mitchell Creek	132.1	1,764	7.5%	148	77	224	4,110	1.9%	5.5%
Bacon Creek	158.7	967	16.4%	287	92	379	2,253	4.1%	16.8%
Unnamed Creek	217.3	946	23.0%	553	126	679	2,204	5.7%	30.8%
Pembina River Tributary	137.2	865	15.9%	322	80	401	2,015	3.9%	19.9%
Hay Creek	344.5	781	44.1%	1,044	200	1,244	1,820	11.0%	68.4%

Column 1 = from GIS mapping with an assumed 200 m perimeter of groundwater influence around pits.
Column 2 =existing stream drainage areas below pits as shown in CR #6, Figure 3.
Column 3 = Column 1 / Column 2
Column 4 = (618 mm average annual precipitation - 58 mm groundwater portion) * (90% as runoff) * (maximum pit areas in basin in ESRD SIR2 Table 15-1)
Column 5 = (58 mm groundwater contribution) * (Column 1)
Column 6 = Column 4 + Column 5
Column 7 = (233 mm May-October mean annual runoff rate) * (Column 2)
Column 8 = Column 5 / Column 7
Column 9 = Column 6 / Column 7

b. Describe and quantify the groundwater contribution to the streams in the area where drawdown is anticipated in relation to the dewatering of the Lakeside and Bryan underground mines.

Response:

Current Situation

Groundwater is expected to be 'recharging' the underground workings replacing the water seeping out of the old mines. The water level in the workings is anticipated to be relatively static, increasing in the spring and during rainfall events but decreasing to near zero in winter months. This fluctuation is observed in portal seepage rates.

Lakeside Mine Dewatering

CVRI will pump water from the Lakeside Mine to decrease the 'stored water level' to below the level which would be intersected by the open pit mining. It is expected that this will reduce water level from 1110 m to 1050 m, a drop of approximately 60 m. Water pumped[1] from the underground will be discharged into the Embarras River basin. This water level will be maintained by pumping until mining in the Lakeside Mine area is completed.

Therefore, the groundwater contribution to the Embarras River will not be changed. The pumping rate will match the inflow into the underground in order to maintain the water level. This will be the same inflow rate that was occurring prior to mining.

Bryan Mine Dewatering

CVRI will pump water from the Bryan Mine to remove the 'stored water' since all of the workings will be intersected by the open pit mining. Water pumped[2] from the underground will be discharged into the Bryan Creek basin. Continued pumping will keep the underground workings dry until mining in the Bryan Mine area is completed.

Therefore, the groundwater contribution to the Bryan Creek will not be changed. Groundwater flow that would have entered the underground workings would enter the open pit, be collected and pumped into the Bryan Creek basin. Thus the same inflow rate that was occurring prior to mining would be maintained.

c. Quantify the anticipated declines in wetland and peatland water levels associated with reduced groundwater recharge in the areas affected by the groundwater level declines.

Response:

CVRI accepts the reviewer's lack of history with previous applications within the coal mining industry in this area and has provided ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley Mine"* which details the hydrogeologic regimes of the main CVM-Yellowhead Tower, the South Extension-Mercoal West and the Robb Trend mining areas. It is pointed out in that response that response in the wetlands of the Project area will be the same.

No declines in water levels in wetlands adjacent to mining are anticipated in the Project area.

[1] Duration of 'dewatering' will be extended over several months in order to avoid 'rapid drawdown'.
[2] Duration of 'dewatering' will be extended over several months in order to reduce impact on normal flows in the stream.

16. Supplemental Information Request Responses, Question 74a to 74c, Section 5.1, Pages 137 and 138

CVRI state *they will return groundwater that has entered mine pits from adjacent watercourse to those same watercourses. This process acknowledges that whatever the amount of water being diverted, it will be returned to the adjacent watercourse. Any impact is thus mitigated and thus becomes insignificant.*

CVRI have not addressed the question in relation to TOR 3.2.1 (A), in terms of defining baseline conditions, or quantifying water amounts that could be diverted away from the streams as a result of groundwater declines.

a. Provide a balanced quantitative water budget showing stream input and output parameters prior to, during and after mining operations in the pit footprint and outlying areas. Provide this quantitative analysis for each stream that transects the mining footprint.

Response:

Refer to response ESRD SIR2 #15a) and Table 14 of CR #6.

b. Describe and quantify the groundwater contributions to the streams in the areas where drawdowns are predicted by dewatering the mine pit footprint and adjacent affected areas.

Response:

Refer to response ESRD SIR2 #15a) and Table 14 of CR #6.

c. Quantify the anticipated declines in stream levels associated with the reduced groundwater recharge to the streams in the areas affected by the groundwater level declines.

Response:

Refer to response ESRD SIR2 #15a) and Table 14 of CR #6.

17. Supplemental Information Request Responses, Question 75a, Page 138, and Figures 75a-1 and 75a-7; Supplemental Information Request Responses, Question 79a, Page 151 and Figure 79-1

CVRI was asked for a set of figures that show the anticipated final configuration of end pit lakes and channels. CVRI was also asked to assess whether adjacent lakes would hold water at the differential levels shown. The response to the second request stated that seepage is assumed to be an issue and will be controlled by placement of compacted glacial till where it is necessary to maintain differential elevations between adjacent lakes.

The analysis shown on Figure 79-1 indicates that no core is necessary or will be provided between adjacent Lakes 1 and 2, despite a proposed 15 m elevation difference, because they drain to the same stream. It follows that if seepage is as great as anticipated, these two lakes will normally fluctuate more or less together in a water level range controlled by the outlet elevation of the downstream lake. However, Figure 75a-1, which shows the final configuration of lakes and channels, has Lakes 1 and 2 with a 15 m water level difference which will support approximately 700 m of reclaimed connecting channel. There are similar inconsistencies between the anticipated seepage and final elevations of water levels at Lakes 12 and 10 which are shown to be joined by 1500 m of connecting channel (Figure 75a-7).

Response:

General Comments

CVRI has proposed that massive rock fills would be placed as backfill into areas of the mined pit in order to create separate lakes. The reclamation plans describe possible lake configurations including water levels. This concept has been based on prior experience at the CVM and other mine operations. Sufficiently massive rock fills have been found to be adequate to provide a 'dyke' to retain water volumes with different levels. ESRD SIR2 Photo 17-1 is provided to illustrate this concept. This photo illustrates free dumped mine rock fill across the CVM tailings pond. Even the narrow fill section in these conditions is adequate to maintain 'perched' water levels. The photo shows three different water levels separated by narrow rock 'dykes'.

CVRI has proposed similar construction for separating the various lakes at the Project. CVRI acknowledges that these are somewhat larger rock fills, however selective materials may be placed as a 'core' within the rock fill barrier to further inhibit any flow through the dykes.

CVRI believes that this technique has been adequately substantiated as a possible method of lake construction. Therefore, CVRI continues to support the reclamation and lake plan previously presented with provision of potential development modifications such as discussed in ESRD Appendix 86 and below in ESRD SIR2 #20.

ESRD SIR2 Photo 17-1: Rock Fills within Tailings Pond

a. In light of the seepage assessment described in Response 79a, clarify whether Lake 1 is expected to hold water at a level 15 m higher than adjacent Lake 2, and whether Lake 12 is anticipated to hold water at a level 30 m higher than adjacent Lake 10.

Response:

Barriers to Be Provided

CVRI notes that the response to ESRD SIR #79a) indicates that a commitment is made to provide 'barriers' as necessary. As a result, CVRI would expect that Lake 1 and Lake 12 would hold water at the elevations proposed.

Potential Alternatives

Depending upon the final mine pit extent and backfill at reclamation, Lake 1 could be lowered to be similar to Lake 2 level. This is an alternative mentioned in ESRD Appendix 86 (Water Management and Discussion Paper). Alternatively, an impermeable core (as indicated in the response to ESRD SIR #79) and a lined channel section over the backfill or on the side cut into natural ground may be used. The same comments would apply to Lake 12 above Lake 10.

b. Provide revised reclamation plan drawings that show the anticipated final water levels.

Response:

Barriers To Be Provided

CVRI has made a commitment to provide barriers as necessary. Therefore, CVRI continues to support the reclamation plan previously presented based on the water levels noted. A 'revised' reclamation plan is not required.

Potential Alternatives

Revised Figures 75a-1 and 75a-7 (listed as ESRD SIR2 Figure 17-1 to 17-7) provide alternative lake configurations for Lake 1 and 12 should common water level be proposed or naturally developed. In these circumstances water would flow through the intervening rock fills. Lake shapes, depth and volumes would change as a result.

c. If functional connecting channels cannot be created between these lakes as shown on the reclamation plan drawings, explain what CVRI will do to mitigate the project impacts.

Response:

CVRI has committed to constructing functional connecting channels as part of the reclamation plan. Such construction would consider long term viability of the channels. For example, channel sections may need to be lined with compacted clay material or be cut into natural ground beside the pit backfill to maintain functional drainage channels.

Possibilities for lake outflow may include:

1. groundwater outflow;
2. spillage from the lake into or over the rock fill; or
3. flow through a constructed outflow channel. CVRI has proposed outflow channels. Such channels are expected to enhance fish passage and provide additional fish habitat.

18. Supplemental Information Request Responses, Question 75b, Page 139 and Figures 75a-1 and 86-1

CVRI provided a summary of diversions to be completed over land bridge fills as a table in Response 75b. Figure 86-1 appears to show a diversion of Bryan Creek over the Mynheer Pit which is not identified in the table of diversions over land fills

a. What methods will be used to divert Bryan Creek over the Mynheer Pit as shown on Figure 86-1?

Response:

The mine plan related to Bryan Creek can be accomplished without disrupting the continuous flow of the creek. The staged development in this area would involve the following:

- The Mynheer Pit would be completed first. This would require minor adjustments to the natural creek channel to remove small meanders out of the pit limit. This would result in straightening the channel for short distances through a constructed creek channel. Natural flows and fish passage could be maintained. This stage would be limited to < 2 years of duration.

- Upon completion of the Mynheer Pit the pit would be reclaimed including a constructed channel through the pit floor for the final routing of Bryan Creek. The channel could be constructed to accommodate long term flows and fish passage. Accommodation for fish habitat could be included into the construction.
- Upon completion of the Mynheer Pit reclamation and channel construction Bryan Creek would be redirected to this new route. This would remove the channel from the Val d'Or pit area thus allowing it to be mined.
- Upon completion of the Val d'Or Pit the area would be reclaimed and end pit lakes allowed to establish. The end pit lakes would outflow into Bryan Creek.
- This revised phasing would result in Bryan Creek being maintained throughout the life of the Project as a fish passable stream with natural flows retained. Fish habitat loss would be eliminated by retaining the old channel until replacement habitat is established.
- As an alternative, Bryan Creek could be directed into the end pit lake to flow through the lake and exit into its natural downstream channel. Such an alternative would be subject to agreement with fish management authorities.

This scheme would result in the Bryan Creek being permanently routed 'through' the completed Mynheer Pit following the pit floor. A constructed channel would be provided in the bottom of the pit including suitable fish habitat provisions.

b. If a land bridge fill is proposed, expand Table 75-1 to include this diversion.

Response:

As described in ESRD SIR2 #18a), with the revised approach no land bridge would be required for this diversion.

19. Supplemental Information Request Responses, Question 75c, Pages 139 and 140

CVRI provided information to describe the amounts of settlement anticipated at land bridge fills where existing watercourses will be reinstated. Two reports respectively dated 1995 and 1965 were identified. The response includes the statement *The chart provided illustrates settlement rates for rockfilled dams but no chart was provided.* CVRI states that the rock dumps at CVM are comprised of a wide size distribution of material ranging from boulders to silt.

a. Identify the location of, or provide the chart referred to in the response.

Response:

The referenced report, Review of Long Term Geotechnical Stability of Mine Spoil Piles, Agra Earth & Environmental Limited, R.F. Dawson, R.L. Martin, D.S. Cavers, August, 1995, is provided in ESRD SIR2 Appendix 19. The chart noted by CVRI is contained within this report.

b. Do the previous studies address a wide size distribution of materials as is anticipated at CVM?

Response:

Yes, the report noted reviews a variety of waste pile materials and construction. The waste rock dumps developed within the Project will contain blasted sedimentary rocks, primarily sandstone and siltstone, which will be hauled by trucks and end dumped into high, large volume dumps. Selective handling of finer materials will be placed in discrete 'lifts' to form an impervious core where needed to construct a 'dam' between lakes.

c. Outline previous studies or prior CVRI experience that addresses settlement of potentially steep embankments under possibly fully saturated conditions. Saturation will occur when end pit lakes are filled on one or both sides of the land bridges.

Response:

End dumped rock fills will naturally develop with an angle of repose of approximately 37 degrees. Such embankments are stable over the long term with local slumping and erosion.

Rock dump slopes are reclaimed with bulldozers to a final slope of 27 degrees. Such slopes have long term stability and closely resemble natural slopes in the region.

CVRI has established multiple rock dumps that have experienced 'saturated conditions' both during and after construction. Both rock dumps and coarse reject dumps have been constructed by advancing the dump slope into the tailings ponds or end pit lakes. In these cases the material is continuously added to the dump face which is saturated. Likewise, multiple rock dumps have been developed by dumping into flooded pits. In these instances the rock dump face is toed into the water filled pit, often with considerable depths of the fill submerged. In other cases reclamation of dump slopes have occurred while the toe of the dump slope remains submerged.

Experience in these circumstances has indicated that advancing fill slopes will tend to become 'over-steepened'. The repose slope of submerged material tends to develop a steeper repose angle. As a result frequent minor sloughing or 'face failures' occur as material slides to the natural repose angle. Caution is necessary when equipment is operated near dump slopes which toe into deep water.

CVRI has not observed any increased settlement of waste rock while being dumped into water filled pits.

ESRD SIR2 Photo 17-1 (above) is provided illustrating rock dumps developed within the tailings pond. Note the variation of water levels on each side of the dykes even though no impermeable zones were constructed within the dykes.

20. Supplemental Information Request Responses, Question 77a and 77b, Pages 142 and Appendix 86

CVRI was asked about changes in flow regime, including but not limited to changes caused by pump capacity limits. CVRI has responded with references to Appendix 86, titled *Water Management and Aquatic Discussion Paper*. Appendix 86 describes project operations with water management operations that are substantially different from the water management system that is proposed and described in the original project description. Furthermore, Appendix 86 suggests a number of presumably-viable project "alternatives" which would significantly reduce impacts to several of the watercourses. For example, one of the alternative drainage plans described for the Erith River (from Appendix 86 Section 4.1) would *eliminate the Mynheer Pit in the Erith River valley section altogether to leave most of the existing channel undisturbed.*

a. Provide clarification of what water management system is proposed for the project and what elements of the project description are superseded by the discussion paper in Appendix 86.

Response:

The Project Application was designed to maximize coal recovery. The mine plan including the pit layout, sequencing, and dump formation is based on maximum coal recovery as per guidance of the ERCB. ESRD Appendix 86 (*Water Management and Aquatic Discussion Paper*) provided potential conceptual alternative plans but would require approval from the ERCB as coal recovery is not maximized. The original water management system proposed in the Application is still to be followed at this, conceptual stage of the review process as it allows for maximum coal recovery.

In the first round of Supplemental Information Request (SIR), a discussion option was presented (ESRD Appendix 86) which outlined the numerous potential options to address some of the initial SIR questions. The Project Team then had several individual discussions with Review Team Members in advance of SIR Round 2. Based on that discussion with review team members and regulators (DFO), CVRI has developed further potential revisions, ESRD SIR2 Appendix 20, building upon what was presented in ESRD SIR Appendix 86. Within ESRD SIR2 Appendix 20 two conceptual reclamation plans can be found locating the position of these potential revisions as well as a table comparing the fish habitat impact between the original application, ESRD SIR Appendix 86 and the potential revisions captured in ESRD SIR2 Appendix 20.

These further potential revisions incorporate the following key principles:

- Fisheries habitat effects have been reduced by;
    - avoidance of critical habitat locations;
    - increased stream habitat reconstruction;
    - modified reclamation plans to ensure the maintenance of natural flow to critical downstream water courses and to limit significant changes in reclaimed drainage basin areas; and
    - modified operations plan to maintain natural stream flows, without the operational risk of pumping, during periods of diversion;
- Options to reduce end pit lake sizes and depths as described in ESRD Appendix 86 are still available for implementation at the licencing stage; and
- Stream connectivity, as identified for habitat purposes, will now be accommodated by the use of land bridges to allow for reconstructed stream channels that will not be connected to end pit lakes.

b. Provide clarification of the timeline and process that CVRI anticipates for deciding which, if any, of the project footprint and water management "alternatives" identified in Appendix 86 will be adopted as defining elements of the project description

Response:

The conceptual changes are described in 20(a) above. Specific, operational plans and the resulting specific approvals will be further evaluated at the licensing stage of the approval process where CVRI will further evaluate alternatives based on a progression of a series of 5 to 10 year mine blocks. Additional analysis will take place, considering maximum coal recovery and environmental effects.

21. Supplemental Information Request Responses, Question 77c, Page 144

CVRI provided an update to Volume 3, CR #6, and Table 14, which quantifies residual impacts to 2-year, 5-year, and 100-year peak flows. The table indicates significant (around 50%) reductions in peak flows in Hay Creek and Bryan Creek. The initial analysis also indicated large flow reductions but did not specifically look effects on regime and flushing flows.

a. Describe predicted changes to regime flow in Hay and Bryan Creeks in relation to possible resulting impacts to fisheries and aquatic habitats in these streams.

Response:

The impact of a 50% reduction in the peak discharges were discussed in Volume 3, CR #6, Section 4.5.1 page 59 where "*gravel bed river relationships (Hey et al. 1982) based upon the 2-year flood peak would predict the following impacts with a 50% decrease in the mean annual flood: a 26% decrease in channel width, a 20% decrease in bankfull channel depth and a 25% increase in slope*. The potential for these changes to occur and the time frame are further elaborated on in response to ESRD SIR #182.

As stated in Volume 3, CR #2, Section 5.2.2 some changes in habitat composition may occur due to changes in peak flows. As indicated in the response to ESRD SIR #170, CVRI will assess and quantify impacts to fish habitat downstream of lakes and will implement mitigation and/or compensation measures if it determined that there is a detrimental impact. The potential benefits of flow attenuation due to lake development will also be considered. These potential advantages include reduced impacts to Athabasca Rainbow Trout during early life stages and retention of sediments in the lake, which could lead to improved conditions for salmonids downstream of the lakes (further described in the response to ESRD SIR #182).

In should also be noted that CVRI has proposed an alternate drainage plan for Hay Creek and Bryan Creek (described in ESRD Appendix 86 of the initial SIR responses) which would involve reclaiming a permanent channel around the end pit lakes to maintain a more natural flow regime. A discussion of potential changes to the flows in lower Hay Creek is also discussed in ESRD Appendix 86.

Bryan Creek

CVRI has adopted the alternative mining sequence in the Bryan Creek development (ESRD Appendix 86). This sequence would result in Bryan Creek being temporarily diverted and then routed through a permanent reconstructed creek bed as part of the reclamation profile of the Mynheer Pit.

As a result, flows in the creek would be maintained at natural levels throughout the mining period and post mining. CVRI also anticipates that fish passage would be possible throughout the diversion period and afterward in the reclaimed channel. Minor, short term habitat loss might occur during the diversion period however, only short lengths of non-natural channel would be required in the diversion.

Hay Creek

Mining activity will result in surface flows from the upper watershed of Hay Creek being intercepted by the mine development. However, this volume will be handled in the mine area and returned downstream to the Hay Creek flow. There would be no ‘loss’ of water volume however, flood events would be attenuated by the handling and storage process in the mine area.

22. Supplemental Information Request Responses, Question 79a, Page 151 and Figure 79-1

CVRI acknowledges the potential for seepage through fill berms and *will commit to the placement of an engineered barrier of glacial till to reduce flow*. Figure 79-1 identifies locations where barriers may be needed and provides a schematic of a dam core to illustrate how this could be done. The core is specified to be a minimum of 5 m wide, with depths up to 30 m based on incomplete data (missing digits) in the table which is part of Figure 79-1. The text suggests that in lieu of a dam core, the low permeability barrier *may be installed near the upstream sloping face of the backfill.* A surface barrier will not be as durable or as long-lived as a dam core installation.

a. Provide a revised version of Figure 79-1 which does not have missing characters in the table.

Response:

A revised version of ESRD Figure 79-1 has been completed (listed as ESRD SIR2 Figure 22-1). The revised figure contains the missing data in the table which is part of the figure.

b. Is a sufficient volume of suitable low-permeability till expected to be available on site to construct all proposed dam cores? If not, where will this material be sourced?

Response:

Yes, a sufficient volume of suitable low-permeability till is expected to be available on site for construction of all proposed dam cores.

The ‘disturbance footprint’ of the Project is estimated to be 5,728.6 ha and while exploration drilling has indicated varying till thickness, a minimum average of 2 m thickness is predicted. Therefore available glacial till, from areas to be disturbed could provide approximately 100 million cu.m. of suitable low-permeability till. If only the proposed pit area were used, where the excavation of material will occur, a total of 1778.7 ha of area would yield 35 million cu.m. of till. This is more than adequate to supply the required material volume which is roughly calculated to be 900,000 cu.m.

23. Supplemental Information Request Responses, Question 86b & c, Pages 157-158.

CVRI states *CVRI has also initiated more detailed water management planning (with a key goal of avoiding critical habitats)….* They also state *The primary mitigative action employed by CVRI will be to develop mine plans that minimize direct disturbance to critical habitats* (in response to SIR 86.c.).

Athabasca rainbow trout spawning habitat maps provided in CR#2 (Figure 6, 8, 10, and 12) show no avoidance of critical rainbow trout spawning habitat.

a. Provide examples where CVRI has planned to avoid critical rainbow trout spawning habitats in the current mine plan.

Response:

A discussion of updated water management strategies and alternatives that have been developed in an effort to reduce potential risk to aquatic resources are discussed in 20 (a) and were presented in ESRD SIR Appendix 86 of the supplemental information request responses initially provided by CVRI. Included in the Appendix was a discussion of alternate mine strategies that would minimize direct impacts to critical Rainbow Trout habitat. Please refer to ESRD SIR Appendix 86 for more detailed information regarding detailed water management strategies and mine planning. In addition, recent adjustments to the mine plan as described in the response to ESRD SIR2 #20 will further reduce direct impacts to high-value Rainbow Trout habitat.

A summary of the changes to mine plan and associated impacts to fish habitat is provided below. Please refer to ESRD SIR Appendix #86 (provided as part of the initial responses to SIR questions) and the response to ESRD SIR2 #20 for more detailed information regarding detailed water management strategies and mine planning. Table 1 provided in ESRD SIR2 Appendix #20 provides a summary of direct habitat impacts associated with each iteration of the mine plan.

Erith River

- CVRI has selected an alternate mine plan that would result in the Erith River being reclaimed as a river channel instead of an end pit lake. Part of the reclamation strategy will be to construct the channel to maximize habitat productivity, including the construction of spawning habitat for Rainbow Trout.

ERT1

- CVRI has selected an alternate mine plan that would involve the elimination of approximately 500 m of the Mynheer Pit. This strategy would minimize impacts to ERT1 leaving most of the natural channel intact and much of the existing spawning habitat undisturbed.

Bacon Creek

- CVRI has selected an alternate mine plan that would involve reconstructing the stream channel and maintaining downstream flows in Bacon Creek rather than reclaiming to an end pit lake that would have drained into the Erith River and resulted in loss of flows in lower Bacon Creek (~2-3km of stream channel would have dewatered).

Bryan Creek

- CVRI has selected an alternate mine plan that would result in Byran Creek being reclaimed as a stream channel instead of an end pit lake. Part of the reclamation strategy will be to construct the channel to maximize habitat productivity, including the construction of spawning habitat for Rainbow Trout.

Halpenny Creek

- CVRI has selected an alternate mine plan that would involve the elimination of portions of the Munheer Pit. This strategy would reduce disturbances to the Halpenny Creek mainstem as well as HLT1 and HLT2. Under this scenario a substantial amount of the Rainbow Trout spawning habitat in Halpenny Creek would be undisturbed.

PET1

- CVRI has selected an alternate mine plan that would result in PET1 being reclaimed as a stream channel instead of an end pit lake. Part of the reclamation strategy will be to construct the channel to maximize habitat productivity, including the construction of spawning habitat for target species.

24. Supplemental Information Request Responses, Question 86f, Page 160.

CVRI states CVRI will consider installing barriers to limit fish access to lakes… in response to concerns that end-pit lakes will have a high probability of being colonized by northern pike and essentially result in a significant shift in fish community.

a. Describe a barrier system that will enable rainbow trout, Arctic grayling, and bull trout bi-directional fish passage throughout the lake complex while preventing the colonization of northern pike.

Response:

As described in the response to ESRD SIR2 #20 updated mine planning there will no longer be an end pit lake situated on the Erith River mainstem. Instead the channel will be constructed and reclaimed to provide lotic habitat of equal or greater quality to the existing habitat.

A barrier capable of allowing Arctic Grayling, Rainbow Trout, and Bull Trout to move upstream while excluding Northern Pike may not be feasible. Arctic Grayling, like Northern Pike, are often considered to be weaker swimmers (Behlke et al 1991) and as such any barrier intended to prevent movement of Northern Pike might also exclude them. However, there is potential to design and install a partial barrier (similar to a natural waterfall) that would allow adult size Rainbow Trout and Bull Trout to pass the barrier but would preclude the upstream movement of other species. Natural waterfalls, which seem to exclude all fish species with the exception of Rainbow Trout and Bull Trout, are known to occur on Mackenzie Creek and the Gregg River, which are located west of the CVRI area.

A completely impassable barrier could also be considered for end pit lake systems. With this scenario Artic Grayling or Bull Trout (currently these species have a limited presence in the

LSA) could be stocked upstream of the barrier so that a population could become established in the lake and streams upstream of the barrier. The area upstream of the barrier could also be left for the existing Athabasca Rainbow Trout population (no stocking required). A similar approach has already been implemented on the upper Embarras River and Chance Creek where barriers have been constructed with the intent of establishing natural self-reproducing populations of Athabasca Rainbow Trout. Under this proposed scenario all undesirable species would be precluded from accessing the end pit lake system. This would include exclusion of Brook Trout, which have increased their range in the coal branch area since being stocked in the early 1900's. There is some evidence to suggest that Brook Trout may be able to displace native Rainbow Trout in Athabasca streams (SRD 2009) and a headwaters Bull Trout population that is isolated from invasive Brook Trout could be valuable from a genetics standpoint.

As previously mentioned, baseline investigations found limited evidence of Artic Grayling or Bull Trout use of habitat within the LSA and it is suspected that there is limited movement of these species from downstream reaches of the Erith River where they are more common. However, CVRI will be installing a fish trap or trap(s) on the Erith River in 2013 to document fish movements in the vicinity of the project.

References:

Behlke, C.E., D.L. Kane., R.L McLean., and M.D. Travis. 1991. Fundamentals of culvert design for passage of weak swimming fish. US Department of Transportation, Federal Highway Administration. Report # FHW-AK-RD-90-10

Alberta Sustainable Resource Development and Alberta Conservation Association. 2009. Status of the Athabasca Rainbow Trout (Oncorhynchus mykiss) in Alberta. Alberta Sustainable Resource Development. Wildlife Status Report No. 66. Edmonton, AB. 32 pp.

25. Supplemental Information Request Responses, Question 185c, Page 336.

It has been suggested that impacts on water temperature regime are restricted to the area of stream directly below the pit lakes and that temperatures downstream of the pit lakes will be similar to that upstream of the lakes. Given that the end-pit lakes have a greater surface area and reduced flow, it is likely that summer water temperature regimes will be directly affected. Without some downstream cooling influence (e.g., groundwater inputs), reaches with increased summer water temperatures will not be able to reduce added heat during summer, but will continue warming according to natural stream processes. This heat loading has the potential to maintain downstream temperatures above the range that cold-water fish species such as Athabasca rainbow trout, bull trout, and Arctic grayling require.

a. Discuss the effect stream temperature heat loading will have on Rainbow trout, Bull trout, and Arctic grayling within the LSA and RSA.

Response:

As stated in the response to ESRD SIR 185c), initial water temperature monitoring at existing end pit lakes has indicated that water temperatures downstream of the lakes are similar to temperatures upstream of the lakes within a few hundred metres of the lake outlet. As such, it would appear that the potential impacts to fish species, as theorized above, are not necessarily going to occur. However, in an effort to increase their understanding of the potential temperature effects of end pit lakes CVRI will be implementing a comprehensive temperature monitoring program in 2013. This program will include:

- Installation of temperature loggers upstream and downstream of existing end pit lakes that have surface connection to lotic waters.
- Assessment of physical design factors (*i.e.*, presence of overhead cover, depth of lake and outlet etc.), that may impact water temperatures at lake outlets.
- Installation of temperature loggers on streams within the vicinity of the project to obtain additional information regarding the natural temperature regime.

In addition, as described in the response to ESRD SIR2 #20 the number of flow-through end pit lakes on the reclamation landscape has been reduced (including removal of the proposed lake on the Erith River) which should further reduce the perceived risk of heat loading of downstream waters.

b. Describe the water temperature monitoring program that CVRI will conduct to measure such an effect.

Response:

A description of the monitoring program that will be implemented to help in the design of end pit lakes is described above. Once the lakes have been constructed a temperature monitoring program will be implemented as part of the end pit lake study that will be conducted. This will include document temperatures downstream of lakes compared to temperatures upstream of lakes. Results of the monitoring program will be used to assess impacts to fisheries (if any) and to develop mitigation measures (if required).

c. Discuss measures that can be implemented to mitigate a stream temperature heat loading effect.

Response:

Past research and recent end pit lake monitoring indicates there are measures that can be implemented at the design stage to help mitigate potential solar heating of surface waters in lakes. These include: design and construction of outlets so that they are located close to deep water areas, contour of slopes and streambanks so that they provide shade, use of light coloured material for substrate and on the surface of the banks, and vegetation of riparian areas using established trees that can provide shading. The monitoring initiative described in the response to (a) may identify additional factors that could be implemented to mitigate impacts of potential solar heating of surface waters.

3.4 Terrestrial

26. Supplemental Information Request Responses, Question 106a & b, Page 188; Response 118a, Page 207; and Response 144a, Page 241

CVRI indicates in response 106a that *If there are insufficient volumes of soils available for salvage for the soil replacement demand of the reclamation program all the soils will have to be salvaged.* In Response 118a, when discussing the potential salvage of surface soil from Gleysolic and Fluvial landscapes, CVRI states that *If the potential shortfall turns out to be real, this would make up the difference.* In Response 144a, CVRI states that *most, if not all, of the B horizon material will be required* to meet the Approval Condition of 0.30 m of coversoil and that there is no excess salvaged surface soil. In Response 106b, CVRI states that *Soils from soil landscape units F1, F2, F3, and F4 will be salvaged*, but in Table 12, these units have been shaded, indicating that the available peat, A horizon, and B horizon volumes were excluded from the salvage volumes.

These various statements appear at odds with each other, and it is unclear exactly what volume of soil is available for salvage, how much will be salvaged, what horizons will be salvaged from each soil landscape unit, and if there is sufficient soil available to meet the overall coversoil requirements.

a. How will CVRI track the volumes of soil salvaged, and at what point will CVRI know whether sufficient material has been (or will be) salvaged to meet coversoil requirements?

Response:

Salvage Requirements

CVRI calculates soil volumes available and required for the disturbance area as part of each EPEA application. This process identifies the preferred soil salvage horizons, locations and salvage depths to be targeted for salvage. As mining operations proceed soil salvage is performed.

Soil salvage activity is tracked on an operating shift basis through equipment hours and labor timecards. This allows calculations of volume moved and tracking of equipment and labor productivity and costs allocations for accounting purposes.

Environmental staff inspect salvage operations to monitor salvage depths and areas. As salvage progresses, volumes are tracked against expected and adjustments are made as necessary.

Inventory of individual soil stockpiles are 'credited' as material is added. Monthly reconciliation of volumes of soil salvaged is undertaken by visual or physical surveys of soil stockpiles.

Soil Placement

Similarly, volumes of soil either directly placed or taken from stockpiles are tracked with equipment and labour timecards. Soil stockpiles inventories are 'debited' as material is removed.

Soil placement is monitored and inspected by environmental staff. Measurements of soil placement depths and areas are undertaken and documented.

Annual Reporting

Annual reports to ESRD detail quantities salvaged, placed and in stockpile inventory. A material balance comparing actual salvaged volumes versus calculated volumes available is provided within the report for inspection. Any deficiency is highlighted to ESRD with a remedial action plan.

Soil Salvage Requirements

With these procedures CVRI is able to track the actual soil volume salvaged and balance this with what volume is required for each mining area. The volumes kept in stockpile are held in inventory. An annual review of areas and volumes is provided to government for inspection.

b. Will CVRI know in time to make adjustments and salvage sufficient volumes to cover any projected shortfalls?

Response:

Yes. Soil salvage volumes are monitored on a routine basis with monthly management reviews of production progress. Salvage forecasts are compared to actual salvage volumes for each individual pit and dump operational area. Adjustments for potential shortfalls can be made as salvage progresses in each mine area.

Alternatively, additional or excess material from adjacent salvage areas can be utilized to 'make-up' any shortfalls.

Please note that CVRI salvages 10% in excess of calculated salvage amounts to accommodate possible soil losses or minor shortfalls.

c. If the tracking indicates that insufficient volumes of soil have been salvaged (especially in the Robb West Pits and Haul Road area) and insufficient material remains available to be salvaged, how will CVRI make up the difference?

Response:

CVRI has indicated there could be a potential shortfall of soil availability in the Robb West area. A potential remediation plan has already been presented which would utilize additional volumes of organic materials and/or salvaging to a deeper depth to recover more or all of the B horizon material.

As stated in the various SIR responses (ESRD SIR #106, 118, and 144) from the first round of review, shortfalls can be dealt with a number of different ways utilizing less desirable soils based on handling characteristics. The definition of 'upland surface soil' in the current Approval Conditions is essentially a stratum salvaged from an upland soil (mineral parent material with imperfect drainage or drier) that includes the LFH, A horizon, and in some cases part, or all, of the B horizon.

If insufficient volumes of soil exist for the reclamation process some alternate salvage options exist, including:

- wet soils that are more difficult to handle can be salvaged to help make up the difference;
- salvage peats as well as A and B horizon soils from Gleysolic soils and fluvial landscapes. Once again these type of soils are much more difficult to handle but can be salvaged if shortfalls exist; and
- salvage most, if not all, of the B horizon material. The current Approval conditions state CVRI must salvage all of the upland A horizon material, the Gleysolic peat material, and sufficient B horizon material for use in upland minesoil construction. If a shortfall exists, larger volumes or all of the B horizon could be salvaged to provide the required soil volumes.

d. Provide a detailed description of the decision-making process that the soil salvage monitor will follow when deciding if part or all of the B horizon material will be salvaged in an area.

Response:

The decision to salvage part or all of the B horizon material from a particular area will be determined by a number of factors. These will include volume requirements, including identified volume deficiencies, drainage conditions and the thickness of B horizon. Salvage of surface soil material (LFH, A and B horizons) will first be conducted on upland areas having imperfectly drained or drier conditions. The general thickness of B horizon can vary between soil landscape units and where it is relatively thin; all the B material will likely be salvaged, while salvage from areas with a relatively thick B horizon will proceed until the volume of needed coversoil is achieved. If coversoil volumes required for reclamation are not met from upland areas, the condition will be mitigated by proceeding with salvage of poorly drained soils beginning with the A horizons and progressing into the B horizons as necessary.

e. Confirm if the available peat, A horizon, and B horizon materials from soil landscape units F1, F2, F3, and F4 are required to meet the minimum coversoil of 0.30 m as specified in the Approval Condition.

Response:

Soil landscape units F1, F2, F3 and F4 contain poorly drained Gleysolic soils (CR #10, Section 3.5.2, Page 21, Table 5) and do not meet the upland soil parameters of being imperfectly drained or drier set forth in the Approval Conditions of meeting the 0.30 m coversoil required for reclamation. In Table 12 of CR #10 (Pages 60 and 61), the volumes of peat, A horizon and B horizon material from these soil landscape units are shown but shaded to indicate that they are not included in the summation of upland surface soil volumes.

For Robb Main-Center-East, the mean volume of Gleysolic peat, plus A horizon and B horizon material from upland soils is sufficient to meet the coversoil of 0.30 m according to the Approval Condition. This is also true when, to be conservative, an allowance is made for the potential that volume may be 20% less than the average. No Gleysolic peat, A horizon or B horizon material from F1, F2, F3 and F4 soil landscapes are required to meet the coversoil needs of the reclamation plan for Robb Main-Center-East as a whole.

For Robb West, the mean volume of Gleysolic peat, plus A horizon and B horizon material from upland soils is sufficient to meet the coversoil of 0.30 m according to the Approval

f. Provide updates to the reclamation material balances in Table 12, Table 13, and Table 15 to clarify what materials will be salvaged from which soil landscape units and the coversoil material balance for the Robb Trend Project.

Response:

An alternate Table 12 (listed below as ESRD SIR2 Table 26-1) as well as updates to Table 13 (listed as ESRD SIR2 Table 26-2) and Table 14 (listed as ESRD SIR2 Table 26-3) are provided to help clarify material salvage requirements.

ESRD SIR2 Table 26-1 Volume of Upland Surface Soil & Peat Available for Salvage in the Local Study Area

Soil Landscape Model	Peat from Organic Soils (BCM)*	Peat from Gleysolic Soils (BCM)*	A Horizon from Upland Soil (BCM)*	B Horizon from Upland Soil (BCM)*
ROBB MAIN-CENTER-EAST PITS & HAUL ROADS				
G1	-	-	63,291	169,926
G5	-	-	19,553	11,732
L1	-	-	1,630,444	3,613,504
L2	-	-	35,671	104,778
L5	-	-	414,138	911,360
L6	-	107,092	-	-
M1	-	-	2,475,671	4,378,990
M2	-	-	482,350	774,793
M3	-	-	84,767	191,404
M4	-	-	115,164	130,776
M5	-	-	125,868	192,764
M6	-	34,195	-	-
O1	2,586,545	-	-	-
O2	1,533,282	-	-	-
O4	910,415	-	-	-
S1	-	-	0	4,389
S3	-	-	24,749	83,532
S4	-	-	25,639	45,850
S5	-	-	18,506	35,359
Total	5,030,242	141,287	5,515,811	10,649,158

ESRD SIR2 Table 26-1 Volume of Upland Surface Soil & Peat Available for Salvage in the Local Study Area

Soil Landscape Model	Peat from Organic Soils (BCM)*	Peat from Gleysolic Soils (BCM)*	A Horizon from Upland Soil (BCM)*	B Horizon from Upland Soil (BCM)*
ROBB WEST PITS & HAUL ROAD				
F1	-	-	29,765	57,242
F2	-	82	883	883
G1	-	-	4,719	9,055
G6	-	16,996	2,833	16,996
L1	-	-	95,984	239,592
L3	-	-	10,391	18,011
L4	-	-	17,496	39,030
L5	-	-	28,293	67,213
L6	-	127,903	39,515	120,515
M1	-	-	435,292	789,533
M2	-	-	225,753	393,737
M3	-	-	40,426	92,414
M4	-	-	79,615	183,954
M5	-	-	102,081	173,496
M6	-	29,358	26,010	58,349
O1	857,102	-	-	-
O2	148,887	-	-	-
O4	768,119	-	-	-
S3	-	-	5,204	26,020
S5	-	-	10,418	16,669
RB2	-	-	0	34,656
Total	1,774,108	174,257	1,055,672	2,048,724

* BCM = Banked Cubic Meters.
NOTES:
- Landscapes with slopes > 45% are excluded from the salvage volume to allow for the safe operation of equipment.
- Values in shaded cells are excluded from the salvage volume totals according to the Operating Approval, generally because of wet conditions, but these materials may be accessed to mitigate a potential shortfall of coversoil volumes following salvage of all upland surface soil.
- Landscapes with slopes > 45% are excluded from the salvage volume to allow for the safe operation of equipment.

ESRD SIR2 Table 26-2 Summary of Soil Salvage Volume Estimates for the Local Study Areas			
Disturbance Area	**Soil Horizons**	**Mean Volume (BCM)**	**Minimum Volume (BCM)**
Robb Main-Center-East Pits & Haul Roads	Organic Peat	5,030,200 +/- 20%	4,024,100
	Gleysolic Peat	141,200 +/- 20%	113,000
	A Horizon	5,515,800 +/- 20%	4,412,600
	B Horizon	10,649,000 +/- 20%	8,519,200
Robb West Pits & Haul Road	Organic Peat	1,774,100 +/- 20%	1,419,200
	Gleysolic Peat	174,200 +/- 20%	139,300
	A Horizon	1,055,600 +/- 20%	884,500
	B Horizon	2,048,700 +/- 20%	1,638,900

BCM = Banked Cubic Metres (rounded off numbers reported).

ESRD SIR2 Table 26-3 Coversoil Materials Balance								
	Volume (BCM)							
Disturbance Area	**Organic Peat**		**Gleysolic Peat**	**Upland A Horizons**	**Upland B Horizons**	**Coversoil**	**A+B+Peat**	**+ / -**
	Minimum	**Required**	**Mean Minimum**	**Mean Minimum**	**Mean Minimum**	**Required**	**Mean Minimum**	**Mean Minimum**
Robb Main-Center-East Pits & Haul Roads (4,579.4 ha)	4,024,100	687,100	141,200 113,000	5,515,800 4,412,600	10,649,000 8,519,200	12,083,700	16,306,000 13,044,800	+ 4,222,500 + 961,300
Robb West Pits & Haul Road (1,149.1 ha)	1,419,200	44,850	174,200 139,300	1,055,600 844,500	2,048,700 1,638,900	2,955,300	3,278,500 2,622,700	+ 323,200 - 332,600
Total	5,443,300	731,950	315,400 252,300	6,571,400 5,257,100	12,697,700 10,158,100	15,039,000	19,584,500 15,667,500	+ 4,545,500 + 628,500

BCM = Banked Cubic Metres (rounded off numbers reported).

27. Supplemental Information Request Responses, Question 130, Pages 219-220

CVRI states *the west bank of the Pembina River is controlled by a 15-30 m bedrock embankment. The mine development will not extend past the embankment and therefore will not impact the river or the floodplain.* CVRI also states *For the purposes of this EIA, a vegetation buffer of 30m will be maintained along streams and rivers which are not being diverted. Disturbance, including space for clearing, mining, dumps, soil stockpile, or reclamation sloping of dumps will not enter into the Pembina River or its floodplain.* The majority of recent mine approvals in the province have included significantly larger vegetated buffers from the escarpment of watercourses.

a. Explain why a minimum setback of 30 m from the bank was selected. Discuss the factors included in the decision of 30 m. Provide references if available and include references to other mining projects with a similar watercourse setback.

Response:

Selection of 30 m

The proposed Project mine plan is developed from a illustrate maximum coal recovery within reasonable mining and operational limits. A 30 m setback value was utilized as a reasonable assumption based on CVRI past practices in similar situations near watercourses. The setback was applied from the edge of the 'break' of the river floodplain embankment which increased the buffer from the actual current river flow position (ESRD SIR 2 Figure 27-1).

CVRI notes that current and recent mine approvals with setbacks equivalent to what is proposed are found in recent approvals for CVRI development at CVM.

Comments Regarding Setbacks

Various government documents have been reviewed with respect to provision of 'setbacks':

Directive Number ID 2002-01, Lands Division, Land Management Branch, Petroleum Land Use & Reclamation Section indicates in describing 'setbacks' for wellsites the guidelines suggest a minimum setback of 45 m from the edge of the breaks. The document also indicates that this distance may be modified by request with provision of supporting geotechnical reports.

Guidelines for Acquiring Surface Material Dispositions on Public Land, 2008 Edition, Industrial and Commercial Land Use Section, Land Management Branch, Section 7.2.3 indicates that 'buffer areas near surface water features may be as narrow as 30 meters and as wide as 200 meters. The width of the undisturbed buffer zone generally depends on the importance of the water body and the characteristics of the floodplain'.

Government of Alberta, Integrated Standards and Guidelines, Enhanced Approval Process (EAP), July 16, 2012, Section 2A-4 Watercourse/Waterbody, indicates that Approval Standards 100.4.4 (c) provides for 'watercourse setbacks for all activities from the edge of site disposition' for 'large permanent watercourses' a setback of 'at least 100 meters from the top of the break'.

Future Approval

Development plans for the Project will be subject to future regulatory approval which would apply various approval conditions, including setbacks based on the physical and regulatory conditions for those specific circumstances.

b. Discuss the proposed footprint disturbance boundary with respect to escarpments (including the Pembina River) &/or upland riparian zones associated with all watercourses in the area. Does the disturbance boundary or lease boundary extend directly to the upland escarpments or riparian zones of all watercourses? Confirm the area of buffer that will be maintained from the project disturbance area to the proposed lease boundary and from this boundary to the escarpment/upland riparian zone of all watercourses (consider developing a figure that clearly shows the proposed disturbance boundary, proposed lease boundary and the vegetated buffer from all watercourse escarpments &/or upland riparian zones). What criteria will be used to determine the size of the buffers to be used between the disturbance, lease boundary and watercourse escarpments &/or upland riparian zones?

Response:

The proposed buffer between the disturbance and the Pembina River has been described in ESRD SIR2 #27a).

Portion of the remaining watercourses that lie within the proposed mining footprint are proposed for diversion at various stages during the life of the mine. Until scheduled for mining, vegetation buffers will be maintained around all watercourses.

c. Discuss the minimum setback required to maintain the geotechnical stability of the Pembina River escarpment. Include discussion on any other watercourse escarpments or upland riparian zones.

Response:

Geotechnical Considerations

The conceptual mine plan has been based on an overall highwall of 45 degrees. This is intended to present a typical stable highwall angle. Post mining, the highwalls would be sloped to the reclaim angle of 26 degrees. At the end wall position both the hanging and footwall would be sloped and would result in backfilling much of the end wall. Therefore the end rim position would not be expected to move significantly during the reclamation process.

The 'end wall' would be established perpendicular to the seam strike direction hence following the seam dip direction. Walls in this configuration are often more stable than the hanging wall side. CVRI anticipates that the proposed end wall would exhibit above average stability. The reclaimed end wall could be expected to have long term stability.

Future Exploration and Engineering Design

It is noted that exploration in the Pembina River area is preliminary only. Sufficient drilling has been completed to identify the geology structure and seam characteristics. From this data a preliminary concept mine plan has been derived. Future work in the area will involve the following:

- Additional exploration drilling to the east and on the east side of the Pembina River to further define the geologic structure in the area. This is expected to further identify any faulting and possible further seam over thickening.
- Infill drilling within the proposed pit limits to either a 400 or 200 m sectional spacing depending on complexity of the over thickened sequence.
- Installation and monitoring of additional piezometers near the river escapement. Such installations would be utilized to investigate groundwater conditions.
- Completion of core holes and geotechnical rock testing in the 'end wall' area to determine rock characteristics and potential faulting zones. Such data would be utilized for analysis of pit wall stability.

- Dump foundation investigations to provide data for analysis of dump foundation stability and definition of dump limits.

At this point, based on the information available, CVRI believes that the proposed pit limit and a 30 m setback from the escarpment of the Pembina River is an appropriate limit for mining.

No additional watercourse escarpments or upland riparian zones have been identified in the EIA as requiring disturbance zone buffers.

d. What is meant by for purposes of this EIA? Is CVRI intending to maintain proposed buffers throughout the lifetime of the project?

Response:

See response to ESRD SIR2 #27a). An assumption of 30m was included in the EIA assessment information based on past practice in similar situations. The actual setback(s) that will be used will be subject to future regulatory approval.

Please note that the setback distance in this situation would have competing consequences. A greater setback would reduce the extent of coal mining hence recovery of the available resources but would be seen as a greater mitigation capacity to environmental impact.

e. Provide evidence (including scientific references) that support that a 30 m vegetated buffer is adequate to support wildlife movement. Include discussion on the potential impacts to wildlife movement resulting from the 15-30 m Pembina River escarpment and associated upland and lowland habitat.

Response:

Key Wildlife and Biodiversity Zones identified by the Fish & Wildlife Division (2010) are considered to be a combination of key winter ungulate habitat and higher habitat potential for biodiversity. Typically Key Wildlife and Biodiversity Zones occur along major river valleys. These landforms contain the topographic variation and site productivity conditions that provide increased levels of biodiversity and good winter browse conditions in proximity to forest and topographic cover.

The Pembina River valley in the vicinity of the eastern boundary of the Project is not identified as a key wildlife and biodiversity zone and therefore is not considered a locally and regionally-significant wildlife movement corridor. Key Wildlife and Biodiversity Zones in the Project RSA are identified on Figure 1.3 (CR #14). The map layer can be downloaded from the web page “Wildlife Sensitivity Maps – Data Sets” at:
http://srd.alberta.ca/MapsPhotosPublications/Maps/WildlifeSensitivityMaps/Default.aspx

On the eastern side of the Project, the Pembina River meanders through a floodplain characterized by a variety of vegetation and topographic types including areas of White Spruce intermixed with young aspen, alder thickets and sedge ground cover. The valley bottom features the occasional small pond formed from cut off oxbows which provide nesting habitat for bird species like Barrow’s Goldeneye and Bufflehead and habitat for aerial foragers like Tree Swallows. The variable habitat associated with the floodplain provides wildlife biodiversity value and has largely been undisturbed as compared to the forest cover on the top of the escarpment which has been subjected to multiple land uses (*i.e.,* gravel pits, forest harvesting).

The escarpment between the Project and the Pembina River is steeply sloping but vegetated with pine and spruce and provides a connection between the floodplain and upland pine and spruce vegetation. Few ungulates were observed in the Pembina River valley during winter aerial surveys conducted for the Project (CR #14, Figures 5.1, 5.2, 5.3, and 5.4). Ungulates encounter little impediment to movement through and along the Pembina River floodplain during the winter months. On top of the escarpment on the west side of the river, the mine dumps will be offset from the edge of the valley break and will be reclaimed to vegetation that will provide foraging and hiding cover for ungulates and other mammals as well as foraging and nesting cover for a variety of bird species. Note that development will not occur in the floodplain or on the east side of the Pembina River where large complexes of bog and fen wetlands characterize the vegetation.

The Banff wildlife crossings project indicate that different species use different crossing structures of varying length and width based on their evolved behavioral traits and life history requirements (Clevenger et al. 2002). These studies also found that human influence consistently ranks high as an important factor affecting how wildlife use the crossing structures. Unlike Hwy 1 which presents a physical barrier to wildlife movement, there will be no physical impediment to wildlife moving along the top of the escarpment or from the top of the escarpment onto the mine dumps or the top of the escarpment to the floodplain. Wildlife trails currently used to travel between upland and floodplain habitats will not be disturbed by mining. Habitat linkages between the floodplain and upland will not be broken by mining activity.

References:

Clevenger, A.P., Chruszcz, B., Gunson, K., & Wierzchowski, J. 2002. Roads and wildlife in the Canadian Rocky Mountain Parks - Movements, mortality and mitigation. Final Report (October 2002). Report prepared for Parks Canada, Banff, Alberta.

Fish & Wildlife Division. 2010. Recommended land Use Guidelines: Key Wildlife and Biodiversity Zones 2pp. http://srd.alberta.ca/FishWildlife/WildlifeLandUseGuidelines/documents/WildlifeLandUse-KeyWildlifeBiodiversityZones-Dec03-2010.pdf

f. Discuss the baseline and operational monitoring planned to detect changes in wildlife movement through vegetated buffers (including upland and lowland habitat between along the lease boundary). Explain mitigations to be implemented if reductions in wildlife movement are identified.

Response:

Wildlife use of vegetated buffers will be incorporated into wildlife inventory and monitoring as has been done on the existing CVM for various mine expansion activities including the Project. Wildlife inventory and mapping of vegetated buffers were part of all aspects of the wildlife assessment for the Project including habitat mapping, ungulate aerial survey, pellet group counts, breeding bird survey, amphibian monitoring, winter track counts, bat surveys, and ground surveys. Mitigation has been discussed in Sections 12.0 and 13.0 (CR #14) and Sections 5.0 and

6.0 (CR #7). A review of the detailed mine plans for the eastern boundary of the Project relative to wildlife use can be made at the time of licensing.

g. Provide evidence (including scientific references) that support that a 30 m vegetated buffer is adequate to maintain watercourse health. Include a discussion on the feasibility of increasing the size of the buffer.

Response:

The Department of Fisheries and Oceans Canada released a report in 1993 titled "*Land Development Guidelines for the Protection of Aquatic Habitat*" and in this report it refers to the distance of 30m numerous times as the accepted distance for a protective barrier between development projects and watercourses. The report was based on commercial and high density development areas where the potential for impacts to watercourses in increased due to erosion. A 30m vegetated buffer from the high water mark provides adequate space for eroded sediment to be trapped prior to reaching a watercourse. When vegetation is removed surface runoff will have a higher flow velocity leading to higher levels of erosion of soil material. A 30m vegetated buffer eliminates this problem in and protects watercourses from receiving harmful sediment loads. A 30m vegetation buffer also provides enough shade to the watercourse to maintain water temperature. Without enough shade water temperatures can rise creating an environment that is susceptible to pathogens and not optimal for certain fish species.

The feasibility of increasing the size of the buffer has been discussed above. Most importantly, the final decisions on buffer sizes will be the matter of specific mining licence applications expected after 2020.

Reference:

Chilibeck, B., Chslett, G., Norris, G. 1993. Land Development Guidelines for the Protection of Aquatic Habitat. Report prepared for the Department of Fisheries and Oceans Canada. http://www.dfo-mpo.gc.ca/Library/165353.pdf.

h. Discuss the monitoring planned to detect changes in watercourse health. Discuss if/how placement of monitoring sites will be related to buffer width.

Response:

As indicated in Section F and Section E.11.4.2, Page E-173 of the Application, CVRI will monitor surface water quality in natural watercourses, both upstream and downstream of Project activities as required in the EPEA approval. In addition, as stated in CR #11, Section 4.5.2, Page 60, CVRI will conduct environmental monitoring as required in all Project approvals. This is expected to include: monitoring of Project impoundments and monitoring for surface water quality in natural watercourses, both upstream and downstream of Project activities.

CVRI expects any decision on specific monitoring requirements will be determined by ESRD as part of approval requirements for the Project.

28. Supplemental Information Request Responses, Question 131a, Page 221

CVRI was asked to discuss the methods or techniques that will be employed to ensure that any soil or groundwater resources left in place after the initial spill response and removal of spilled product have not been adversely affected by the spill. Information was provided on how the soil resources will be managed, but not the groundwater.

a. Discuss the methods or techniques CVRI will employ to ensure that groundwater resources have not been adversely affected by a spill.

Response:

The methods and techniques employed by CVRI are:

- Immediate spill response;
- Immediate containment between spilled material and surface water courses; and
- Removal of all contaminated materials to offsite locations.

The incidence of spills occurring at the CVM is low and a comprehensive spill response plan is in place to prevent any adverse effects on the environment including groundwater sources. As mentioned in Section C.6.6.5 to C.6.6.9 of the application, CVRI maintains a Standard Practice and Procedure for Spill Response which includes training all staff members in spill response and clean up measures. Employees are accountable for ensuring that a high level of spill prevention is maintained by following good housekeeping and maintenance practices.

In the event of a spill, the effectiveness of response operations are influenced by the time in which the spill is detected, controlled and contained. The initial spill response is designed to address the issues of paramount concern such as safety, environmental and property protection. After a spill is detected, the following actions are taken:

- ensure that the source(s) of the spill has been shut-off;
- determine the level of hazard to personnel, property and the environment. If necessary, the Senior Foreman is called for assistance. The Senior Foreman may elect to handle cleanup operations with departmental personnel. If it appears that the spill could result in damage or harm to personnel, the environment or property, CVRI's Emergency Response Team will be called and respond for cleanup. If additional manpower and spill response expertise is required, it will be obtained through mutual aid support groups, spill cleanup contractors and/or consulting services;
- start spill containment, recovery and cleanup operations with equipment on hand; and
- initiate spill notification procedures.

Initial cleanup operations focus on containing all the spilled product to prevent further contamination. The spill is contained to the smallest manageable area possible, reference will be made to the product Material Safety Data Sheet for proper treatment and cleanup procedures. All spilled material is recovered and sent to off-site licensed disposal facilities and or recycling stations as appropriate. Procedures followed in the onsite disposal or short term storage of contaminated material comply with regulatory requirements for disposal/storage.

Spills are contained immediately and materials are used to soak the product up or the area is excavated not allowing for the spilled product to seep into the ground or groundwater sources. The CVM has a long-term groundwater monitoring program that monitors groundwater levels and chemistry in various areas of the mine including the active mine areas, future mining areas, reclaimed areas and surrounding the plant, shop and maintenance facilities. Any potential spills would be detected from the numerous piezometers found within the mine permit.

29. Supplemental Information Request Responses, Question 132a, Page 223

CVRI states that a small buffer is included between most of the development features and the proposed disturbance boundary.

a. What are the minimum, maximum, and average buffer distances between the proposed disturbance and mine permit boundaries?

Response:

Included Buffer Area

This *"small buffer"* is intended to indicate that the 'disturbance boundary' illustrated on the development figures had been purposely expanded a minor amount beyond the actual pit and dump limits developed in the mine planning process. This buffer was intended to account for ancillary activities which might occur along the rims of the planned activity. This buffer area is also provided as a 'safety margin' in estimating land disturbance assessments. This was an effort to not 'underestimate' the disturbance area.

Buffer Within Approved Mine Permit Boundary

One of the approval boundaries being sought by CVRI will be the Mine Permit. It should be noted that the Mine Permit is not a 'land disposition' hence carries no land use authority. The Mine Permit is an area approved by ERCB to designate an approved mining development.

In consideration of the Mine Permit area requested CVRI must consider:

- all mining activities must be within the Mine Permit;
- other energy development cannot occur within the Mine Permit without ERCB approval; and
- any coal mining within 400 m of any oil and gas facilities must be separately approved by ERCB.

Therefore there is an advantage to CVRI to have the Mine Permit boundary at least 400m larger than the proposed mining development area in order to exercise some control over other future energy development encroaching within 400 m of the coal development which would create addition approval requirements for CVRI.

The Mine Permit boundary requested for the Project area includes a minimum 400 m 'buffer' from anticipated blasting areas. This provides CVRI with a greater degree of control over possible encroachment of oil and gas development detrimental to the coal mining operation.

Buffer Within Approved Mineral Surface Lease

In the near future CVRI will seek approval of a Mineral Surface Lease (MSL) covering the starting areas of the mine. This MSL is a land disposition which provides for land use for mineral development. At start-up of the Project only the area planned for immediate development will be included in the MSL. Over time the MSL will be amended and enlarged as the mine disturbance progresses into adjacent area.

Please note that the application as presented does not include any request for a MSL.

When CVRI does apply for a MSL for the Project the boundary will be limited to the areas required for only the beginning stages of the mine. Typically, the area required within the next 10 years is included in order to limit the number and frequency of amendments that would need to be made.

The MSL boundary which will be proposed will include a ‘buffer’ area around the proposed disturbance area. Each application would include a development and reclamation plan similar to the current application but in greater detail and certainty. The buffer included in the MSL boundary will be focused on public safety. CVRI will wish to maintain an appropriate separation of publically accessible land from the mining activity, especially with concern for blasting safety. CVRI will need to be in a position to be able to limit public access into unsafe areas.

Environmental Buffers

CVRI development will be subject to approval conditions including buffers and setbacks designated at the appropriate approval stage.

b. Identify those areas that will have no buffer.

Response:

No buffer will exist between some the pits and dumps as spoil material will be located as close as possible to the pit to maximize mining efficiency. At the licensing stage buffers will be better defined as mine plans will be broken down to 5 or 10 year mine blocks.

30. Supplemental Information Request Responses, Question 135a & b, Pages 231& 232; and Question 69c, Page 94

CVRI was asked to discuss alternative uses for non-salvageable debris, including use of coarse woody debris (defined as logs, branches, and stumps) on coversoil stockpiles. In Response 135b, CVRI provided a brief discussion on firewood as a possible alternative, but did not address the use of placing coarse woody debris on the surface of coversoil stockpiles or reclaimed areas after coversoil placement. In Response 69c, CVRI states that *Logging residual placed on the reclaimed surface will function as downed wood in the future forest.*

a. Provide a definition for Logging residual, and compare that to coarse woody debris, commonly defined as logs, branches, and stumps.

Response:

CVRI does not differentiate between ‘coarse’ and ‘fine’ woody debris. The equipment used is able to handle all the material together since the dozing or backhoe operations to salvage soil results in the materials being broken and mixed with the soil volumes that are windrowed for loading.

Logging residual is the woody material which remains following the harvesting of merchantable timber. This woody material will consist of:

- branches and stumps from the merchantable timber;
- non-merchantable timber;
- fallen trees and associated stumps in various degrees of decomposition; and
- shrubs.

All of this material is gathered with the soil salvage operation and incorporated into the salvage soil direct placement or stockpile volumes.

On infrequent occasions, prior to timber harvest, minor volumes of dead standing trees have been cut and removed by local aboriginal communities for firewood.

CVRI does not practice burning of slash piles after timber harvest.

With multiple years of experience in this practice, CVRI has determined that incorporation of this woody material into the soil salvage operation is an effective material handling method and is advantageous in preservation of valuable organic material for reclamation.

b. Clarify if CVRI intends to place coarse woody debris on the coversoil stockpile and/or reclamation surface after coversoil placement, separately from the woody debris that may be retained in the salvaged soil.

Response:

The ‘coarse’ and ‘fine’ woody debris is incorporated into the soil at the point of salvage. Therefore, any soil to be stockpiled or directly placed will already have the woody debris within the volume handled.

No ‘separate operation’ for handling coarse woody debris is proposed.

Directly placed soil, with woody debris, will be dumped and spread on the re-contoured surface. Dozers will spread the volume across the re-contoured surface to provide the required soil depth. During this spreading operation the woody debris is further broken up in size and further inter-mixed with the soil material. In practice, the woody debris will often ‘float’ to the near surface which provides additional erosion protection.

Stockpiled soil, with woody debris, will be loaded and hauled to the re-contoured area and spread in the same fashion. Depending on the age of the stockpile, the woody debris will be in various degrees of decomposition. However, the larger more intact woody material will likewise ‘float’ toward the surface.

CVRI does not practice separate handling of coarse woody debris. Past practice has shown that the current methods used by CVRI are the most effective and efficient method of handling soil and debris volumes and that favourable reclamation results are evident.

c. If CVRI does intend to place coarse woody debris in the reclamation process, provide information on where this debris will come from, considering that CVRI has stated that their *Standard procedure has been to windrow the excess woody debris on the mine development area where it will be incorporated into the overburden mined from the pits and hauled to the rock dumps.*

Response:

As indicated previously (ESRD SIR2 #30a) and b)) and as further described above CVRI does utilize the coarse woody debris in the soil salvage operation by adding it to the soil volumes handled.

On occasion, excessive 'coarse woody debris' will be encountered during the soil salvage operation. This could occur at 'log deck' sites where massive volumes of slash are accumulated from the timber harvest operation. In these instances the large volume of debris cannot be properly mixed into the soil salvage operation. Therefore, this volume of coarse woody material would be left behind to be removed as part of the mine excavation. In these instances CVRI seeks prior approval from the local ESRD inspector.

This 'exception' is a normal operational decision which has been accepted by respective authorities.

31. Supplemental Information Request Responses, Question 137a, Page 233

In Response 137a, CVRI states that the drawdown of water levels adjacent to operating pits was found to be minimal, but in the EIA, CVRI stated that significant groundwater drawdown may extend up to 200 m from the pit.

a. Within the context of groundwater drawdown levels, define what is meant by 'significant' versus 'minimal'.

Response:

In the context of an EIA, an impact is either "significant" or "insignificant". The manner in which the professional opinion on which of these two choices is selected was outlined in Section D with reference to criteria listed on Table D.3-2. The sum-total of the assessment of the eight criteria was that impact of groundwater level drawdown on "surface water quantity" was insignificant. This was a professional opinion given the two choices with which to characterize the impact. In this case, the impact was characterize as "significant" to 200 m and "insignificant" beyond 200 m – this is not specific to a characterization of the groundwater levels but rather to the sum-total of the eight criteria of significance.

One of the assessment criteria is "magnitude" which, in this case would be a prediction of the amount of drawdown of the water table with distance from a mine pit. CR #3 clearly demonstrates that drawdown of the water table extends outward from a mine pit to a distance that could be 100 to 300 m depending on the hydrogeological regime. The drawdown is greatest adjacent to the pit-proper and diminishes exponentially with distance from the pit.

If one considers that out-of-pit mine operations, including spoil piles and roads (the mine footprint), occupy a significant proportion of the 100 to 300 m alongside a mine pit then the area where actual environmental impact could occur is at the farther reaches of the drawdown – where such drawdown has become small.

CVM acknowledges an error in terminology that is the cause of this inquiry. The word "minimal" should not have been used. Rather, the word "low" would have been more appropriate because it is defined in Table D.3-2 as:

"Disturbance predicted to be somewhat above typical background conditions, but well within established or accepted protective standards and normal socio-economic fluctuations, or to cause no detectable change in ecological, social or economic parameters."

CR #3 (Appendix B) shows that fluctuations in groundwater levels can be tens of metres in upland settings and metres in lowland settings. Thus, the area outside of the pit-proper and the associated disturbances would be that which was experiencing drawdown in the range of background fluctuations and therefore classified by the consultant preparing CR #3 as "low".

Preamble:

CVRI has demonstrated that the hydrogeological regime in the Robb Trend is similar to those of the trends lying to the southwest. This similarity allows the use of monitoring and operating data from those trends as an empirical model for the response of the groundwater system to mining in the Robb Trend.

b. Quantify the predicted change in water levels over time in the peatlands and wetlands adjacent to the Robb Trend mine pits.

Response:

The change in groundwater levels over time in the mineral soil and strata beneath the peatlands and wetlands in that area adjacent to the mine disturbance footprint, within several hundred metres of the operating pit, has the potential to be significant in the Project area. Observations at the Mercoal wetland (ESRD SIR2 Appendix 31) have shown that this drawdown does not affect water levels in the overlying organic soils of these wetlands. CVRI expects that the drawdowns within these organic soils will be low –of the order of magnitude of natural variations. CVRI further expects that the drawdowns will be of long duration (effects occurring after development and during operation of facility) but will dissipate quickly after dewatering of the adjacent pit ceases.

c. Discuss whether CVRI expects the predicted changes in water levels in the peatlands and wetlands adjacent to the project disturbance footprint to be significant or minimal.

Response:

Response to ESRD SIR2 #31b) states that CVRI expects that the changes in water level in the peatlands and wetlands will be low (replacing the word "minimal"). CVRI expects that the impact due to any change in water levels will be insignificant.

d. Using the site specific groundwater drawdown levels quantified for the Robb Trend Project, discuss effects that the predicted groundwater drawdown is expected to have on the vegetation communities in the peatlands and wetlands adjacent to the mine pits.

Response:

Section 5, ESRD SIR2 Appendix 11, *"A Comparative Review of the Robb Trend and Coal Valley mine"* provides an assessment of drawdown adjacent to pits.

The conclusions in are pit dewatering shows a consistent trend in two key areas. Groundwater levels show a natural variation of up to 5 m as shown in the Project groundwater level data (Table 3; CR #3). The distance from a pit dewatering event that the drawdown of the groundwater level begins to exceed the natural variation is generally less than a few hundred meters. It is important to recall that the edges of a pit out to this distance is usually disturbed as there are requirements for storing of overburden material, haul routes and other operational mining activities.

32. The extent of the drawdown from a pit is controlled by the topography, geologic structure and the lithology. Supplemental Information Request Responses, Question 145, Page 242

a. Assuming that the quoted mortality risk of 6.1 is pre-mining (Robb Trend) and that both the RSF values and road density will change on the RSA during the T10, T25 and T50 time frames, provide mortality risk calculations for the RSA at the T10, T25 and T50 periods in the context of foreseeable future cumulative developments including other coal mines.

Preamble

Existing mortality risk mapping from the Foothills Research Institute (FRI) was used in the baseline reporting for grizzly bears (Section 4.5.5, CR #7). This mapping uses a combination of habitat quality and human use (as of 2010) to identify grizzly bear mortality risk. Open roads contribute most to increased mortality risk. The purpose of using this data for the EIA was to identify if (in a regional context) the affected area (mine lease) offered particularly high or particularly low <u>baseline</u> levels of mortality risk for grizzly bears. Average values for baseline mortality risk were calculated for the RSA (3,587 km^2), 10 Bear Management Units (263 km^2 to 438 km^2), the LSA (mine permit = 101 km^2) and proposed mine footprint (43 km^2). Mortality risk ranges from 1 (lowest) to 10 (highest). Calculations showed that average mortality risk in the Project LSA (6.9) was higher than for the region as a whole (6.1) (See Table 24, CR #7). Only two BMUs had higher baseline mortality risk ratings than the Project LSA - Erith (7.3) and Raven (7.1). Both of these BMUs are located at the eastern extent of the RSA where open oil and gas and timber harvest roads are abundant. Section 5.3.5.1 of CR #7 assessed the impacts of the proposed mine on grizzly bear mortality. The conclusion was that the mine would lessen grizzly bear mortality risk because of restrictions on hunting and human access for the life of the Project.

Section 6.6.5 of CR #7 assessed the cumulative impacts (Planned Development Case) on grizzly bears from past, current and future lands actions. It was concluded that:

"Significant cumulative effects on regional grizzly bear populations are most likely to express themselves in the following way.......Poaching, malicious killing, self-defence kills and vehicle collisions of and with grizzly bears occur at a level in the RSA and greater Yellowhead region wherein mortality rates exceeds reproduction. This would most likely occur as a result of excessive motorized access levels and the ability to carry firearms and drive at high speeds in high quality habitat areas."

It was further concluded that the above may have already occurred in the RSA and surrounding provincial Bear Management Areas (BMA). It was noted that in spite of known mortality levels from 1999 to 2004 appearing to be greater than sustainable levels, that further DNA inventory was planned and that this would be necessary to reach any conclusions on the effects of regional land use on grizzly populations. This DNA census was completed and reported on in 2012 (Rovang et al. 2012). DNA census was conducted in summer of 2011 for a 1500 km^2 study area south of Hinton. The study area occurs in an ecological setting very similar to that of the Project area and is located 20 to 60 km away. It was determined that the current population level was 25.1 bears, which represented an increase of 5.8% per year from the 16.1 bears estimate of 2004 using a similar technique.

Response:

The Planned Development Case did not predict future road locations/densities and subsequent mortality risk, as these data were not available. The cumulative effects assessment for grizzly bears assumed that the regional mitigation measures outlined on page 60 of Section 6.6.5 of CR #7 would be implemented. It is our professional opinion that DNA census is a superior method than mortality risk modeling to measure grizzly bear mortality. CVRI is supportive of further DNA census in the Project RSA as a means of monitoring cumulative effects.

b. Given that recent local research (Cristescu et al 2011) has suggested that large original forested patches are an important component of grizzly bear habitat on coal mines, provide details regarding original forest cover to be maintained on the mine during active mining:

    i. how much original forest cover will be maintained;

    ii. in what configuration; and

    iii. the locations.

Response:

The wildlife assessment and the requirements of the reforestation program have identified remnant forest patches as being very important for the reclamation program. Section F4.1.1 (page F-36) of the Reclamation Plan (Section F) states that remnant forest patches will be preserved in the development areas to provide connectivity and hiding cover for wildlife species;

where possible remnant forest patches will be left in the mine development areas. The size of the stands will vary from a few hundred square meters to several ha in size. The remnant stands will not be identified until the licensing stage or more likely during the clearing and development operations. CVRI will take every action possible to identify and protect the tree islands left in the mine footprint area.

The proportion of residual forest to mine footprint for the study by Cristescu et al (2012) is 7.7% for the Luscar mine and 6.1% for the Gregg River mines (Cristescu 2012). Approximately 30 residual patches occur on the contiguous Luscar/Gregg River mine footprint (ESRD SIR2 Figure 32-1), with a mean size of 11.3 ha and a range of 0.3 ha to 87.9 ha. Patch metrics on the Luscar/Gregg mine block will be used a preliminary guideline for the design of remnant forest patches on the Project area. The Project permit and footprint is approximately 50% as wide as for the Luscar and Gregg River mines. The average remnant forest patch sizes on the reclaimed Project will be generally smaller because of the much narrower width.

References:

Cristescu, B, G.B. Stenhouse, M. Symbaluk and M.S. Boyce. 2011. Land use planning following resource extraction – lessons from grizzly bears at reclaimed and active open pit mines. Mine Closure 2011 — A.B. Fourie, M. Tibbett and A. Beersing (eds) © 2011 Australian Centre for Geomechanics, Perth, ISBN 978 0 987093714

33. Supplemental Information Request Responses, Question 146, Page 243

a. Recognising that in the Banff example, focused crossing points are located in a protected area with few roads outside of Highway 1 and where no firearms are permitted, discuss, in the context of the end-pit lakes, how focused and predictable crossing points, with a significant road density (above the recommended maximum road density for core areas in the Grizzly Bear Recovery Plan) and permitted firearms, may affect mortality risk for grizzly bears, given that unusual terrain conditions such as this are not a component of the FRI Mortality Model calculations (G. Stenhouse, pers com).

Response:

The Project permit area is approximately 50 km long. Review of the Conceptual End Land Use Plan (Figure F.4-2, Section F) indicates that there are seven (7) segments along the length of the reclaimed mine where lakes are noticeably absent. These segments total approximately 11.5 km with an average segment length of 1.6 km and a range of from 0.5 km to 3 km. At closure approximately 23% of the length of the Project is available for grizzly bears to cross without swimming or wading. The twinned Trans-Canada Highway portion of Banff National Park is also approximately 50 km long. Grizzly bears along this fenced portion of the highway crossed the highway using overpasses 97% of the time and underpasses 3% of the time (Clevenger et al. 2009). This stretch of highway supports 7 overpasses that each are 50 meters wide. This represents less than 1% of the total fenced length of the Trans-Canada Highway that is available for crossing by grizzly bears. As such, the idea that crossing points are as "focused and predictable" as they are in the Banff situation is tenuous. It is also important to note that although road density may be high during mining, access to the mine permit is restricted as is the carrying and discharge of firearms.

Reference:

Clevenger, A.P., A.T. Ford, and M.A. Sawaya. 2009. Banff Wildlife Crossing Project: Integrating science and education in restoring population connectivity across transportation corridors. Prep. for Parks Canada Agency by Western Transportation Institute. 144 pp.

34. Supplemental Information Request Responses, Question 147, Page 249

CVRI indicates that High and Very High marten habitat suitability classes presently make up 56% of the RSA and that, in 50 years, 78% of that will be reduced to Moderate, Low or Very Low habitat suitability classes. Dumyahn et al (2007) has suggested that marten will not establish home ranges unless >70% of the area is suitable habitat and Hargis et al (1999) indicated that marten respond negatively to low levels of habitat fragmentation and are nearly absent when landscapes are comprised of >25% non-forest cover.

Although they didn't have data to confirm that reduced trapping effort and success in areas with increasing industrial activity was a result of reduced marten populations, Webb believes that is the case (S. Webb, pers com).

a. Given the loss of 78% of High and Very High marten habitat suitability classes, please explain the regional habitat impact analysis that suggests marten populations will not decline or that effects on marten populations will be insignificant (CR#7, page 88).

Response:

The reviewer is correct in noting that combined high and very high quality marten habitat will decline markedly with cumulative land use in the RSA. It is important to note however that very high suitability habitat will increase slightly. The main loss is associated with conversion of high quality habitat to moderate quality habitat. Patches of very high suitability habitat will offer source areas for dispersal and re-colonization as forests mature. There is some uncertainty as to the significance of population level effects in the conversion of high quality to moderate quality habitats in the region resulting from cumulative land actions. It is not out of the question that regional marten populations may decline to some extent. Continued winter track count monitoring at a regional level is recommended. This monitoring should not be the sole responsibility of CVM since cumulative effects on marten also arise from timber harvest and oil and gas development.

References:

Dumyahn, J. B., P. A. Zollner, and J. H. Gilbert. 2007. Winter home-range characteristics of American marten in northern Wisconsin. American Midland Naturalist 158:382–394.

Hargis, C. D., J. A. Bissonette, and D. L. Turner. 1999. The influence of forest fragmentation and landscape pattern on American marten. Journal of Applied Ecology 36:157–172.

35. Supplemental Information Request Responses, Appendix 137, Section 3.2.1, Page 5

As part of the provided Wetland Monitoring Program Proposal, CVRI states that, as part of the proposed wetland selection process, those wetlands that are most likely to be affected by reductions in water levels will be given priority.

General Comments

Monitoring programs, including wetland monitoring programs, are established during the EPEA approval process and are routinely included as a condition of the approval. In these instances the details of the program including the extent, duration and methods of monitoring, are determined by ESRD.

a. Confirm if CVRI intends to include all peatlands and wetlands that will be intersected by the mine pit or other disturbance associated with the mine.

Response:

The CVRI program includes a sample of those wetlands that are likely to be affected by reductions in water levels. Wetlands located in the vicinity of the mine will be stratified based on wetland type (fen, swamp, marsh and bog), function (related to observed wildlife use, plant community composition and size, and connectivity) and wetland size will be considered in determining the selection of sites to be monitored. Monitoring will be performed as per Cobbaert 2012 - *Guidance for wetland monitoring program proposals for* in situ *operations*.

Reference:

Cobbaert D. 2012. ESRD guidance for wetland monitoring program proposals for *in situ* operations. Edmonton (AB): Alberta Environment and Sustainable Resource Development, Operations Division, Northern Region.

b. If any peatlands and wetlands directly affected by the mine disturbance are not included, provide information on how CVRI will identify and mitigate any potential adverse effects to peatlands and wetlands not included in the monitoring program.

Response:

Any wetlands likely to be adversely affected by the mine disturbance will be captured during the mapping exercise and appropriate mitigation measures applied if necessary. The first phase of the wetland monitoring program will involve a desktop review and digital mapping of all wetlands and peatlands in the proximity of the mine using the most current aerial photographs. CVRI will provide an updated wetland map of the area every 3-5 years.

The degree of monitoring is expected to be determined by ESRD, (see response to ESRD SIR2 #35a).

36. Supplemental Information Request Responses, Appendix 137, Section 2.1, Pages 3 and 4

As part of the provided Wetland Monitoring Program Proposal, CVRI discusses the water level and water chemistry results obtained as part of the current Wetland Monitoring Program for the “South Extension Wetlands”. While CVRI states that *there were no issues with the lowering of groundwater levels as the drawdown of water levels adjacent to operating pits was minimal*, it is unclear on exactly how much the water levels have decreased over time. No discussion was provided on how the South Extension Wetland vegetation communities have been affected by pit development.

a. Quantify the changes in water levels over time in the South Extension Wetlands. What were the water levels before pit development, and how have those levels changed over time?

Response:

The response to ESRD SIR2 #31 provides an additional assessment of drawdown adjacent to pits. In this case the assessment involves the South Extension Wetland with pits at both ends.

The conclusions in ESRD SIR2 #31 are:

- Although the natural downward hydraulic gradient was increased by mining activities, the downward flow of water from the Wetland did not increase sufficiently to cause any measureable change in the water table within the peat deposits.
- A drawdown of hydraulic head of as much as 40 m in the bedrock produced no demonstrable impact on the Wetland. This lack of impact occurred despite the fact that pits were present on two ends of the Wetland and that the lowering of the water level in the pits has been present since 2006.

b. What effects on the South Extension Wetland vegetation communities has CVRI identified as part of the wetland monitoring program? Discuss whether CVRI considers these effects to be significant or not.

Response:

Post mining assessment of 'vegetation communities' in the South Extension Wetland area has not yet occurred. A 'Baseline Assessment' was undertaken prior to mining. A follow-up assessment is planned after mining and reclamation has occurred. This will be some years in the future.

In the interim the 'wetland monitoring' program continues to monitor changing water levels throughout the area. Visual inspections during these monitoring field operations have not reported any visible changes to the condition of the wetland nor vegetation.

CVRI had not anticipated significant changes to the wetland with respect to water levels or vegetation communities. It was expected that any vegetation changes that would occur would not be evident immediately hence the post mining assessment was planned for post mining and reclamation.

Results of current and future wetland monitoring programs will be applied as 'lessons learned' in the ongoing adaptive management process.

4. FEDERAL

The responses to questions in this Approvals section will not be considered as part of the EIA completeness decision made by Alberta Environment.

4.1 Environment Canada

37. Supplemental Information Request Responses, Response 189, Page 340.

In response to SIR # 189, CVRI stated that *[t]he current ESRD approval for the operation of the CVM specifies that surface water bodies will be monitored by grab sample once per year for "inorganic parameters" listed in "Canadian Water Quality Guidelines for the Protection of Aquatic Life 1999 (as amended). These parameters are listed in CR #3 Tables 3.4-2 and 3.4-3. This would therefore be the "acceptable quality (level)".* However, not all of the inorganic parameters listed in CR #3 Tables 3.4-2 and 3.4-3 have levels listed in the *Canadian Water Quality Guidelines for the Protection of Aquatic Life 1999.*

a. For those inorganic parameters listed in CR #3 Tables 3.4-2 and 3.4-3 which do not have acceptable levels as defined in the *Canadian Water Quality Guidelines for the Protection of Aquatic Life 1999*, indicate how "acceptable quality" will be defined.

Response:

Inorganic parameters listed in CR #3, Tables 3.4-2 and 3.4-3 which do not have acceptable levels as defined in the *Canadian Water Quality Guidelines for the Protection of Aquatic Life 1999*, have no regulatory definition of "acceptable quality" and are therefore taken by CVRI (and regulators) to not require assessment. However, CVRI, if required, will work with ESRD to define acceptable quality for those inorganic parameters for which no acceptable levels defined in the *Canadian Water Quality Guidelines for the Protection of Aquatic Life 1999* on the basis of:

1. guidelines and standards for those parameters that may exist in other jurisdictions (*e.g.*, British Columbia, US Environmental Protection Agency); or
2. comparison of measured values against ranges of regional reference values for those parameters.

CVRI expects any decision on specific monitoring and assessment approaches for these inorganic parameters will be determined by ESRD as part of approval requirements for the Project.

38. Supplemental Information Request Responses, Response 191, PAGE 341.

In response to SIR # 191, CVRI stated that *[t]he 'competent rock' will be taken from the proposed mine pits and hauled to provide 'common fill' for the haul road construction. Solid, unweathered rock is preferred for construction. Therefore, it is the same 'overburden rock' that has been tested for the mine. Overburden characteristics have been described in CR#10, Section 4.0.*

While the reference section does state that *A total of 128 overburden samples (mostly bedrock) from fourteen test holes (Figure 8) were collected by CVM and analysed for texture, carbonate content, detailed salinity and metals*, it does not include any information on testing for the potential for acid generation.

a. Clarify how the testing discussed in CR#10 will determine the suitability of overburden for the construction of haul roads, with respect to the potential for acid generation and metal leaching.

Response:

Overburden sampling was conducted in order to determine chemical analysis of overburden to be mined during the life of the Project. Such analysis allows review for potential impacts.

The sampling results and regional experience indicates that acid generation and metal leaching from overburden is not problematic. The substrates encountered in the Project and surrounding area are described as alkaline and calcareous which results in low probability of acid generation.

CVRI also notes that the sandstone targeted for road construction use also contains a lesser degree of salts and low values of heavy metals.

CVRI will continue the common practice of utilizing local mined rock for road construction.

4.2 Natural Resources Canada

39. Supplemental Information Request Responses, Response 210, Page 363.

In their response to SIR 210, CVRI states that *climate change is indifferent to ecosystem makeup* and that *the minor spatial differences between Edmonton and Edson (CVM) are insignificant to climate change over the long term.*

a. Provide a justification and rationale for the applicability of the predictions generated by using the Edmonton data (e.g. explain how model results are representative of the Edson (CVM) area when existing differences between Edmonton and Edson make Edmonton a poor surrogate for Edson). Response should reference model prediction uncertainty.

Response:

Barrow and Yu (2005) provided regional predictions for climate change in Alberta. From the many predictions available, five scenarios were selected to represent conditions which were cooler and wetter (NCARPCM A1B), cooler and drier (CGCM2 B2(3)), warmer and wetter (HadCM3 A2(a)) and warmer and drier (CCSRNIES A1FI) than median conditions (HadCM3 B2(b)). Climate change scenarios were constructed for minimum, mean and maximum temperature, precipitation, degree days > 5°C and annual moisture index.

Changes in annual mean temperature by the 2050s were predicted to be typically between 3°C and 5°C. Changes in maximum and minimum temperature are similar to those for mean temperature, although the changes in minimum temperature tend to be slightly greater than those for maximum temperature thus implying a general decrease in the diurnal temperature range. For the 2050s, changes in annual precipitation are generally within the range –10% to +15%, and any decreases in annual precipitation are generally driven by decreases in summer precipitation. By the 2080s, however, all five climate change scenarios indicate increases in annual precipitation of up to 15% in general. Degree days > 5°C and annual moisture index scenarios indicate increases of between 30-50% and 20-30% by the 2050s, respectively. The projected increases in annual moisture index are generally driven by the large increases in degree days above 5°C, rather than by decreases in precipitation.

Variability in model predictions for mean temperature are shown in CEAA SIR2 Figure 39-1 over the three time ranges considered in the global circulation models, and in joint seasonal temperature and precipitation in CEAA SIR2 Figure 39-2 for the time slice of the 2050s. Considering just the range in temperature in the 2050s in CEAA SIR2 Figure 39-2, the range varies from about 2°C to 6°C depending on the season, much larger than the current difference in mean annual temperature between the two stations of about 0.3°C (CEAA SIR2 Table 39-1 and CEAA SIR2 Figure 39-3).

CEAA SIR2 Table 39-1 Monthly Mean Temperature

	Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Edson	**Temperature Mean Value**	C	-11.8	-9.5	-3.7	3.3	8.7	12.6	14.8	13.7	8.7	3.6	-6.3	-11.7	1.87
Edmonton	**Temperature Mean Value**	C	-14.2	-10.8	-5.4	3.7	10.3	14.2	16.0	15.0	9.9	4.6	-5.7	-12.2	2.12

Source: http://www.climate-charts.com/Locations/c/CN71123030122050.php

CEAA SIR2 Figure 39-4 shows the predicted change in climate over Alberta for the five scenarios examined. It shows that the change in climate is similar in most areas of the province for most scenarios and in particular for the median scenario used in the assessment. Changes in precipitation are more geographically variable but the change in precipitation is similar in the Edmonton and Edson areas.

Further, by considering the actual conditions in the period 1960-1990, Barrow and Yu described detailed climate scenario results for only six representative sites in Alberta – Lethbridge, Medicine Hat, Calgary, Edmonton, Grande Prairie and Fort McMurray. Edmonton is the closest of these cities to Edson and based on the discussion above, its climate change statistics were used to represent the Edson area.

Reference:

Barrow, E. and G. Yu. 2005. Climate change scenarios for Alberta. Prepared for the Prairie Adaptation Research Collaborative (PARC) in co-operation with Alberta Environment. 73 p.

40. Supplemental Information Request Responses, Response 211, Page 363.

In their response to SIR 211, CVRI states that with regards to 're-worked till', *[s]econdary deposits are those having undergone 'reworking' through actions such as fluvial transport or erosion.*

a. Explain why re-worked till is not classed as fluvial sediment.

Provide a description of the sedimentological and physical characteristics of the "reworked till" unit, and explain why it classifies as a 'till', whether it is a diamicton and whether it contains erratic clasts.

Response:

Volume 2, Appendix 9 was provided by CVRI to give a '*summary of geological and geotechnical characteristics at the site*[3]'. This report notes that 'the surficial deposits in the proposed Project area and CVM areas is primarily a thin mantle of till with local glaciolacustrine deposits and post-glacial alluvial, colluvial, and organic deposits[4]'. The report also notes that 'other surficial deposits in the area are only minor in aerial extent and include glaciolacustrine silts and clays, colluvium material transported by gravity driven processes on hillside and valleyside areas, alluvium sands and gravels located within river and stream valleys, and organic deposits situated around wetlands[5].

Section 4.2.1 of Volume 2, Appendix 9 notes that the information presented regarding surficial soils were summarized from a large number of previous engineering reports conducted for CVM[6]. It is in this section that the term 'lacustrine/re-worked till' is mentioned, specifically in reference to 'wetland deposit'. The report appears to be dividing 'wetland deposit' into four material types: 1) peat, 2) organic silt, 3) re-worked-tills and 4) lacustrine.

Section 4.2.2, Volume 2, Appendix 9 also contains a reference to 'reworked till' and 're-worked silt till' and references Table 4.1 which is attributed to Piteau, 1982. This Piteau report is an early engineering materials investigation specific to the Robb Trend area. The relevant material from this reference is as follows:

> *5.1.2 Lacustrine Deposits and Re-worked Glacial Till*
>
> *Present beneath the peat mantle in wetland depressions are water laid sot silts and fine sands derived from parent glacial till. The units form broad, flat lying valley bases, commonly in excess of 200 m in width. Thickness of between 3.2 m and 10.5 m are encountered in Robb Block.*

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[3] Volume 2, Appendix 9, Page 1

[4] Volume 2, Appendix 9, Page 7 & 8

[5] Volume 2, Appendix 9, Page 8

[6] Volume 2, Appendix 9, Page 34

These deposits are distinguishable only by gradation, with the re-worked till being slightly coarser than the lacustrine silt. Larger proportions of gravel are present within the re-worked glacial till. Coarser re-worked till was deposited under conditions of more torrid flow that those prevailing during sedimentation of silt.

The lacustrine deposits consist of greyish green to greenish brown, sot, silty sands and sandy silts containing a trace to a little clay. Rootlets and organics are present to a maximum proportion of 30% within the deposit, the material being odorous. Liquid and plastic limits of 52% and 37%, respectively, were recorded on a sample of highly organic silt. The material is classified as being of medium plasticity.

Where the lacustrine deposit is present, it overlies the re-worked till. The re-worked till is dark greyish green to greenish brown in colour, containing yellowish brown discoloured pockets of oxidized sand and sandstone. The material is a mixture of gravel, sand and silt in varying proportions, although it commonly resembles a sandy silt or silty fine sand of low to medium plasticity. The re-worked till ranges in consistency from soft to stiff. Occasional pockets of highly plastic silty clay are present, the re-worked till is loose to medium dense. The till also contains granular inclusions of sub rounded to rounded fragments of moderately weathered sandstone, claystone and coal.

Plastic limits of between 17% and 21% and liquid limits of between 28% and 33% were recorded in tests on two samples of the reworked till. A natural moisture content of 26% was obtained from a single sample.

CVRI notes that the ‘samples’ mentioned as ‘re-worked till’ were reported in an 1982 report so that further inspection or description of the material is not possible.

The inclusion of the data from these reports was presented as a ‘summary’ of information available from the existing CVM area and the proposed Project area. A reasonable ‘correlation’ between the two areas can be drawn so that current geotechnical design parameters can be reasonable expected to fit at the Project.

CVRI further indicates (CEAA SIR #212) that additional geotechnical testing for pit and dump design purposes will be undertaken to support future ‘licence’ applications. Material classification for such testing will follow Unified Soil Classification System (USCS) standards.

4.3 Health Canada

41. Supplemental Information Request Responses, Response 213, Page 365.

CVRI states that at some locations, for some compounds, air emission values are higher for Project Case 2 than for Project Case 1, even though Project Case 1 was used in the assessment as the worst-case air quality scenario.

a. Revise the assessment using Project Case 2 air emission values when they are higher than Project Case 1.

Response:

Surface mining is continuous process and the location of mining activity changes constantly. It is not reasonable to assess the air quality associated with a mining operation by modelling it in its entirety.

The CRVI air quality assessment chose two cases to estimate air quality that would be considered reasonably worst case for the community of Robb: Case 1: West Mine in 2034 and Case 2: Main Mine in 2025. These cases were modelled with five years of meteorological data; whereas, the actual mine operations will move continuously and will not affect the community for the full five years. Thus, the approach taken was conservative for the community of Robb.

In the response to CEAA SIR #213 (CEAA Table 213-1) it was identified that in most cases, Case 1 predictions were higher than Case 2 predictions, supporting the use of Case 1 as the primary case for the assessment.

CEAA SIR2 Table 41-1 summarizes the cases when Case 2 predictions are higher than Case 1 results. Predictions are summarized for MPOI, and the highest prediction at Robb. Predicted concentrations are remain below the ESRD AAAQOs, except for PM_{10} and TSP predictions which were above the AAAQOS in Case 1. Using Case 2 predictions rather than Case 1 does not change the main conclusions of the air quality assessment.

CEAA SIR2 Table 41-1 Modelling Results ($\mu g/m^3$) for Cases When Project Case 2 Values are Higher than Project Case 1 Values

Compound	Case 2	Case 1	Maximum	ESRD AAAQO
NO_2 – Annual at MPOI	33	14	33	45
Unmitigated Particle Predictions				
$PM_{2.5}$ – 2nd Highest Daily at MPOI	26	21	26	30
PM_{10} – 2nd Highest Daily at MPOI	140	117	140	50
PM_{10} – 2nd Highest Daily Maximum at Robb	117	107	117	50
TSP – 2nd Highest Daily at MPOI	271	252	271	100
Mitigated Particle Predictions				
$PM_{2.5}$ – 2nd Highest Daily at MPOI	11	10	11	30
PM_{10} – 2nd Highest Daily at MPOI	47	41	47	50
PM_{10} – 2nd Highest Daily Maximum at Robb	41	39	41	50
TSP – 2nd Highest Daily at MPOI	92	87	92	100

42. Supplemental Information Request Responses, Response 215, Page 367.

According to the National Pollutant Release Inventory, the benzo(e)pyrene, dibenz(a,h)acridine, phosphorus, and sulphuric acid are emitted by this industrial sector/facility and are not emitted from project fugitive sources or from diesel combustion.

a. Identify and describe the other project sources that emit benzo(e)pyrene, dibenz(a,h)acridine, phosphorus, and sulphuric acid.

Response:

Sulphuric acid is listed in the National Pollutant Release Inventory (NPRI) (2011) as substance which could, potentially, be released from the Coal Valley Coal Processing Plant (Plant). It is listed as manufactured for on-site use/processing. No sulphuric acid was released from the Plant in 2008, 2009, 2010, and 2011. Moreover, according to NPRI (2011) sulphuric acid was mainly released in oil sands upgraders, coal burning power plants, refineries, pulp mills, fertilizer plants, or food processing plants.

No phosphorus was released to air from the Plant in 2011 (NPRI, 2011). About 88 tonnes (t) of phosphorus was released to land (81.5 t was released to waste rock and 6.5 t to tailings). In previous years phosphorus was released to tailings (104 t in 2010, 113 t in 2009 and 76 t in 2008). There was no emission of phosphorus to atmosphere listed in NPRI.

There is no information about emissions of benzo(e)pyrene and dibenzo(a,h)acridine in the Coal Valley NPRI submission in 2011. In 2008 to 2010 benzo(e)pyrene was released to tailings in amounts 17 to 26 kg/year. No benzo(e)pyrene was released to air.

Furthermore, there are no emission factors in AP42 for these compounds for bituminous and sub-bituminous coal combustion (U.S. EPA 1998) or from diesel exhaust (U.S. EPA 1996a,b).

43. Supplemental Information Request Responses, Response 216a, Page 368.

CVRI states that water trucks will be deployed on a continuous basis during peak traffic periods and warm weather conditions.

a. Provide specific details on the watering schedule including a discussion of:
   i. the application rate of water;
   ii. the time between applications;
   iii. traffic volume during the period; and
   iv. the meteorological conditions during the period.

Response:

Details of the 'watering schedule' are not available. Water suppression is applied on an ad-hoc basis ('as needed' basis).

Volume 2, CR #1, Section 4.1.2, Page 26 provides a brief outline regarding water application for dust control on haul roads; 'haul roads will be regularly watered in summer'.

In response to CEAA SIR #216, CVRI noted 'the water trucks would be deployed on a continuous basis during peak traffic periods and warm weather conditions with decreasing frequency as traffic is reduced or cooler weather prevails'.

The response to ESRD SIR #25 also provides additional information related to 'watering application'. This response indicates that CVRI currently has three water trucks available for road service. Two Haulpak trucks with tank capacity of 172,000 and one Cat 777 with a tank capacity of 90,000 l are in service. These trucks currently service approximately 72 km of active haul road, dump and pit ramps. As the operations runs on a 24 x 365 basis the water trucks are available on the same schedule.

CVRI normal practice for water applications is focused on a 'priority' basis:

- Safety is of primary concern. Areas of high dust conditions with heavy traffic or congested areas (loading areas, intersections) receive priority treatment.
- Waste loading benches, ROM stockpiles and public highway crossings are prioritized to be kept monitored and well watered. These sites often have high traffic, potential spillage of hauled materials, require truck manoeuvring, and higher potential for interaction with other smaller equipment.
- Intersections, sharp corners, and narrow road sections are next in line as these sites may also pose safety concerns for visibility.
- Long, low traffic haul road sections are prioritized as low since traffic volume is reduced and trucks are well spaced throughout their routine haulage cycles.
- Road and dust conditions are monitored by operational staff (pit foreman) so that watering applications can be modified as required in response to site specific conditions. During some periods no watering will be required depending on weather and road conditions. At other times the foreman can assign operators to all three water trucks with specific directions on where to apply water and at what frequency. Should safety require specific operational areas may be halted until water is adequately applied.

Operational practices of note include the following:

- The water trucks are equipped with pumps and spray nozzles that enable water application to the entire road width in a single pass. The volume and rate of application provides a heavy 'wetting' of the road surface which will remain effective for several hours in normal weather conditions.
- Multiple water 'loading' stations are maintained throughout the expanse of the mining area so that water trucks can be refilled in an efficient manner. Specific water trucks may be assigned to portions of the mine where heavier traffic or vehicle numbers are working.
- Active 'mining' areas such as pits, ramps and dumps are part of the advancing mining operation. Therefore, these roads and surfaces are continually changing. This results in road surface material (freshly mined rock) being renewed on a frequent basis. Fines (silt content) on these roads is generally non-existent and dust generation potential is low.
- In pit conditions often result in minor groundwater seepage or surface water collection thus keeping the 'loading faces' generally 'wet'. Truck traffic in and around these 'wet'

areas result in water being 'tracked' around the active loading and dump ramps which aid in dust suppression.

Long term haul roads require frequent maintenance through grading and occasional 'resurfacing'. The resurfacing of the 'wear surface' is accomplished with application of newly mined rock. A result is that 'wear surfaces' are renewed and 'silt content' reduced.

44. Supplemental Information Request Responses, Response 217, Page 371.

CVRI states that they will investigate the potential for low-emission practices...

CEAA SIR# 217, Page 371 discusses air emission control of SO_2/NO_2/CO and notes that the 'largest source' of such emissions is blasting. The response further indicates that 'CVRI will investigate the potential for low-emission practices, including the use of greater setbacks and smaller but more frequent blasts. In particular, CVRI will review and apply to the extent feasible the code of practice developed by AEISG (2011) for reducing and managing NOX emissions from blasting, which may also have some applicability to SO2 and CO emissions'.

Therefore, the comments regarding 'investigate the potential for low-emissions practices' were limited to blasting sources.

a. Provide more detail on when these practices will be investigated including what will trigger an investigation and; under what circumstances "low emission practices" will be put into place.

Response:

The AEISG (2011) code of practice manual has already been distributed to engineering staff responsible for blast design and monitoring of blasting product usage. The codes of practice are being reviewed internally and considerations for 'efficiency improvements' are being addressed.

Therefore, investigations toward low-emission practices have already been 'triggered'.

The primary 'driver' regarding blasting procedures is unit operating cost. CVRI monitors production costs and remains observant of available feasible alternatives to implement measures to reduce cost. This includes managing 'blasting efficiency' to high effectiveness of the blasting process which leads to lowest unit cost.

In achieving 'high efficiency' CVRI is working toward managing for best possible blasting conditions, improved denotation, and maximum use of explosive products. This strategy fits with the 'code of practice' outlined in AEISG (2011) which advocates attention to proper explosives handling and usage with tightly controlled blasting conditions. This will lead to high efficiency in explosive combustion and minimizing of emissions.

b. Clarify whether Tier 4 technology will be used when it becomes available.

Response:

Tier 4 technology does not apply to 'blasting'.

However, acquisition of Tier 4 technology comes into play whenever CVRI contemplates engine replacements in existing equipment or acquisition of replacement or addition equipment. Consideration of lower emissions capability is considered in addition to engine operating and service history. In the near future Tier 4 will be standard manufacture on all newly acquired heavy equipment.

c. Clarify whether CVRI will be implementing an air quality monitoring program to determine when additional operational controls should be applied to reduce air quality emissions.

Response:

A long-term air quality monitoring program is currently planned for the community of Robb, starting when mining operations are several years from their closest approach to the community. CVRI would use the results of that monitoring to guide the need for additional operational control, as discussed in the response to ESRD SIR #34e).

CVRI notes that the results of modeling showed that all predictions at study area maximum points of impingement and in the community were below Alberta's ambient air quality objectives.

CVRI determined that additional dustfall monitoring is recommended to assess the impact of road watering and the mitigative effect of vegetation on road dust. It is expected this program would be established at one location near the haul road near the wash plant and at a location to be determined on the haul road nearer to the community of Robb. At both locations, CVRI anticipates a number of dustfall stations installed at increasing distance from the haul road to measure the decrease in dust deposition with distance.

45. Supplemental Information Request Responses, Response 224, Page 382.

Of the 18 discrete receptor locations (denoted as R1 to R18), 4 locations are not considered in the HHRA (R10, 11, 12, and 13).

a. Clarify why all four of these locations are not considered in Table 3-2, with specific attention to R11 (in Local Study Area) and R12 (identified as a campground).

Response:

As stated in the response to ESRD SIR #155 of the first round:

> *"The missing receptors (i.e., R10, R11, R12 and R13) were included in Table 3-2 and were included in the HHRA (CR #5). These receptors were included in the HHRA and are listed as R9 to R14 in Table 3-2, which includes R10, R11, R12 and R13."*

5. ERRATA

46. Supplemental Information Request Responses, Response 53, Page 113

Some ambient measurements appear to be misinterpreted by CVRI and used in the creation of the box plot. Based on the spread of data at each hour and the strong autocorrelation from one hour to the next, the box plots for Hour 4 are statistically significantly different from all other hours. This is clearly caused by an error in reporting of calibration hours as measurements.

a. The box plots for Hour 4 should be removed from the two graphs.

Response:

CVRI agrees that the Hour 4 data are caused by the inclusion in the Clean Air Strategic Alliance data warehouse of hours with calibration. CVRI has noted that issue in previous discussions with West Central Airshed Zone staff and has passed along this observation. Nonetheless, CVRI had plotted the data as provided.

As requested, CVRI has included updated boxplots in ESRD SIR2 Figure 46-1.

47. Supplemental Information Request Responses, Response 65, Page 126

It makes no material difference to the study results, but the explanation of mixing height calculation provided by CVRI is misleading.

CALMET recalculates mixing height for every hour and every grid cell using the micrometeorological module of the CALMET model as described starting on page 2-23. This explanation does reference twice daily temperature profiles, which may be the source of the confusion. However, the model was run (correctly) with no upper air data using MM5 prognostic fields only. In this case, the model uses the temperature profile from MM5 to perform the mixing height calculation.

As the response states, it is true that upper air and surface obs are among of the sources of data that may be input to MM5. The data may be included in re-analysis fields to set initial and boundary conditions (if reanalysis fields are used in the MM5 model run) or may be used to nudge the 3-D wind and temperature fields (if nudging is used). If such data are used they will obviously influence the MM5 solution, but the text in the report read as though the mixing heights are directly determined from twice daily soundings.

However, in neither CALMET in no obs mode nor MM5 are twice daily profiles directly used to calculate mixing heights.

a. The reference to mixing height and twice daily soundings is confusing and should be removed.

Response:

CVRI notes the reviewer's confusion and agrees with the explanation above. Sounding information was not included in the CALMET run. For that reason the following expressions should be removed from CR#1, Appendix B, and Section B2.3:

"Hourly surface heat fluxes, as well as the observed morning and afternoon temperature soundings, were used to calculate mixing heights. The minimum and maximum mixing heights allowed were 50 m and 3,000 m, respectively."

48. Supplemental Information Request Responses, Response 66, Page 126

a. Text should be changed to remove the discussion of interpolation as response indicates none was used.

Response:

MM5 data were used for temperature.

49. Supplemental Information Request Responses, Response 69, Page 130

The CALMET micrometeorological module calculates mixing heights for each hour for each grid cell. These are passed explicitly from the binary CALMET file to the CALPUFF model by this code in the rdmet subroutine:

```
c --- MIXING HEIGHT

      call rdr2d(io,itimes,htmix(1,1,kg),wrk1,mxnx,mxny,

     &          nxm(kg),nym(kg),clabel,

     &          ndathrb,nsecb,ndathre,nsece,ieof)
```

Which reads a 2-d array from the CALMET outputs and passes it to the HTMIX variable which is defined in the same subroutine as:

```
c       HTMIX(mxnx,mxny,mxmetdom) - real    - Mixing height (m)
```

The PRTMET utility only extracts and prints the value from what is held in a CALMET output file. It does no calculation and does not in any manner change the mixing height value to make it ‘explicit’.

a. The original text is incorrect and should be changed.

Response:

CVRI’s response to ESRD SIR #69 was as follows, in part: “... To obtain explicit values for mixing heights, the post-processor PRTMET must be run.”

CVRI did not mean to imply that PRTMET calculated mixing heights but rather that it is a means to access (or “extract”) mixing heights. CVRI apologizes for the confusion.

50. Supplemental Information Request Responses, Question 75a, Page 138 and Figures 75a-1 to 75a-6

CVRI provided a set of figures that show the anticipated final configuration of end pit lakes and channels. Some information on these figures is missing and/or unclear.

a. On all figures, most of the “prime” symbol to orient sections is the plan view is shown as a blank box in the section view. In the figure legend(s) a blank box is also shown in as the symbol for water. All legends needs to be expanded to explain what is shown in green in the plan views. Please provide corrected versions of all figures.

Response:

ESRD Figure 75a-1 to 75a-6 (listed as ESRD SIR2 Figure 17-1 to 17-7; response to ESRD SIR2 #17) have been revised and now contain the correct information within the legend.

b. On Figure 75a-2, the plan view horizontal scale of 1:12500 is different from the section view horizontal scale of 1:20000, which makes interpretation of the figure extremely difficult. Provide a revised figure that uses the same horizontal scale for the plan and section views.

Response:

ESRD Figure 75a-2 has been revised (listed as ESRD SIR2 Figure 17-2). The plan view horizontal scale and the section view horizontal scale are now both 1:15000.

c. On Figure 75a-3, the plan view horizontal scale of 1:25000 is different from the section view horizontal scale of 1:20000, which makes interpretation of the figure extremely difficult. Also, the legend uses non-unique blank boxes to identify pit bottom and final grade. One of the water level lines on the section view is identified with as a Lake blank box, and another line is identified as an non-specific lake. Provide a revised figure that uses the same horizontal scale for the plan and section views and correct the other omissions and errors.

Response:

ESRD Figure 75a-3 has been revised (listed as ESRD SIR2 Figure 17-3). The plan view horizontal scale and section view horizontal scale are now both 1:25000. The above mentioned ‘blank boxes’ and legend have been revised accordingly.

d. On Figure 75a-4, the plan view horizontal scale of 1:12500 is different from the section view horizontal scale of 1:20000, which makes interpretation of the figure extremely difficult. Section B’ shows a sloping channel through a reach that is shown as a lake in the plan view. Section C-C’ shows a diversion bridge which is not shown in the plan view. Provide a revised figure that uses the same horizontal scale for the plan and section views, eliminates the discrepancy about whether B-B’ is through a lake, and which and shows the Section C-C’ diversion bridge location in the plan view. The legend needs to identify the meaning of the dashed line shown in plan view for a portion of Bacon Creek.

Response:

ESRD Figure 75a-4 has been revised (listed as ESRD SIR2 Figure 17-4). The plan view horizontal scale and section view horizontal scale are now both 1:20000. The discrepancy’s related to section B-B’ and C-C’ have been revised and the legend has been updated accordingly to reflect all symbols.

e. On Figure 75a-5, there is a diversion bridge shown on Section A-A’ which is not shown in the plan view. Provide a revised figure that shows the diversion bridge in the plan view.

Response:

ESRD Figure 75a-5 has been revised (listed as ESRD SIR2 Figure 17-5). The diversion bridge is now shown on Section A-A' on the plan view.

f. On Figure 75a-6, the plan view horizontal scale of 1:12500 is different from the section view horizontal scale of 1:20000, which makes interpretation of the figure extremely difficult. There are two diversion bridges shown in the sections, neither of which is shown in plan view. Characters are missing from the section view water level labels. Provide a revised figure that uses the same horizontal scale for the plan and section views, and which shows the diversions bridge locations in the plan view, and corrects other errors.

Response:

ESRD Figure 75a-6 has been revised (listed as ESRD SIR2 Figure 17-6). The plan view horizontal scale and the section view horizontal scale are now both 1:15000. The diversion bridges are now shown on the plan view and the missing water level labels on the section view have also been added.

g. On Figure 75a-6, the orientation of Section A'-A in the plan view is reversed from the A-A' orientation in the section view, which complicates the interpretation of the figure. Provide a revised figure which uses a consistent orientation, preferably left-to-right

Response:

ESRD Figure 75a-6 has been revised (listed as ESRD SIR2 Figure 17-6). The orientation of Section A-A' is now consistent (left –to-right) for both the plan view and the section view.

51. Supplemental Information Request Responses, Response 132c, Page 224

In the last sentence on page 224, CVRI states Bi-directional surface runoff from the reclaimed area will be added to the non-disturbed organic soil in continued support of pre-disturbance conditions so that adverse effect is expected in the long term.

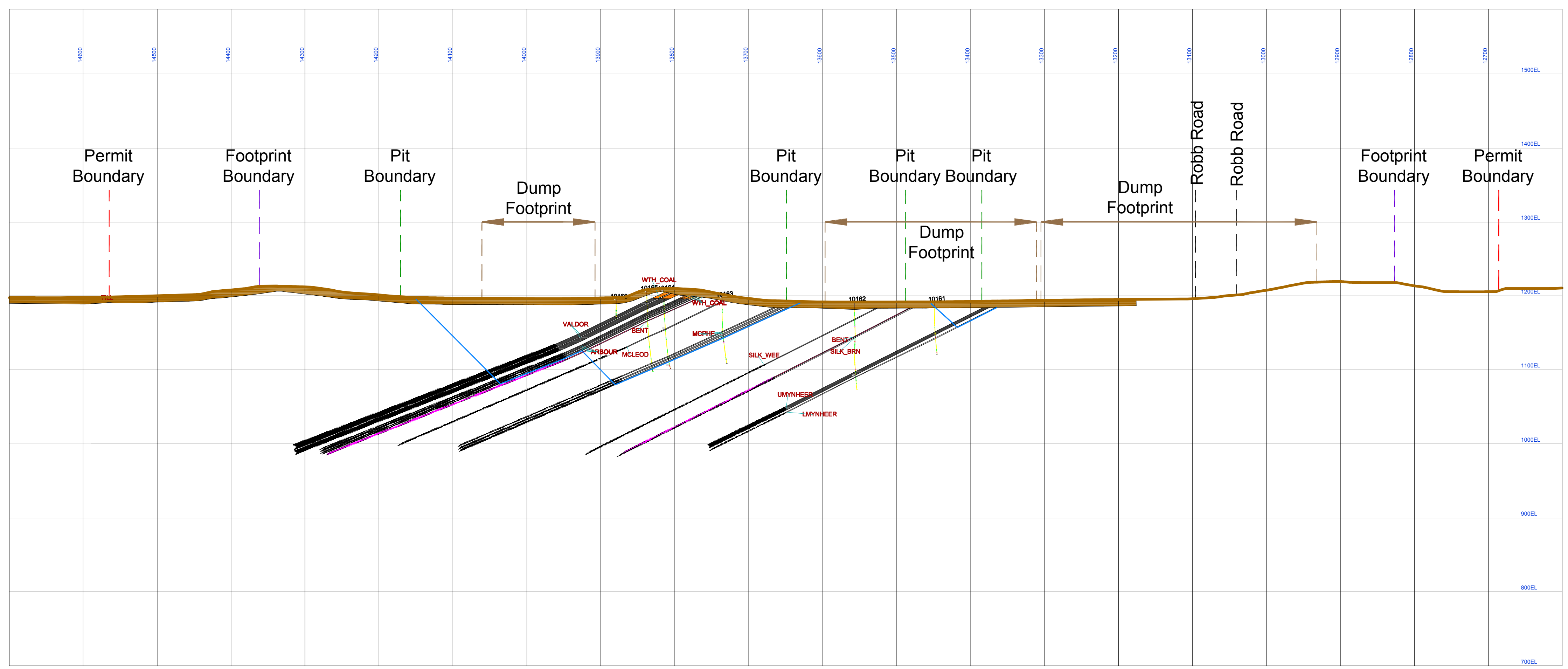
a. Confirm if this sentence should read "… so that no adverse effect is expected in the long term".

Response:

The last sentence on page 224 in response to ESRD SIR #132c) should read:

> *"Bi-directional surface runoff from the reclaimed area will be added to the non-disturbed organic soil in continued support of pre-disturbance conditions so that <u>no adverse</u> effect is expected in the long-term."*

ERCB FIGURES



LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

	BY	DATE
DRAWN	MD/JG/RS	Jun 13, 2013
CHECKED	SL	Nov 15, 2012

SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-1

ROBB TREND
SEC -3600E
(Section Looking East)

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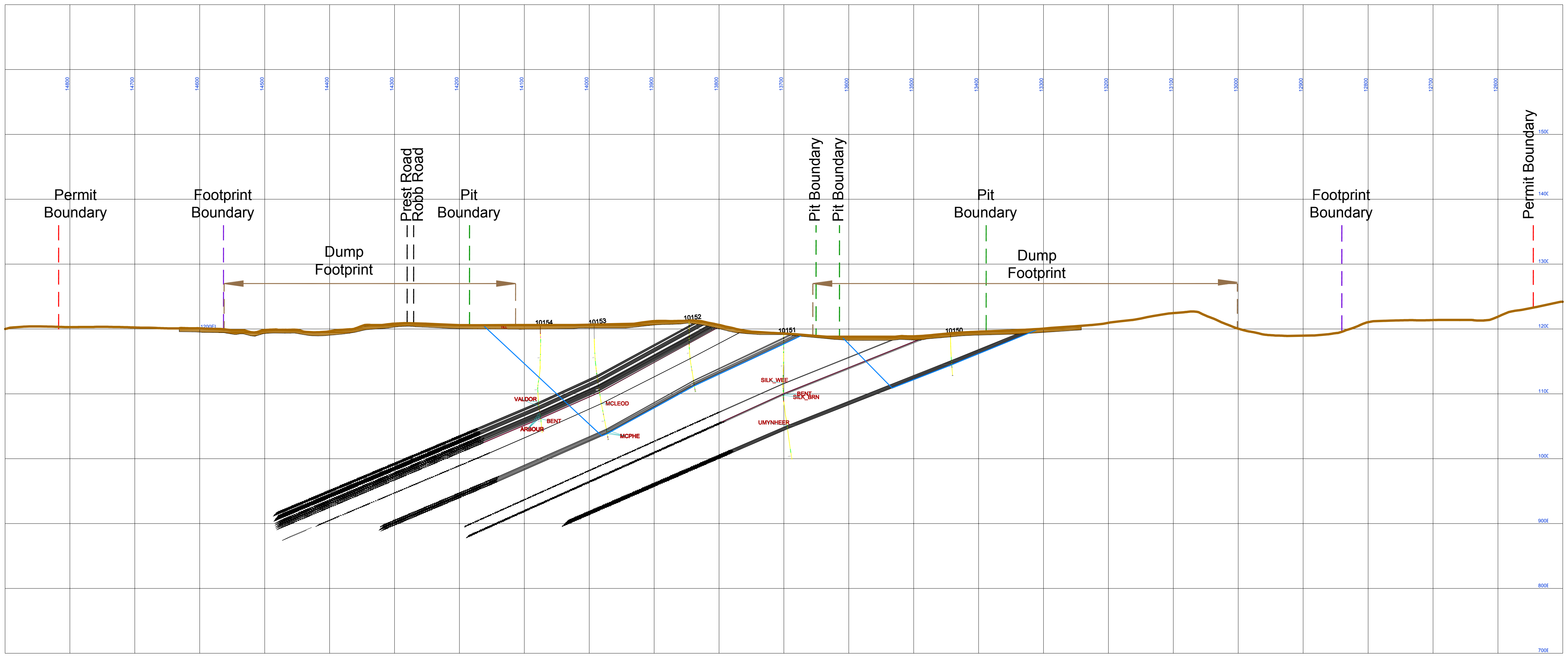

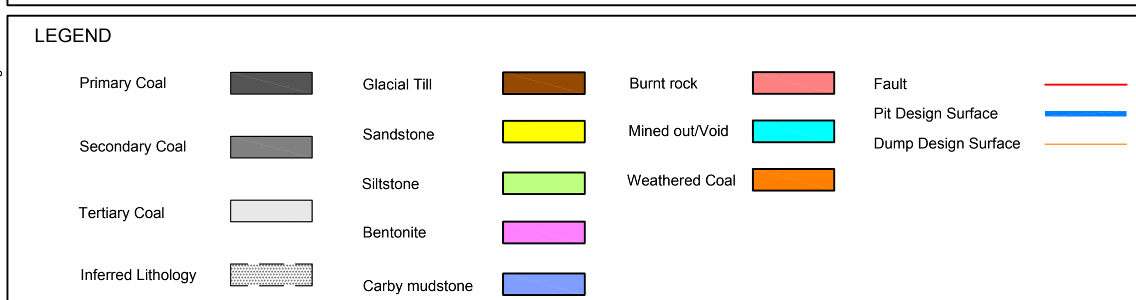

STRATIGRAPHY	
Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO. Fig 3-2

ROBB TREND
SEC -2800E
(Section Looking East)

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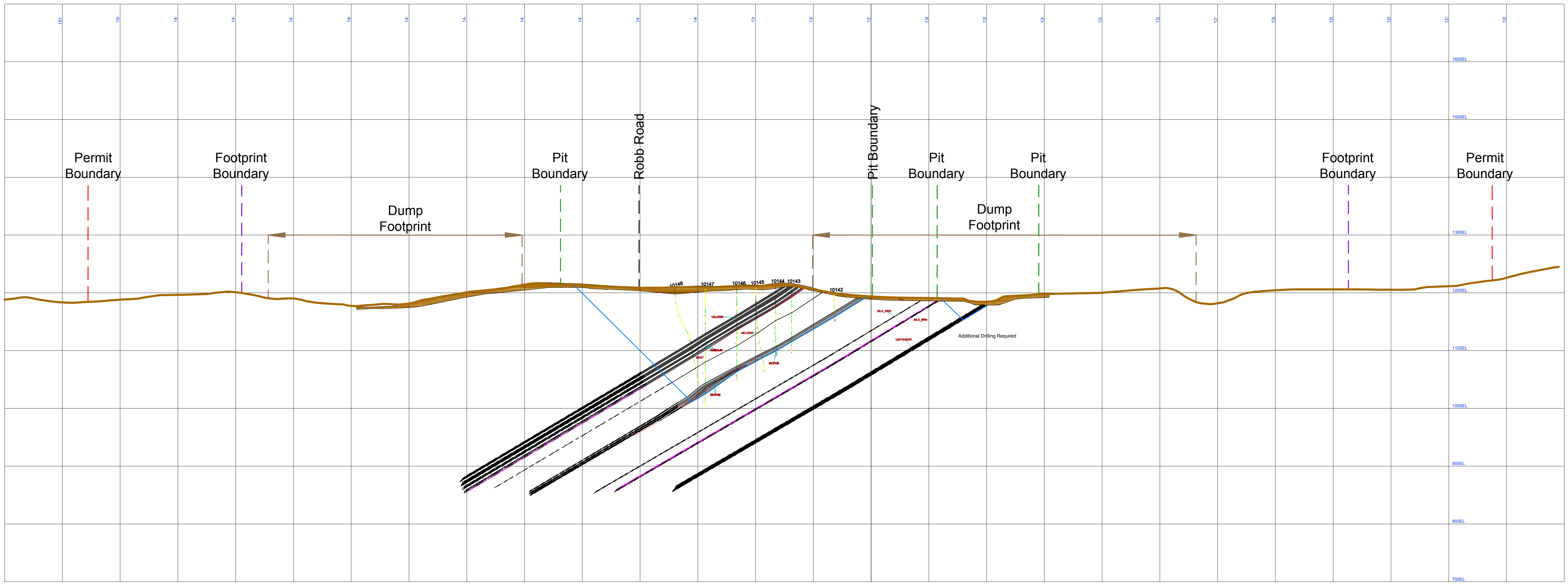

LEGEND

Primary Coal	Glacial Till	Burnt rock
Secondary Coal	Sandstone	Mined out/Void
Tertiary Coal	Siltstone	Weathered Coal
Inferred Lithology	Bentonite	
	Carby mudstone	

Fault
Pit Design Surface
Dump Design Surface

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

cvri

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NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-3

ROBB TREND
SEC -2450E
(Section Looking East)

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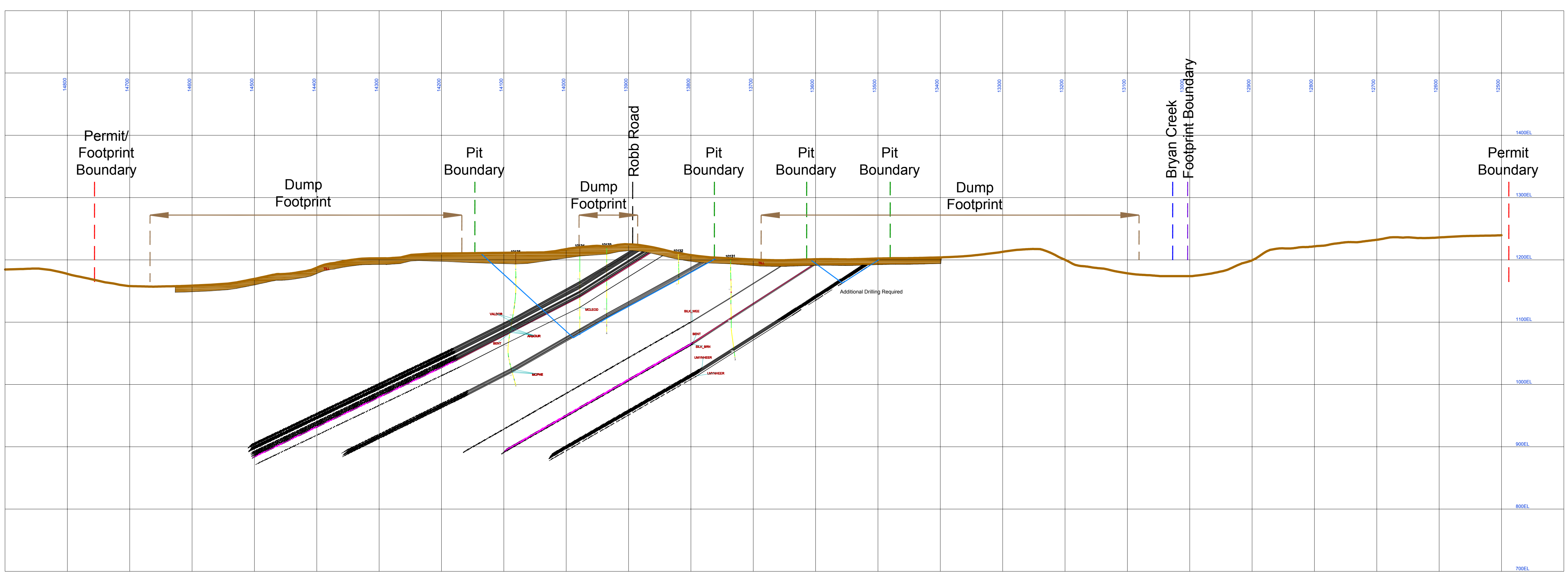

LEGEND

- Primary Coal
- Secondary Coal
- Tertiary Coal
- Inferred Lithology
- Glacial Till
- Sandstone
- Siltstone
- Bentonite
- Carby mudstone
- Burnt rock
- Mined out/Void
- Weathered Coal
- Fault
- Pit Design Surface
- Dump Design Surface

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO. Fig 3-4

ROBB TREND

SEC -1650E

(Section Looking East)

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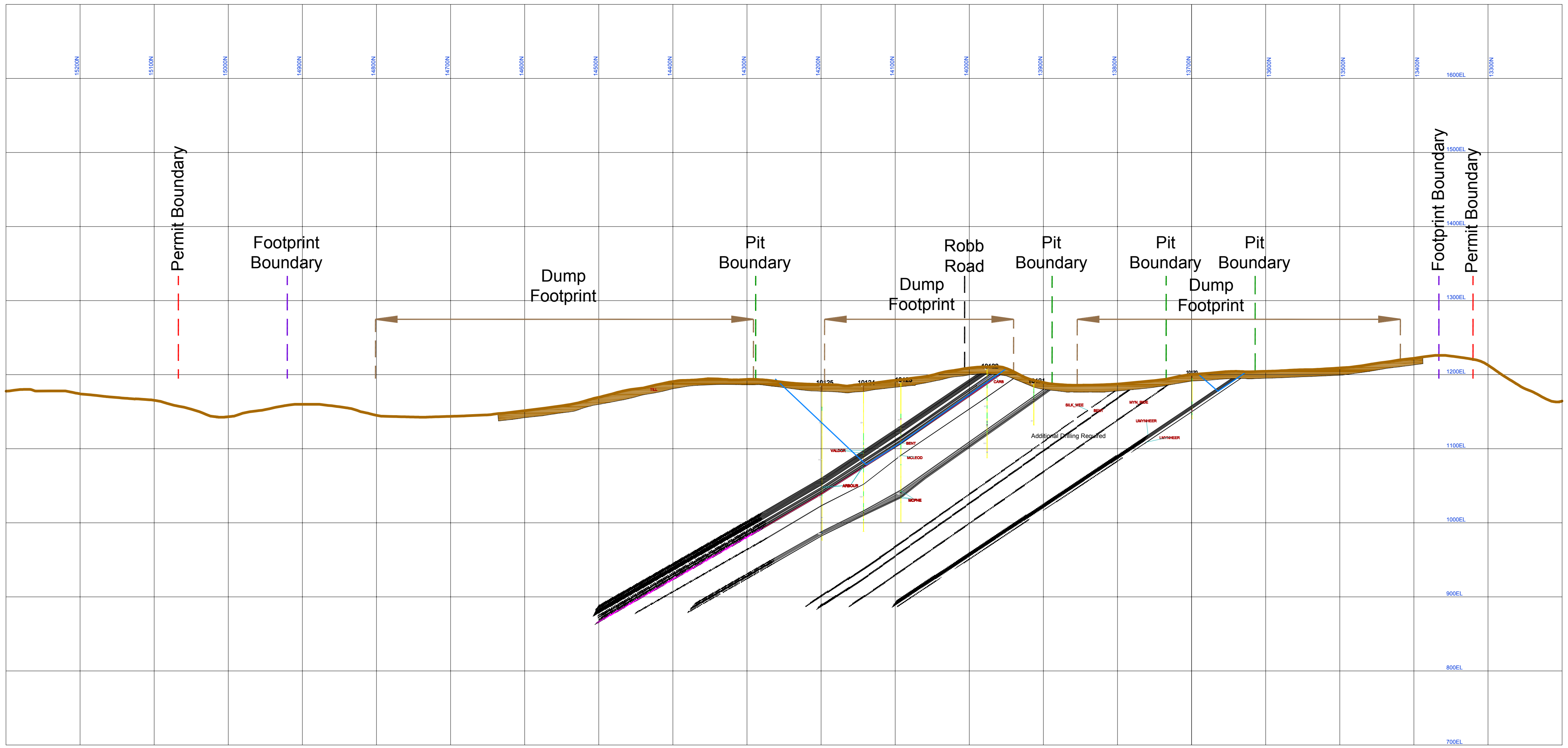

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-5

ROBB TREND
SEC -900E
(Section Looking East)

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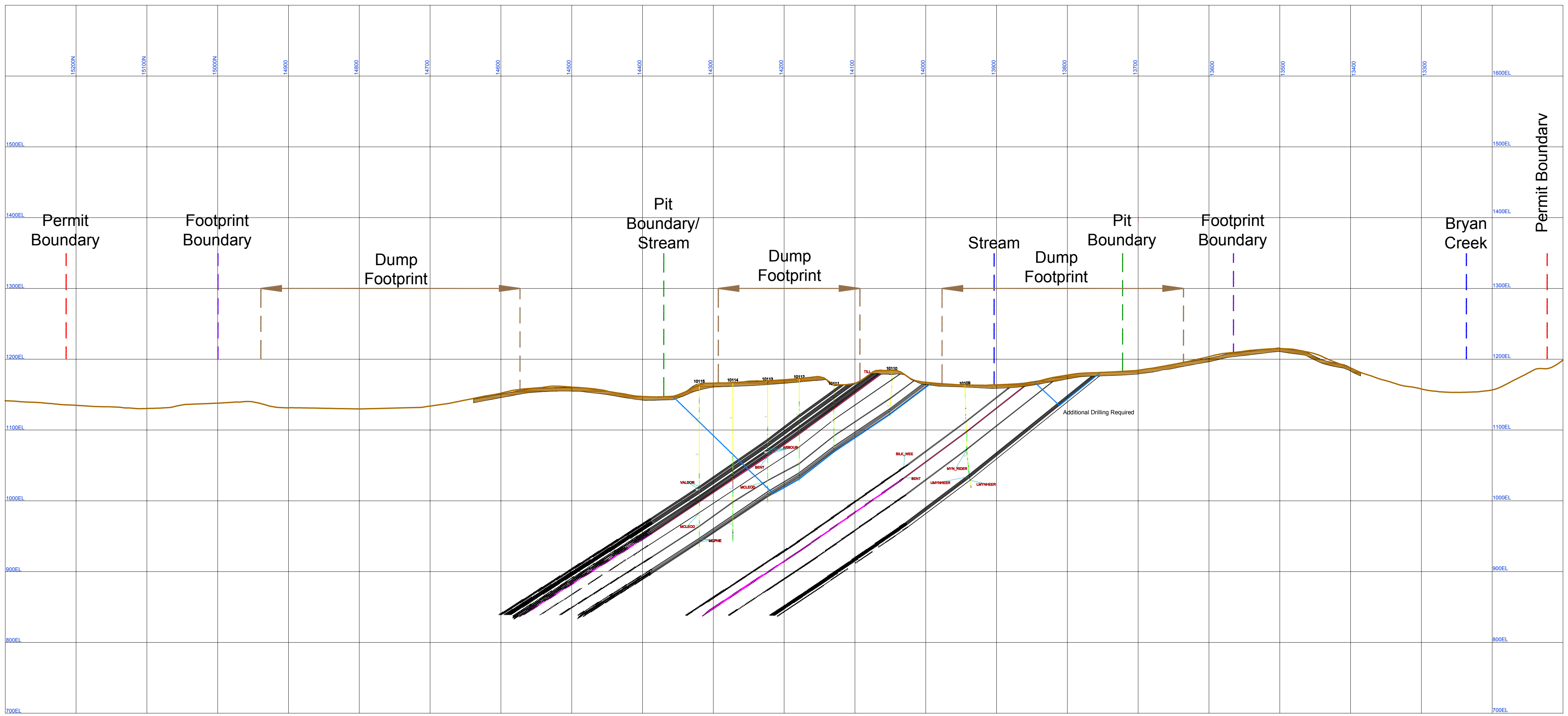

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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DRAWING NO. Fig 3-6

ROBB TREND
SEC -100E
(Section Looking East)

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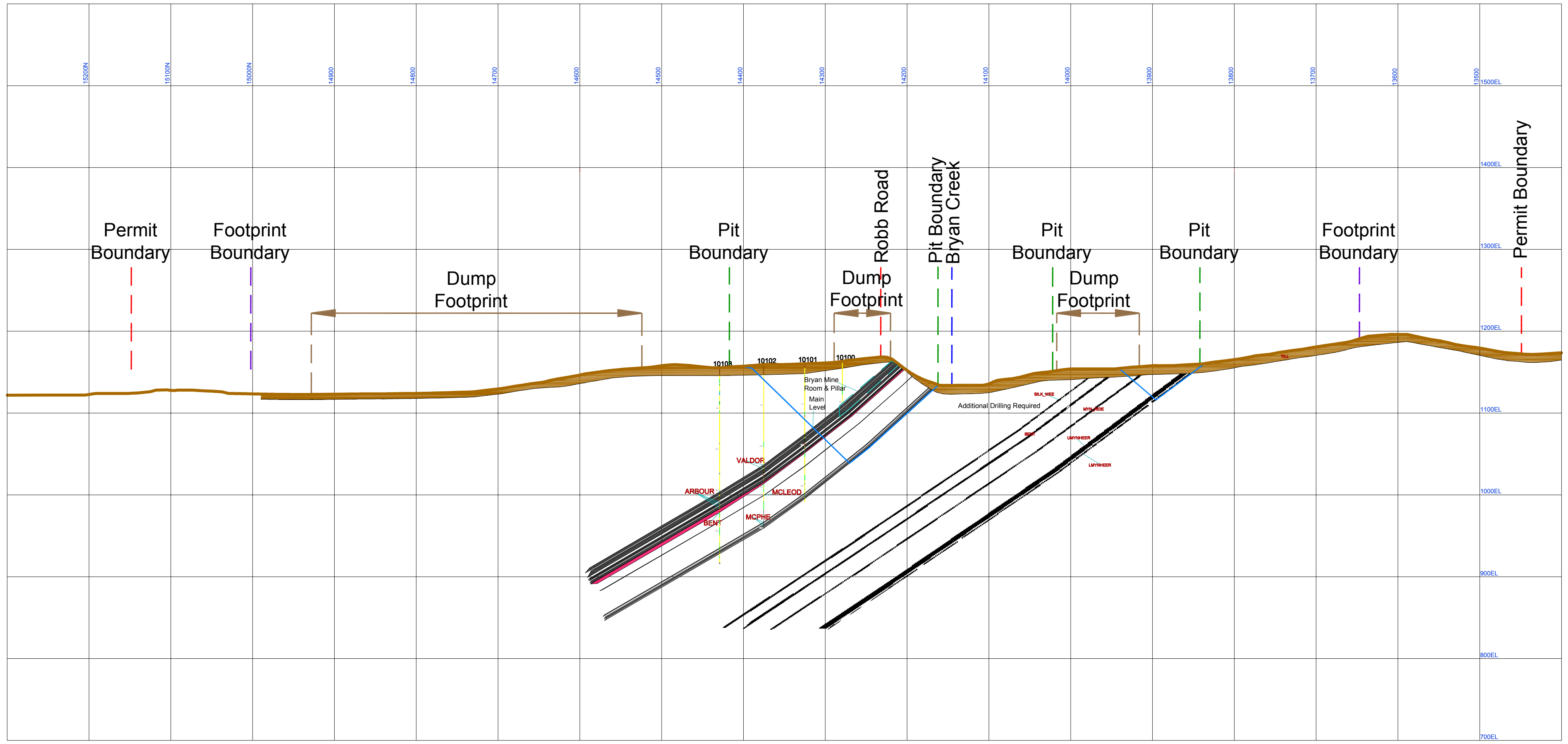

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-7

ROBB TREND
SEC 700E
(Section Looking East)

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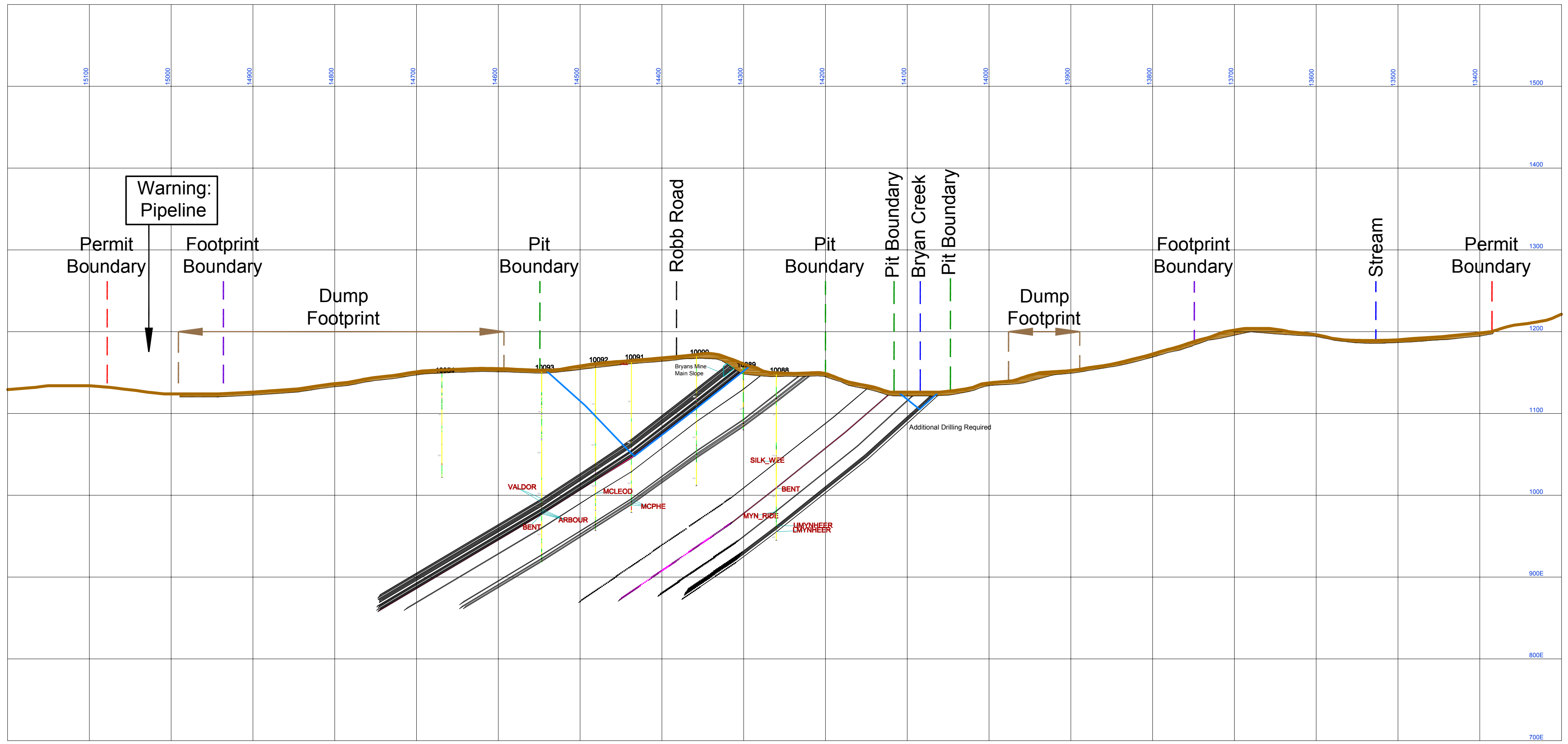

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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DRAWING NO.
Fig 3-8

ROBB TREND
SEC 1500E
(Section Looking East)

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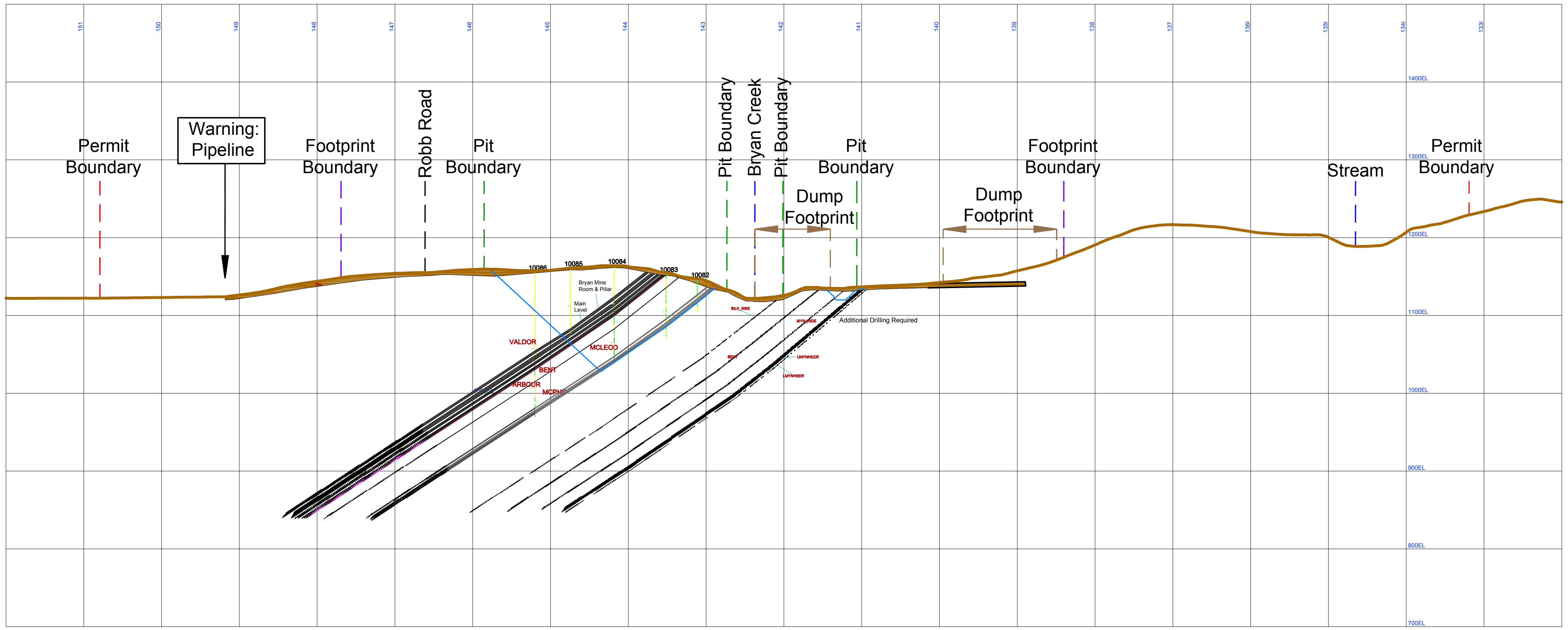

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

cvri

	BY	DATE
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SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-9

ROBB TREND
SEC 1900E
(Section Looking East)

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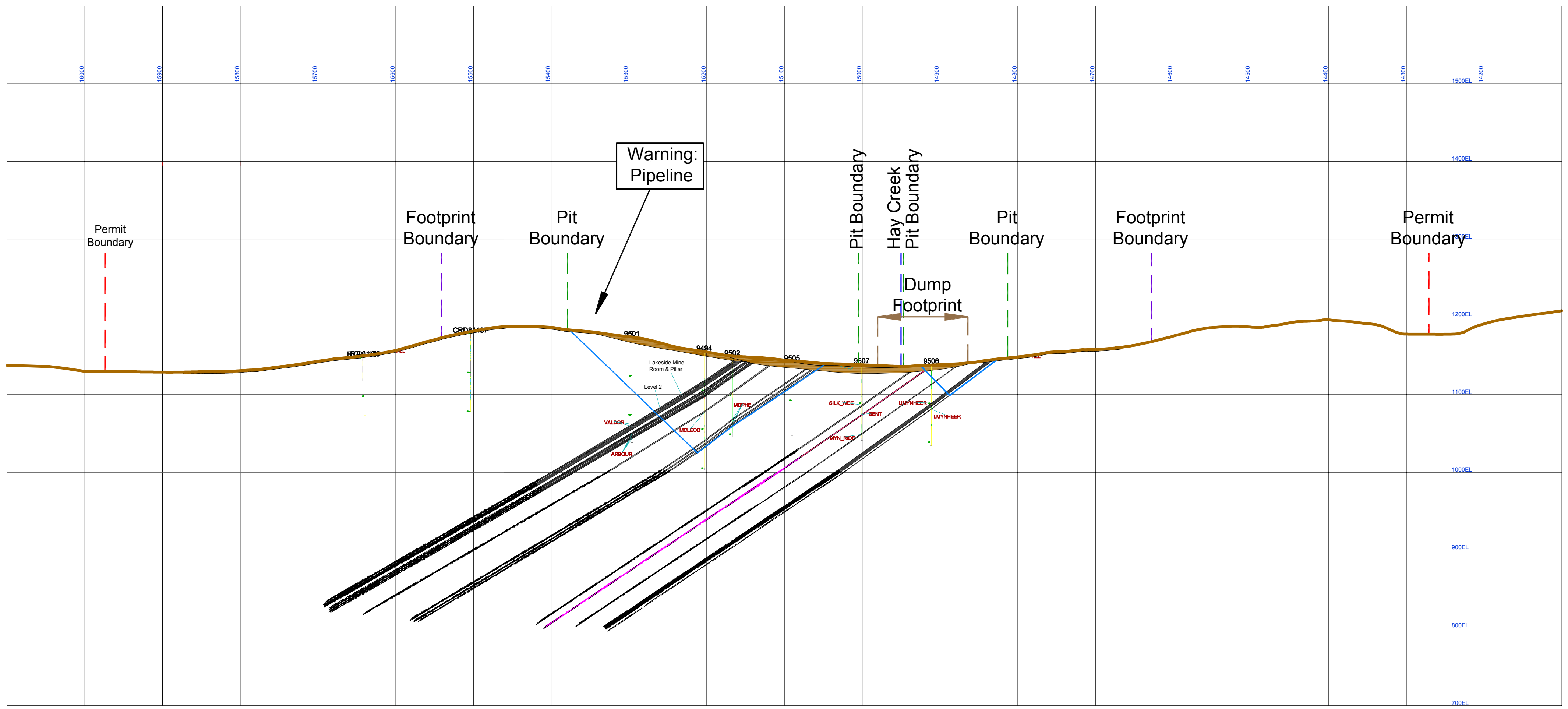

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
		Bentonite					
Inferred Lithology		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

	BY	DATE
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SCALE		

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-10

ROBB TREND
SEC 5900E
(Section Looking East)

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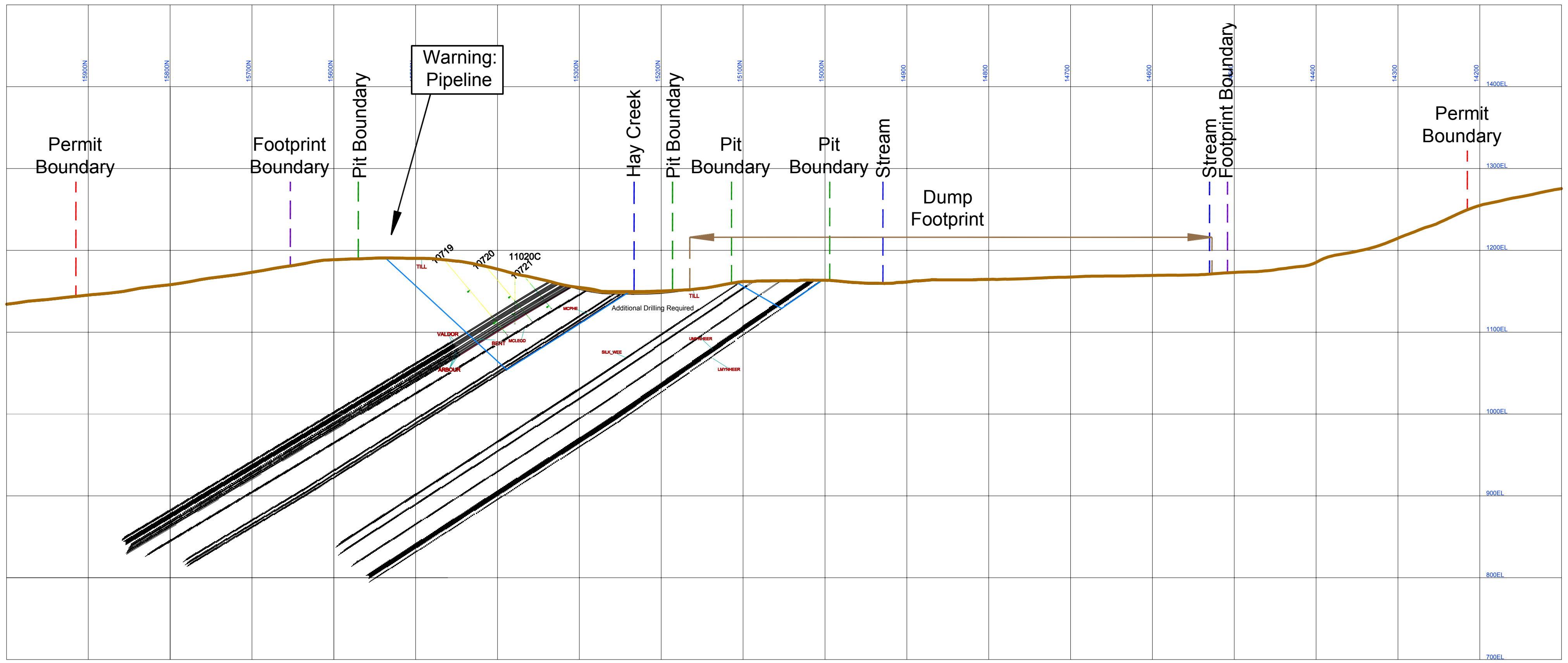

LEGEND

Primary Coal	Glacial Till	Burnt rock
Secondary Coal	Sandstone	Mined out/Void
Tertiary Coal	Siltstone	Weathered Coal
Inferred Lithology	Bentonite	
	Carby mudstone	

Fault
Pit Design Surface
Dump Design Surface

STRATIGRAPHY

Seam	Code
Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

	BY	DATE
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CHECKED	SL	Nov 19, 2012

SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-11

ROBB TREND
SEC 6800E
(Section Looking East)

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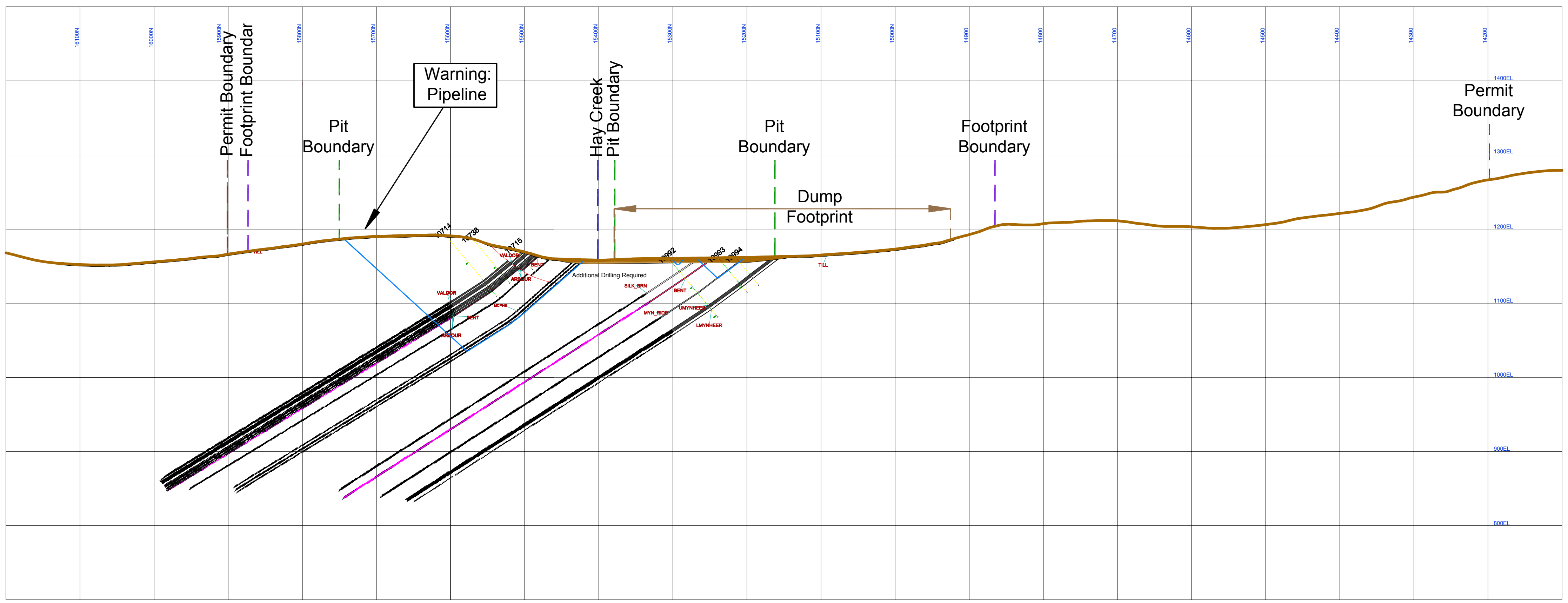

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

	BY	DATE
DRAWN	MD/JG/RS	Jun 10, 2013
CHECKED	SL	Nov 19, 2012

SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.

Fig 3-12

ROBB TREND

SEC 7600E

(Section Looking East)

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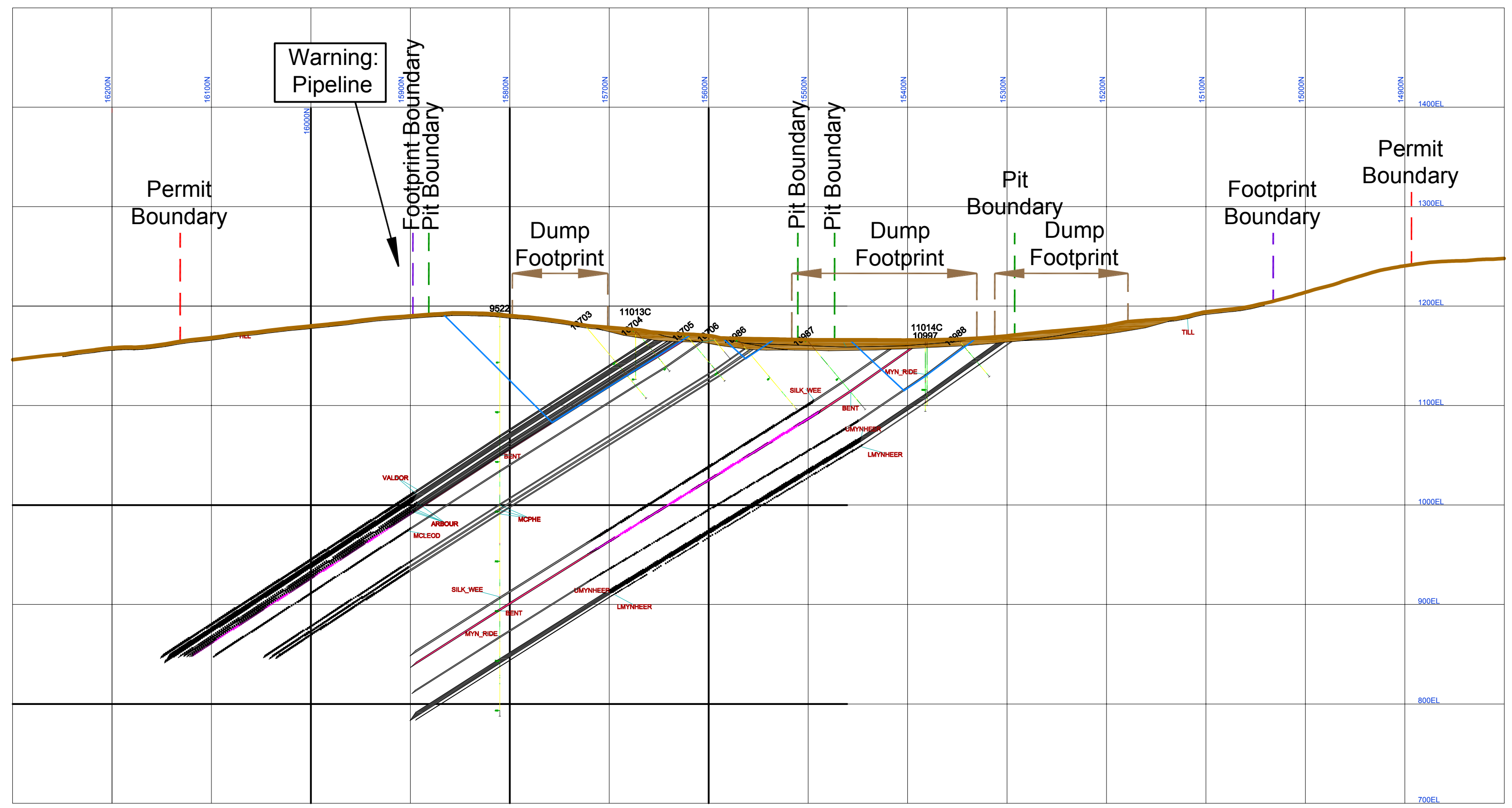

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

cvri

	BY	DATE
DRAWN	MD/JG/RS	Jun 10, 2013
CHECKED	SL	Nov 19, 2012

SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-13

ROBB TREND
SEC 8400E
(Section Looking East)

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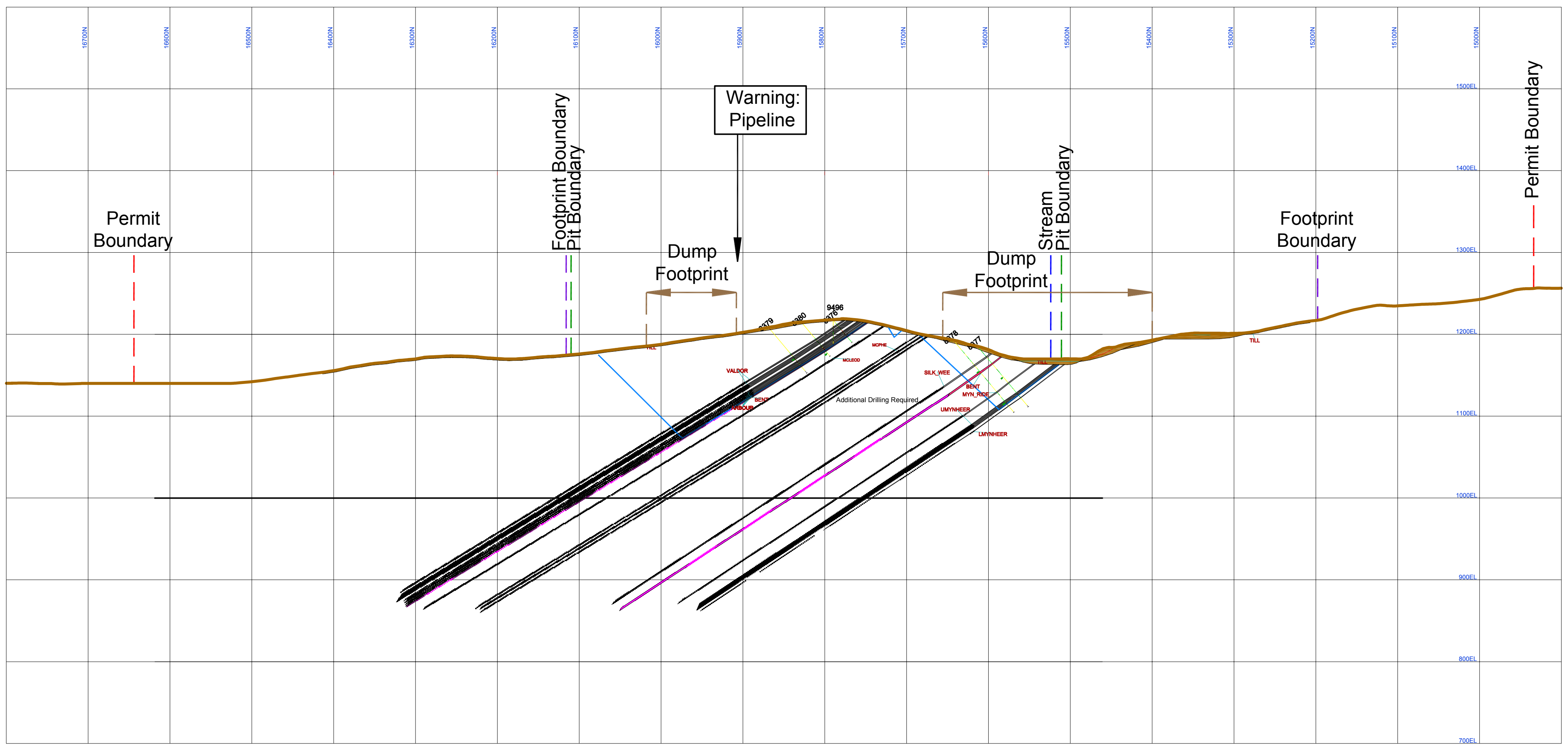

LEGEND

Primary Coal	Glacial Till	Burnt rock
Secondary Coal	Sandstone	Mined out/Void
Tertiary Coal	Siltstone	Weathered Coal
Inferred Lithology	Bentonite	
	Carby mudstone	

Fault

Pit Design Surface

Dump Design Surface

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

cvri

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CHECKED	SL	Nov 19, 2012

SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

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Fig 3-14

ROBB TREND
SEC 9500E
(Section Looking East)

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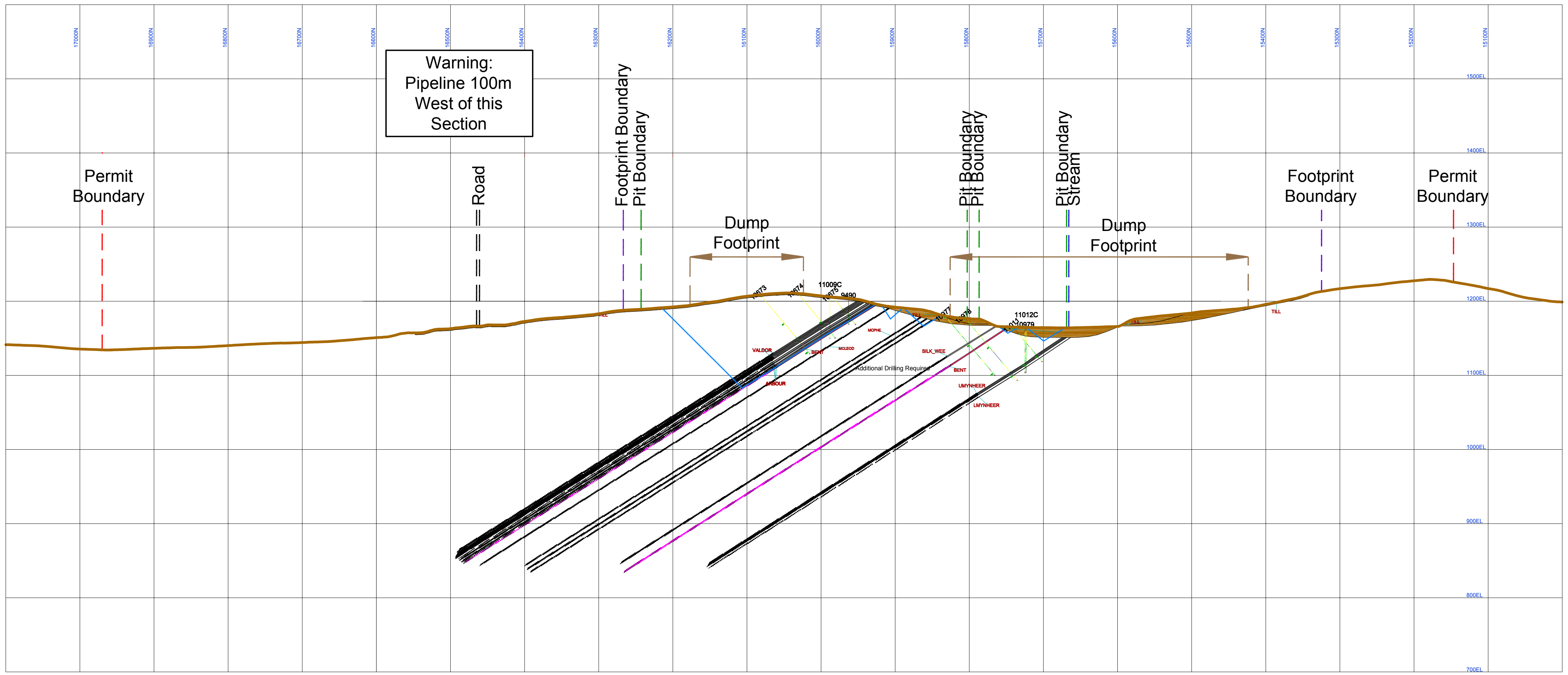

LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault		
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface		
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface		
Inferred Lithology	Bentonite				
	Carby mudstone				

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-15

ROBB TREND
SEC 10400E
(Section Looking East)

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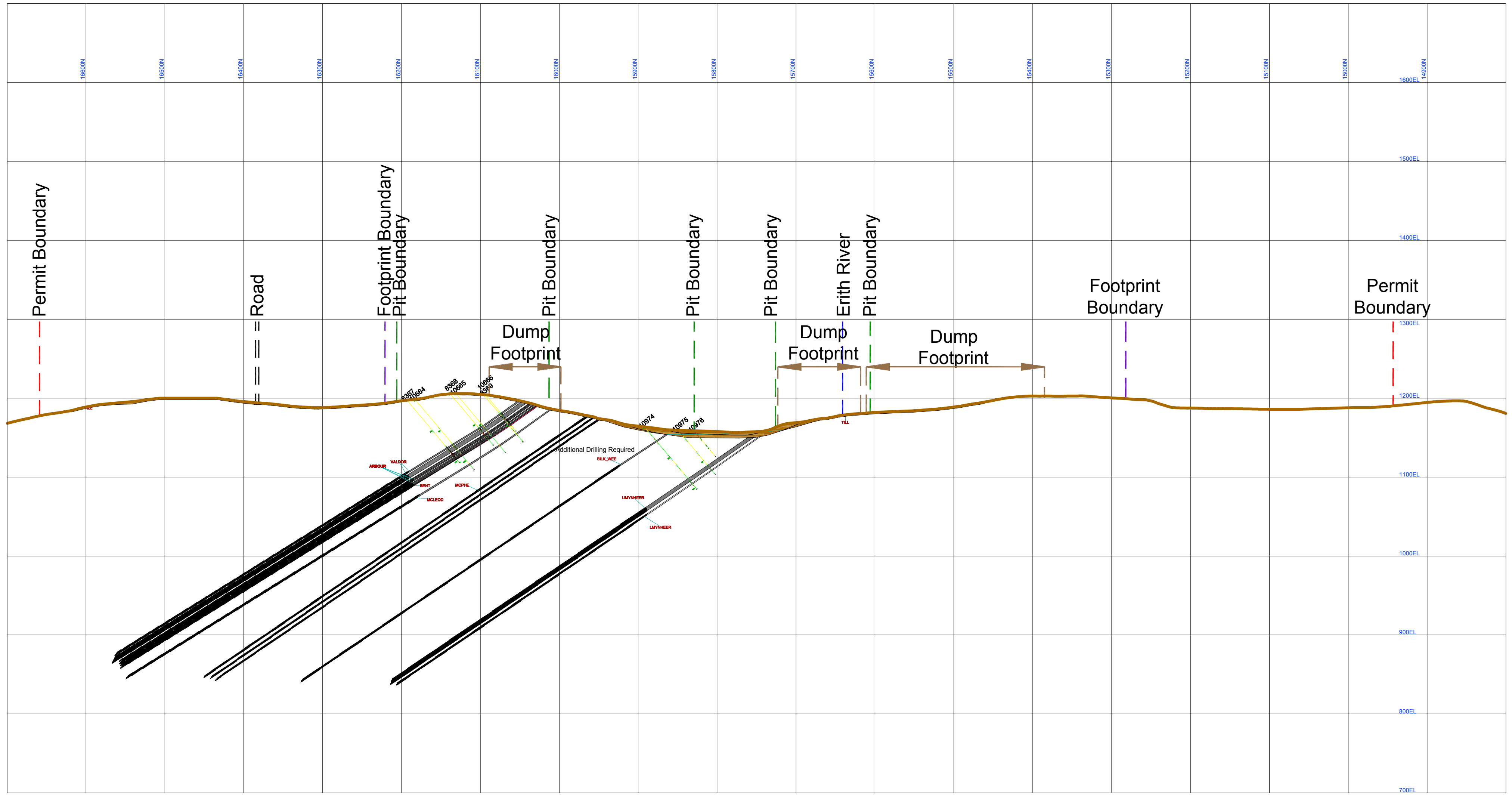

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface
Inferred Lithology		Bentonite				
		Carby mudstone				

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-16

ROBB TREND
SEC 11000E
(Section Looking East)

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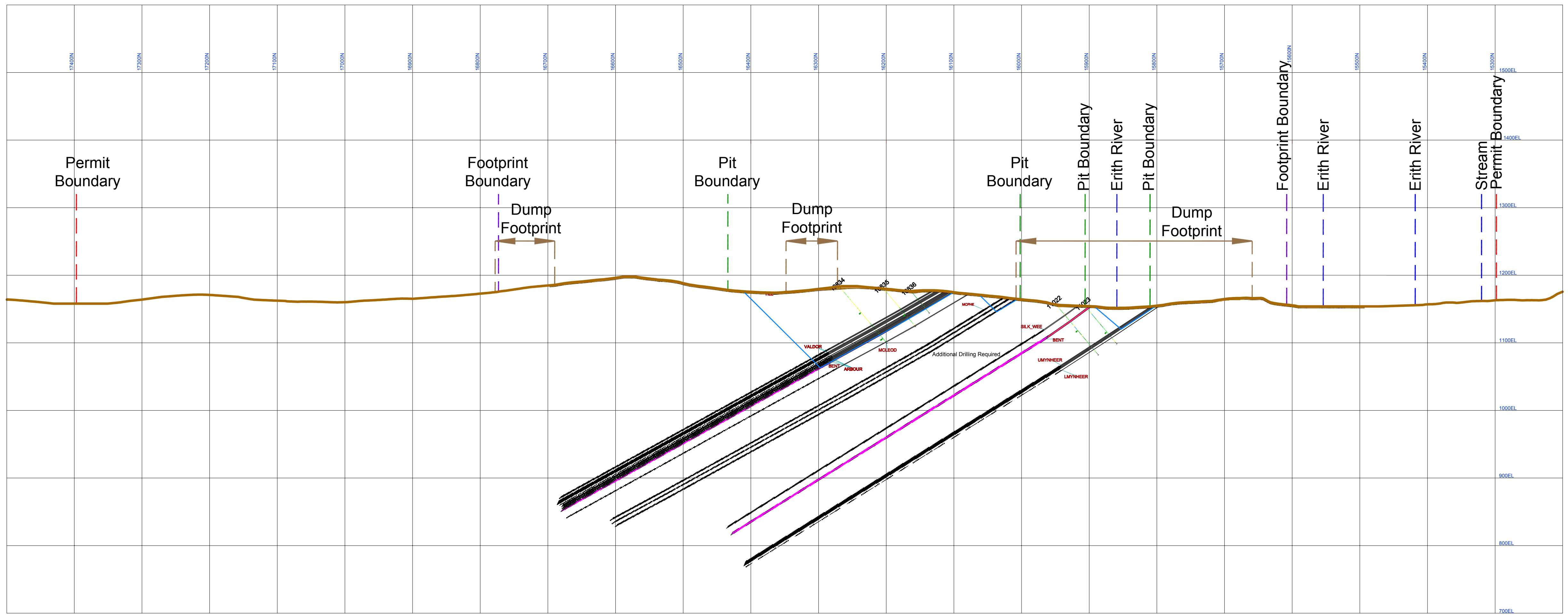

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-17

ROBB TREND
SEC 11400E
(Section Looking East)

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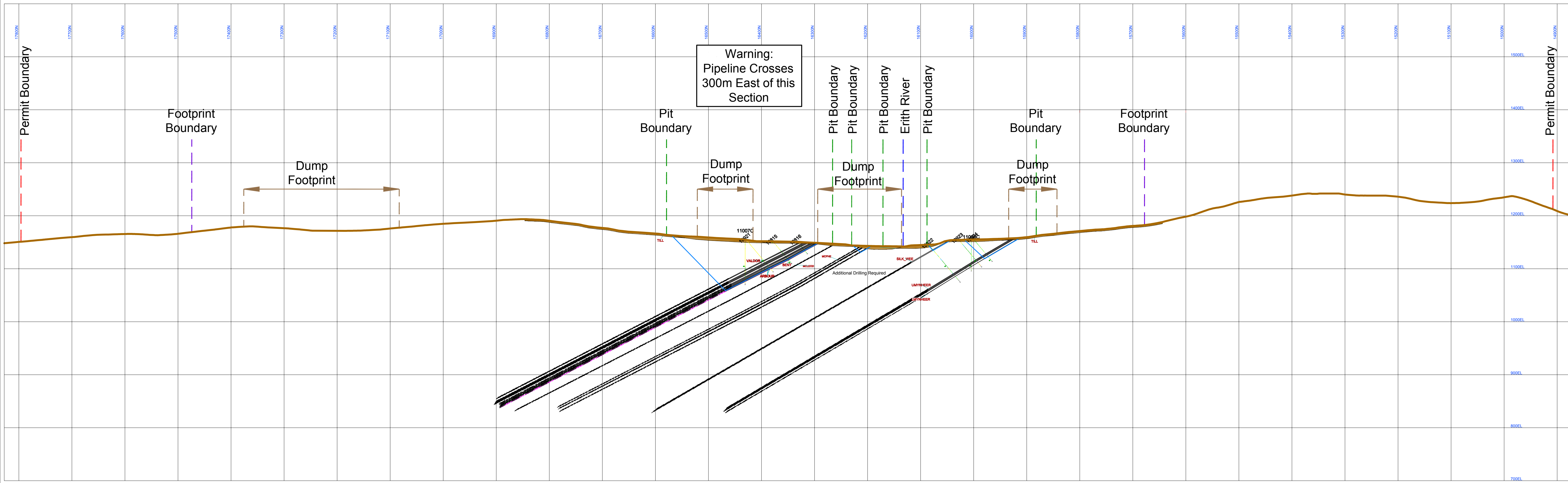

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-18

ROBB TREND
SEC 12400E
(Section Looking East)

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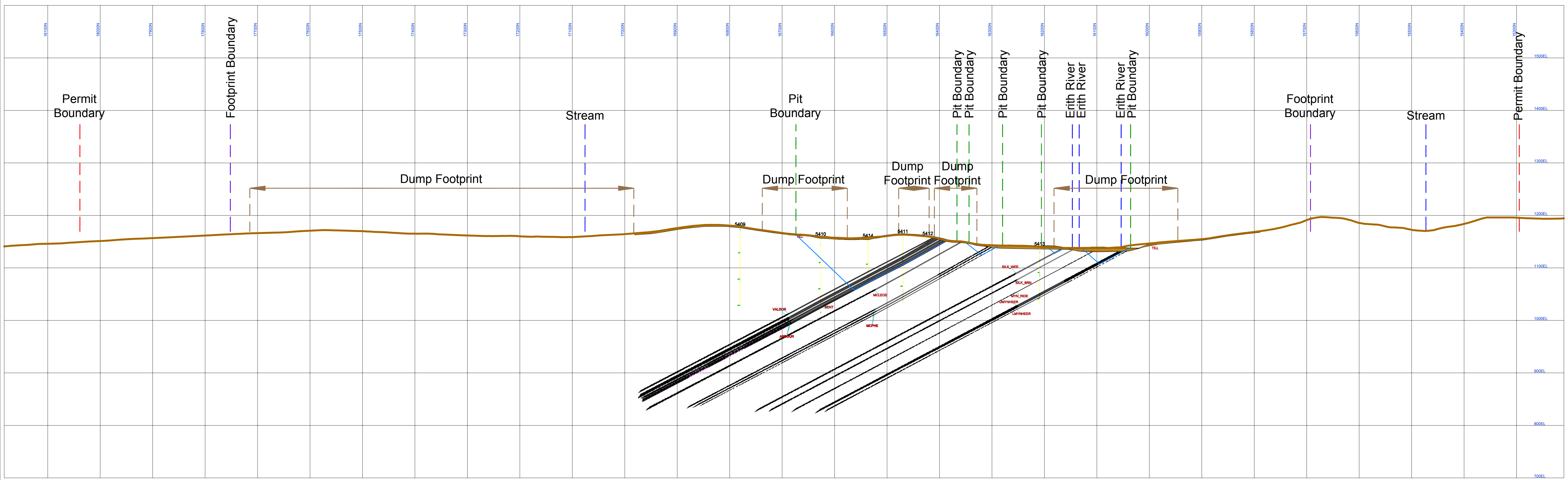

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-19

ROBB TREND
SEC 13400E
(Section Looking East)

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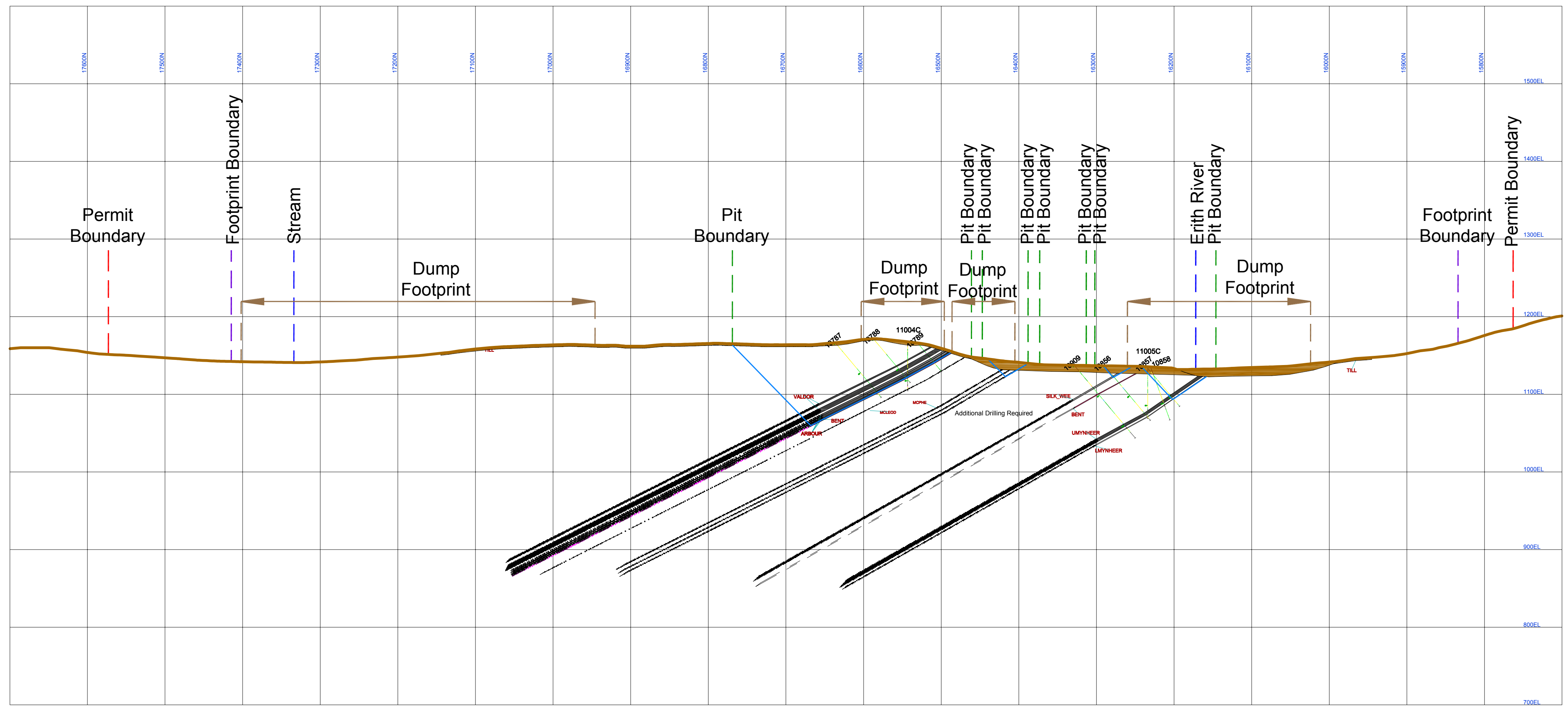

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-20

ROBB TREND
SEC 14400E
(Section Looking East)

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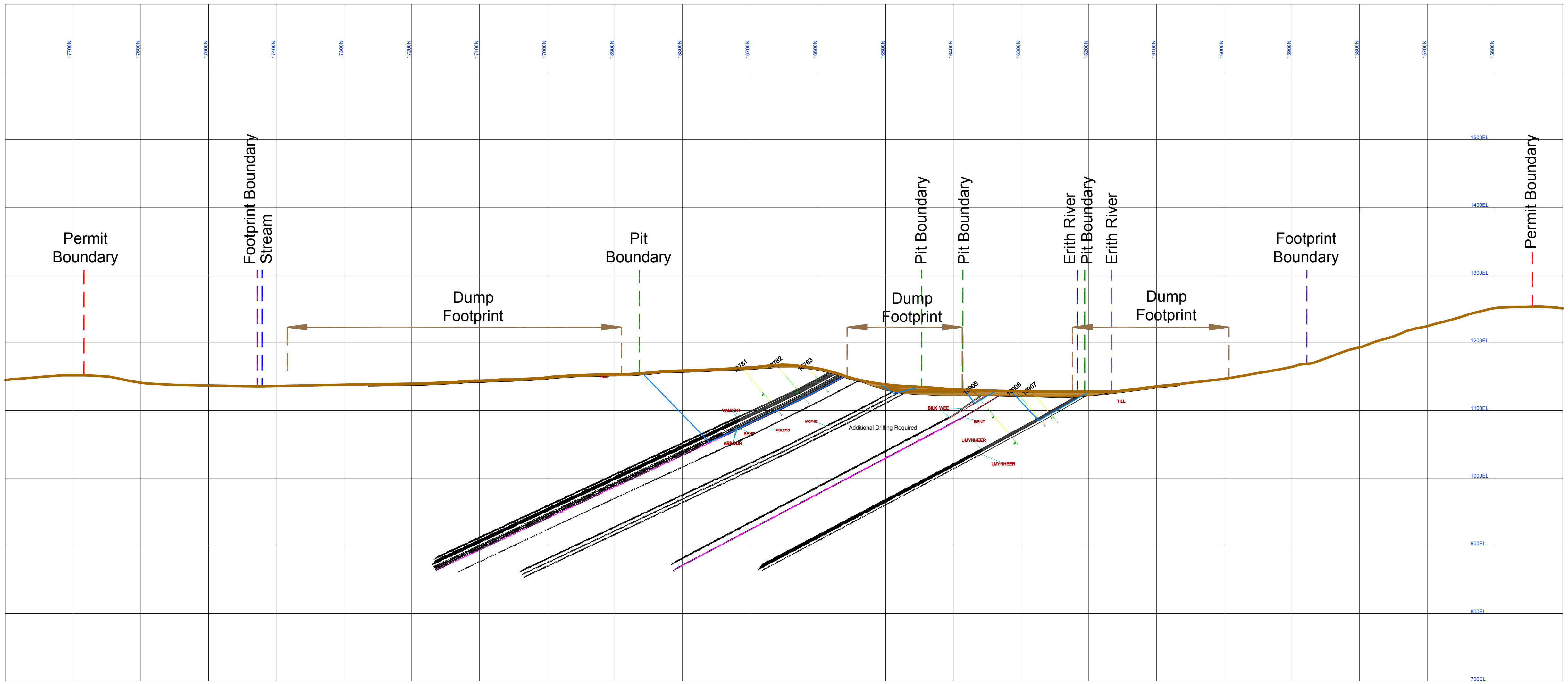

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LEGEND

Primary Coal	Glacial Till	Burnt rock
Secondary Coal	Sandstone	Mined out/Void
Tertiary Coal	Siltstone	Weathered Coal
Inferred Lithology	Bentonite	
	Carby mudstone	

Fault

Pit Design Surface

Dump Design Surface

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-21

ROBB TREND
SEC 15200E
(Section Looking East)

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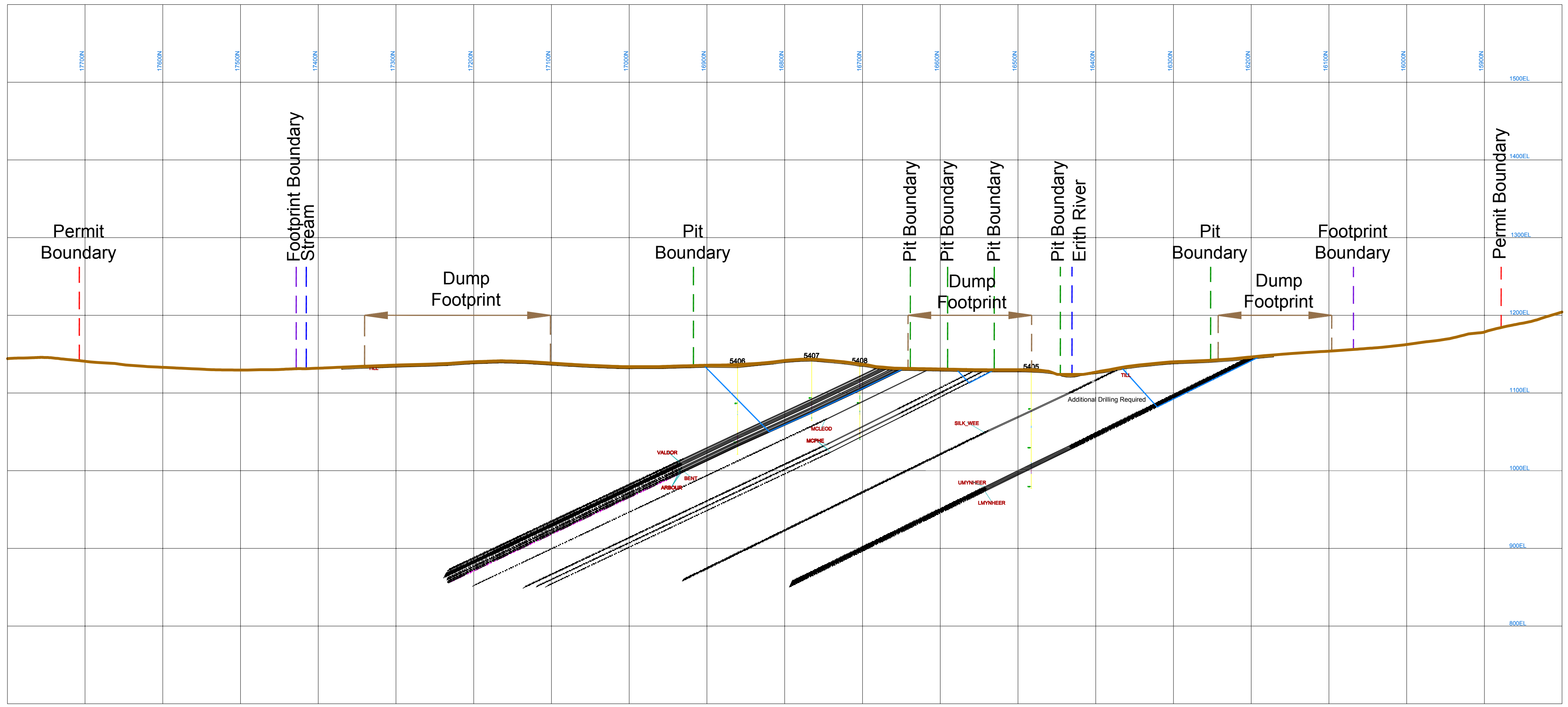

LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-22

ROBB TREND
SEC 15900E
(Section Looking East)

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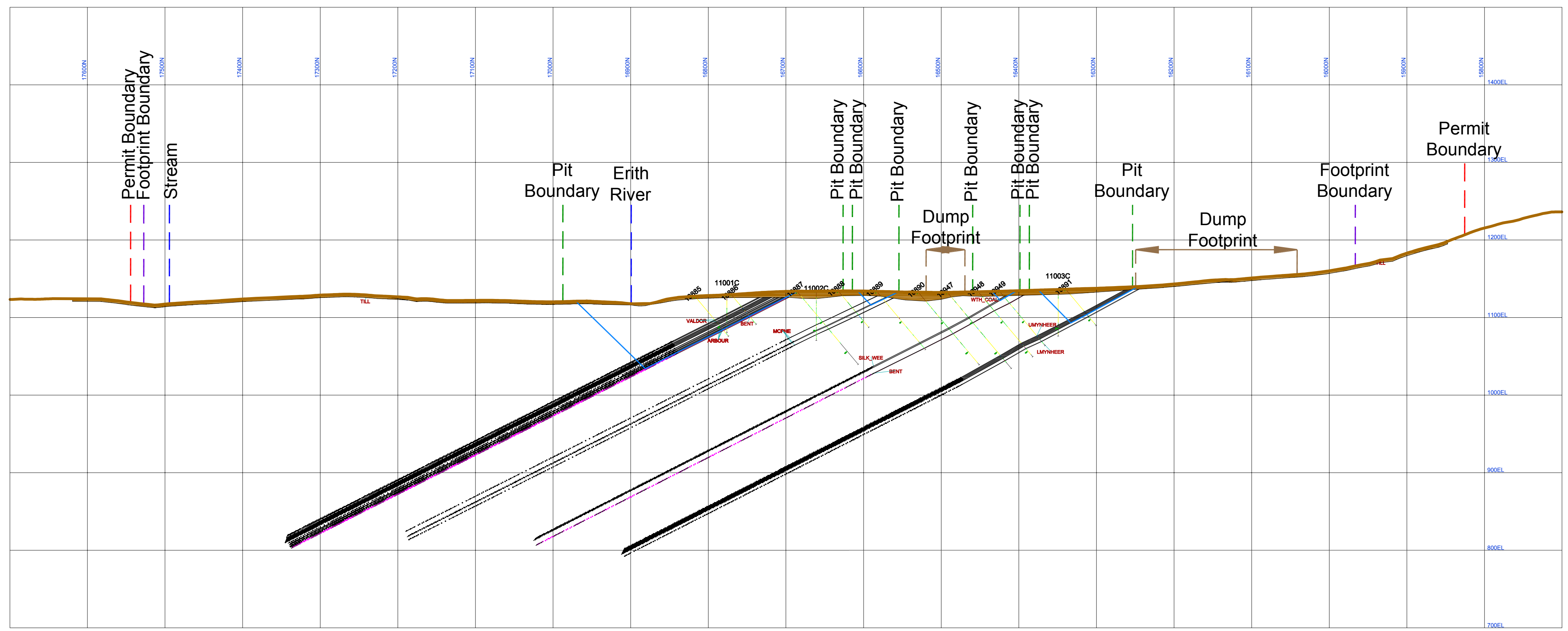

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-23

ROBB TREND
SEC 16600E
(Section Looking East)

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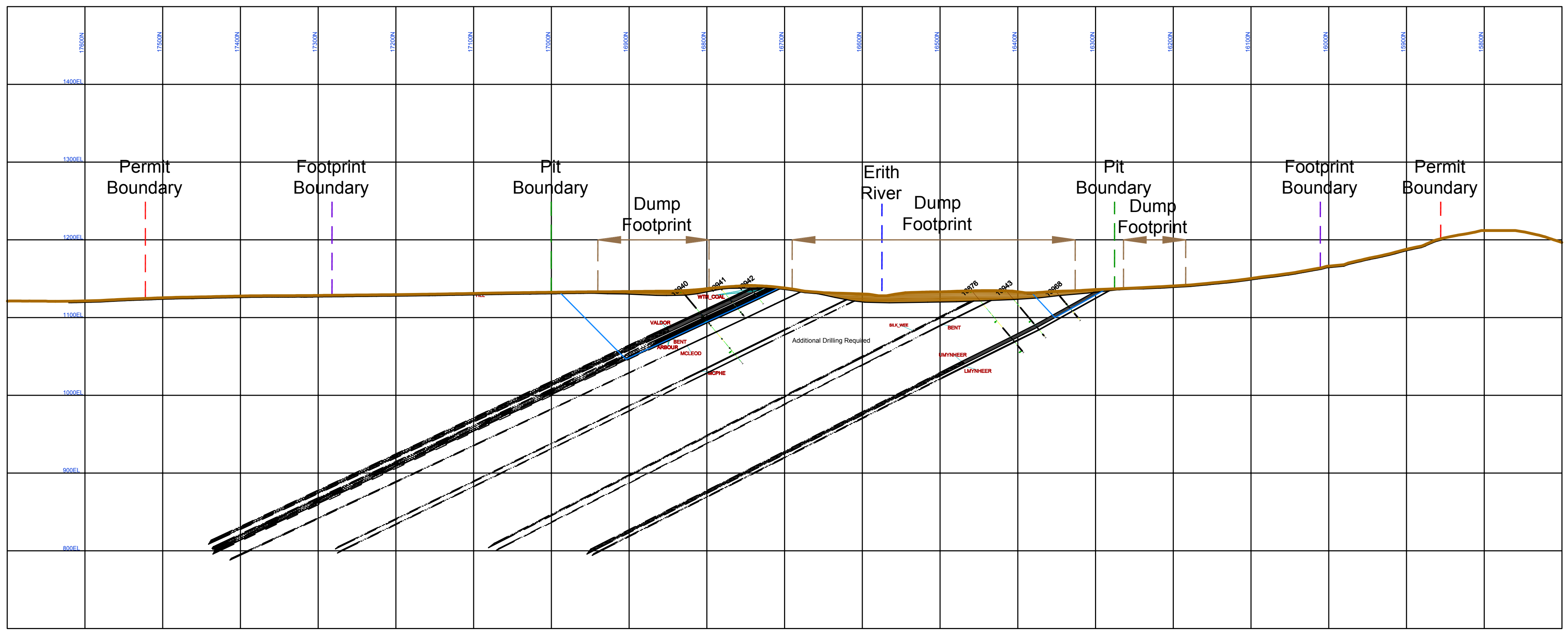

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-24

ROBB TREND

SEC 17400E

(Section Looking East)

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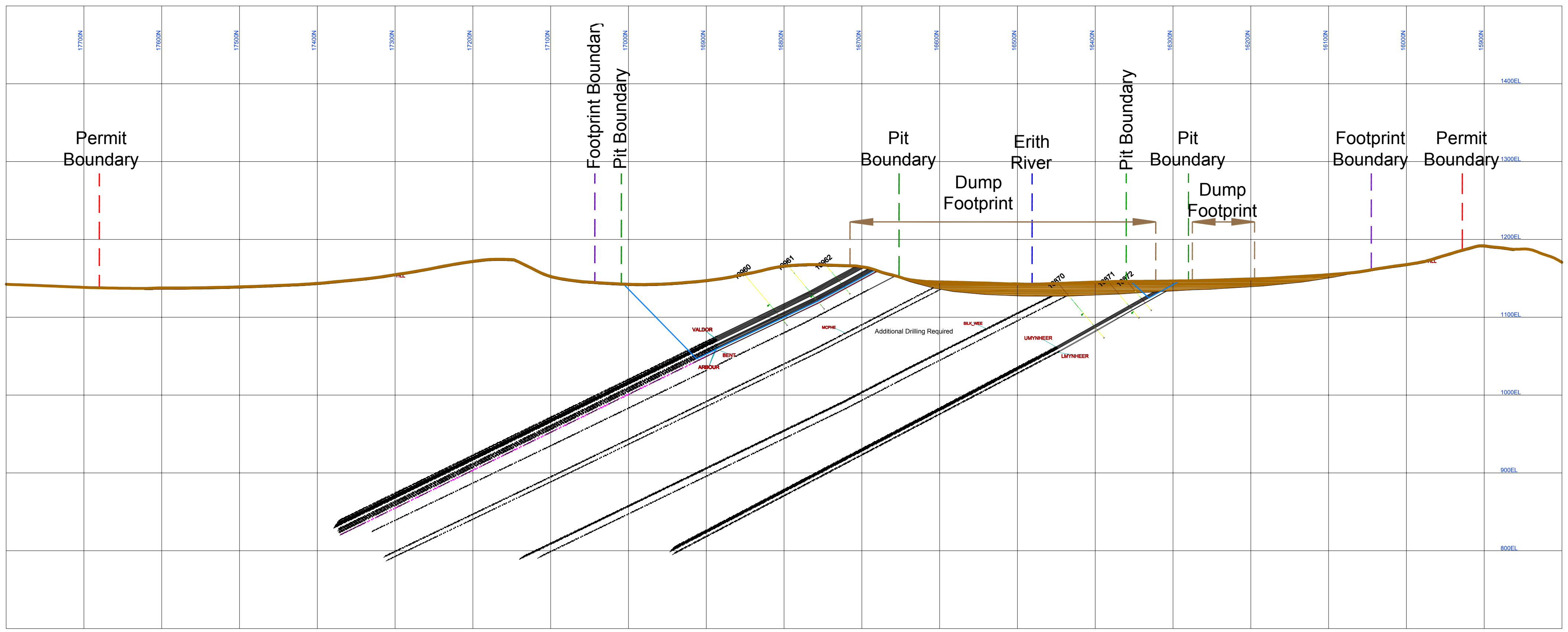

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-25

ROBB TREND
SEC 18200E
(Section Looking East)

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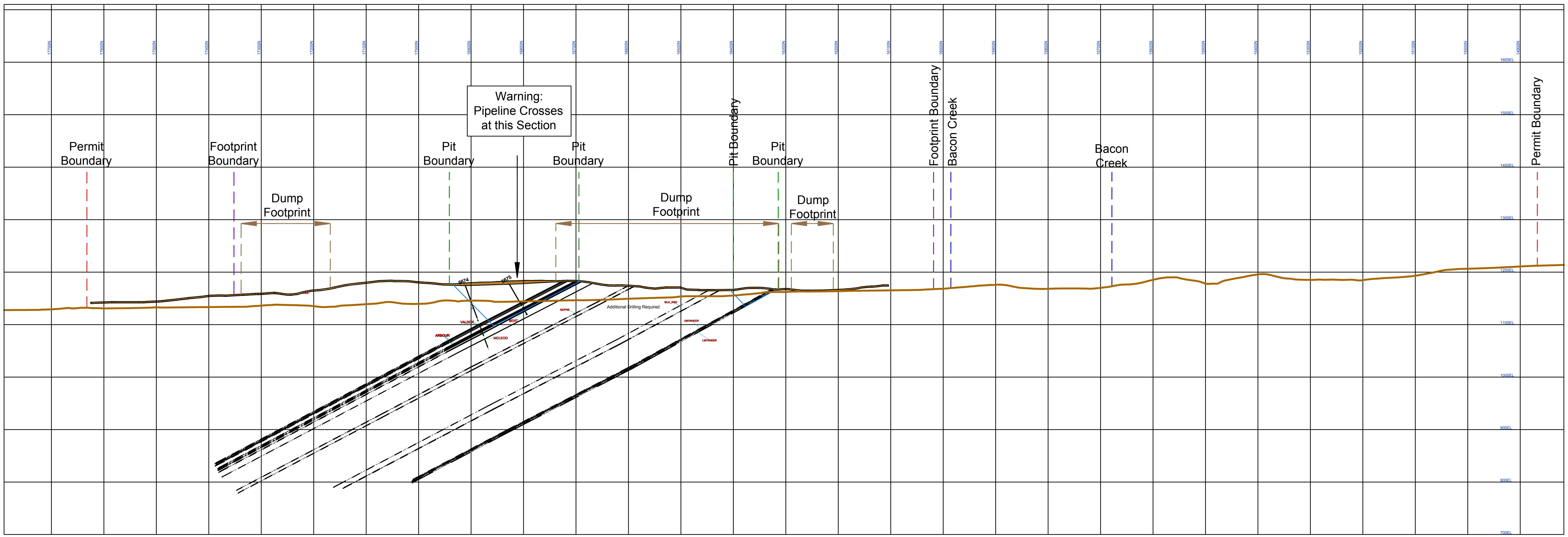

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-26

ROBB TREND
SEC 19400E
(Section Looking East)

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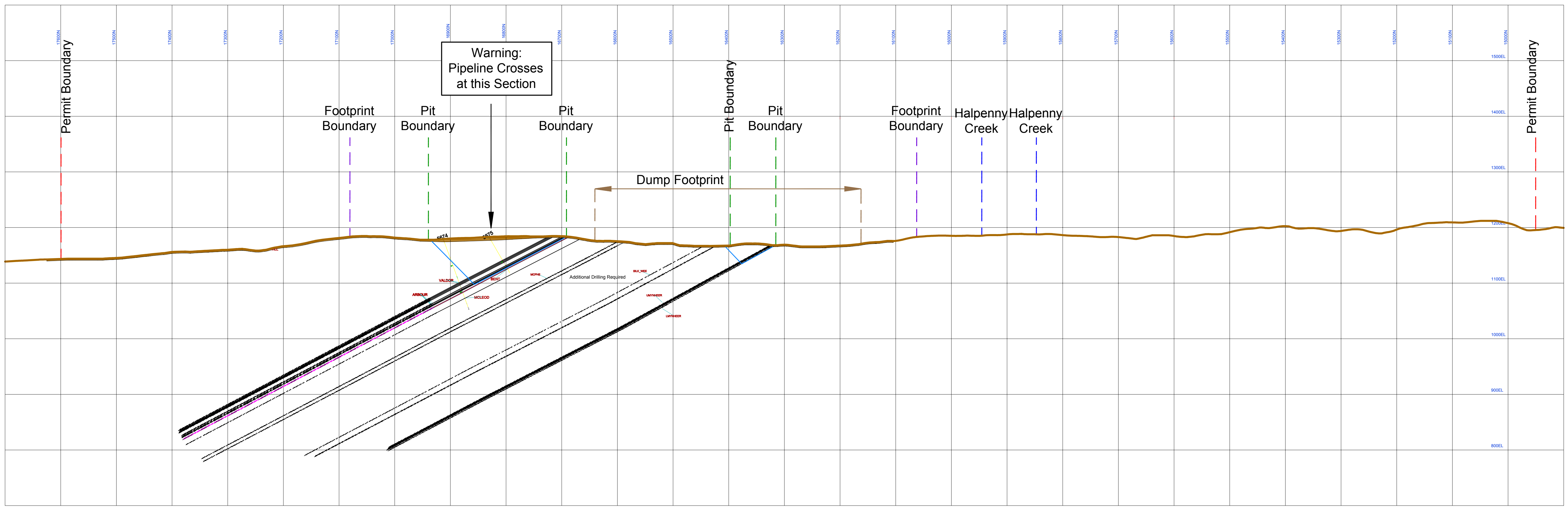

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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NOTE: All coordinates and references are Coal Valley Mine Coordinates

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Fig 3-27

ROBB TREND
SEC 20500E
(Section Looking East)

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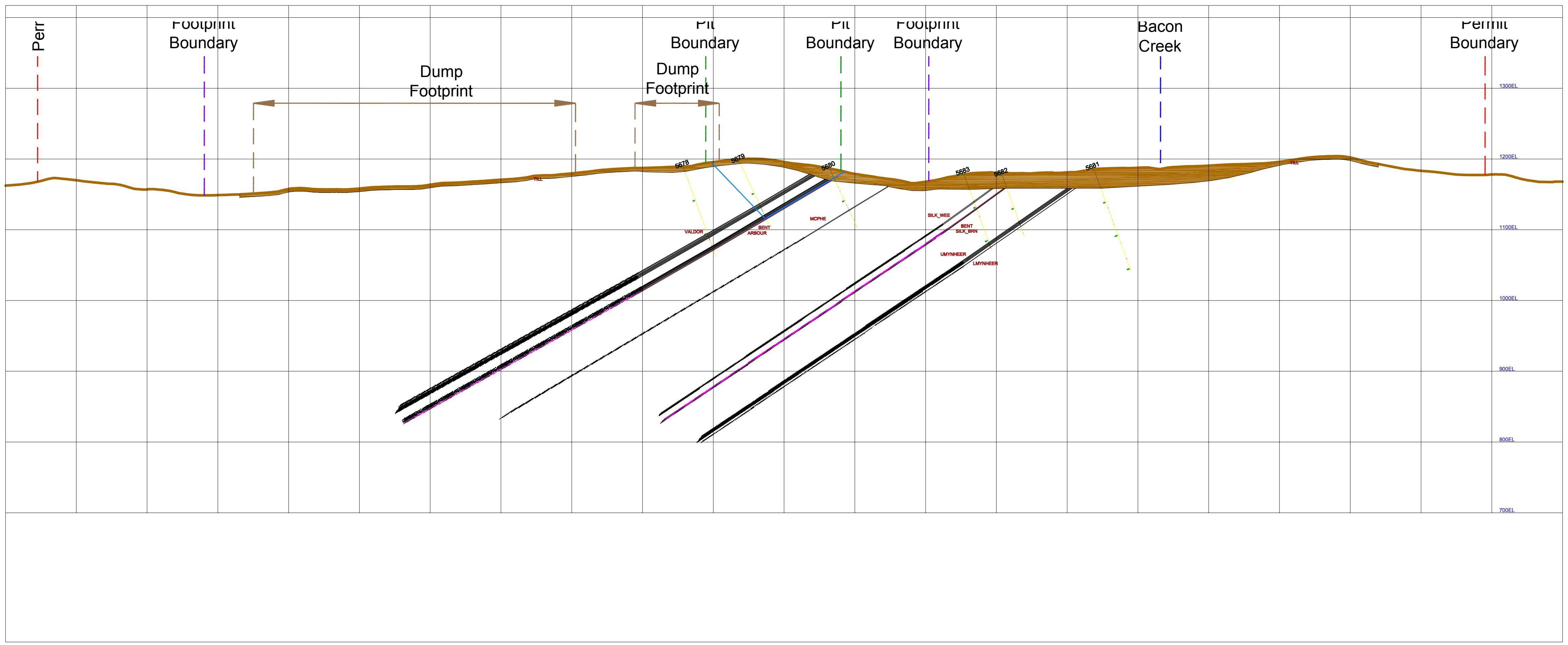

LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

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Fig 3-28

ROBB TREND
SEC 23200E
(Section Looking East)

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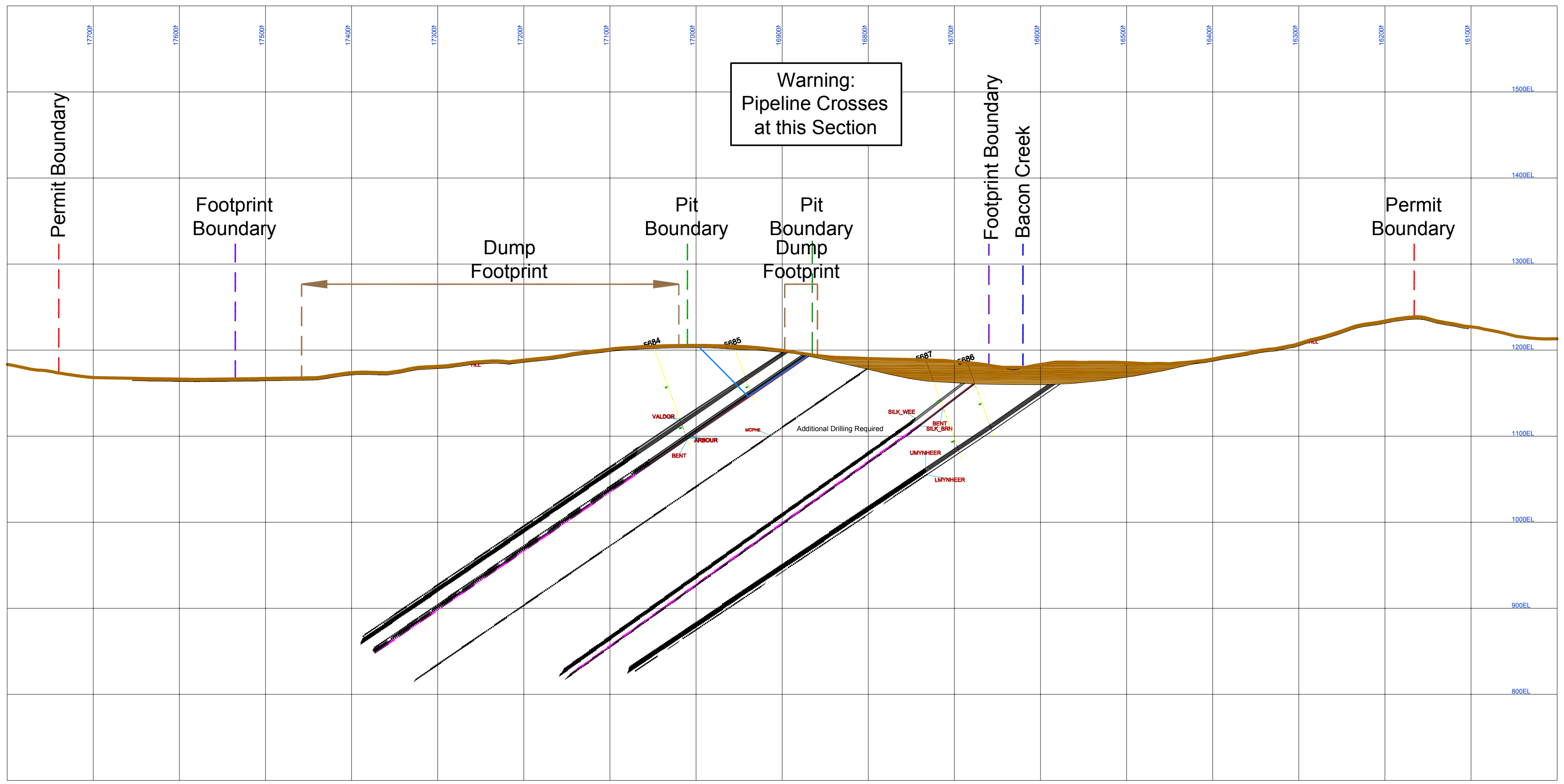

LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-29

ROBB TREND
SEC 24000E
(Section Looking East)

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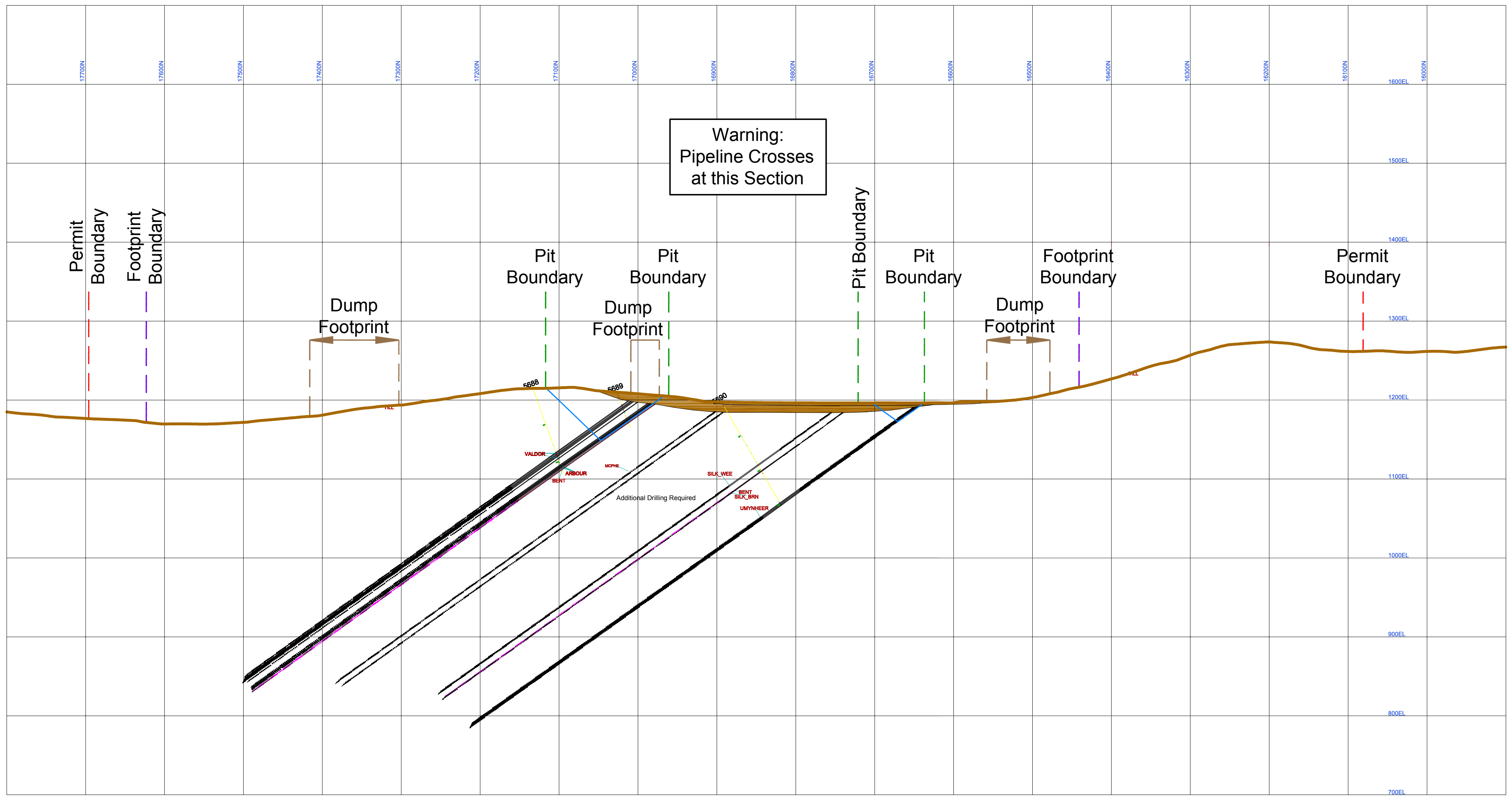

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

cvri

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Fig 3-30

ROBB TREND
SEC 25100E
(Section Looking East)

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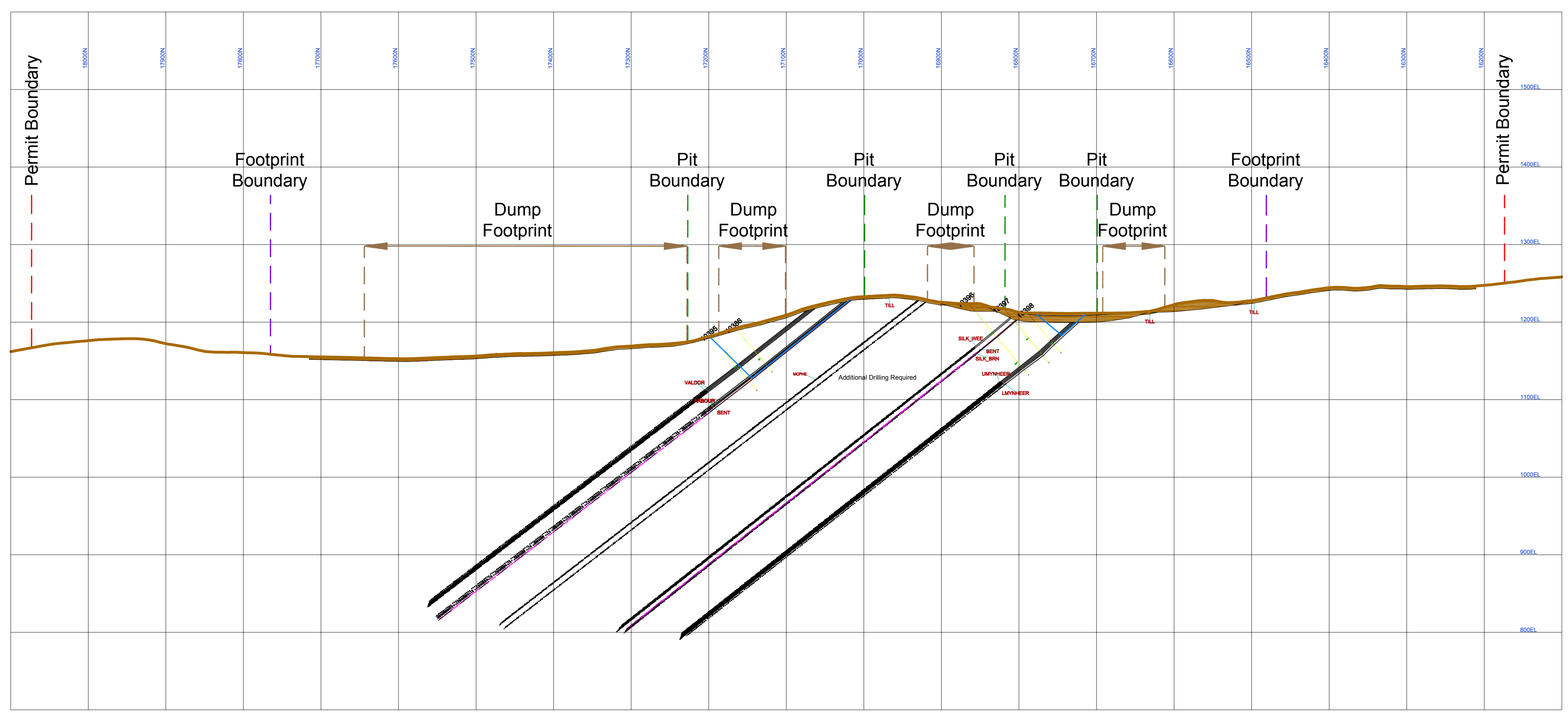

LEGEND

Primary Coal	Glacial Till	Burnt rock
Secondary Coal	Sandstone	Mined out/Void
Tertiary Coal	Siltstone	Weathered Coal
Inferred Lithology	Bentonite	
	Carby mudstone	

Fault
Pit Design Surface
Dump Design Surface

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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NOTE: All coordinates and references are Coal Valley Mine Coordinates

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Fig 3-31

ROBB TREND
SEC 26000E
(Section Looking East)

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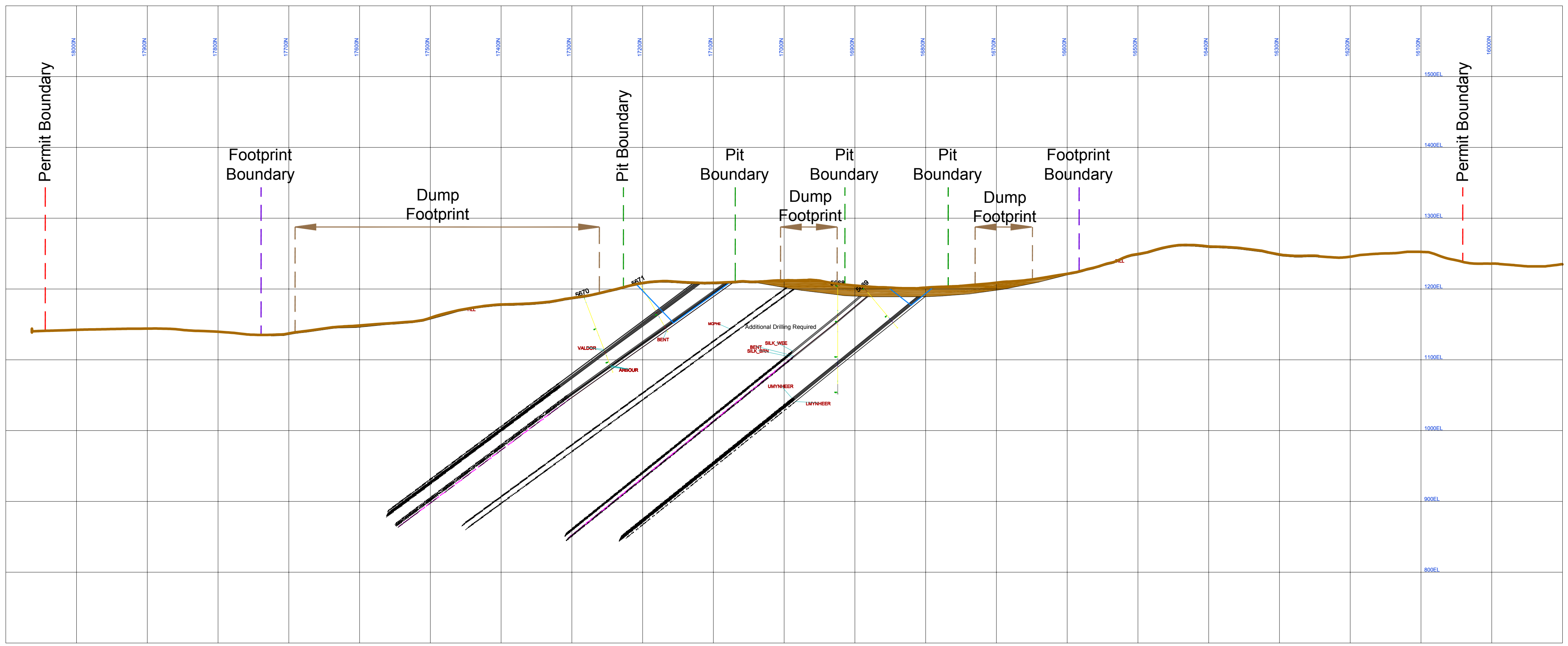

LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-32

ROBB TREND

SEC 26600E

(Section Looking East)

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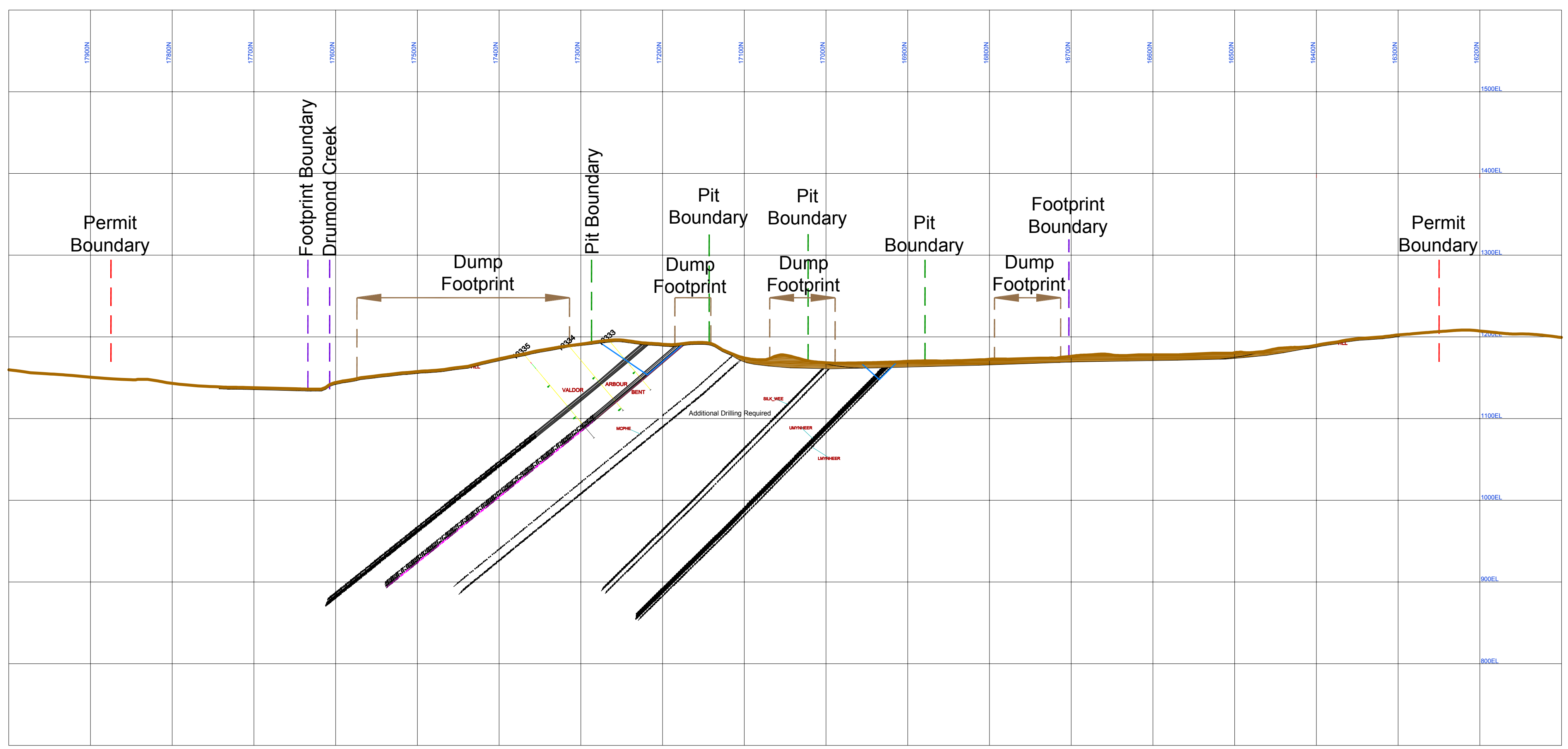

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-33

ROBB TREND
SEC 27600E
(Section Looking East)

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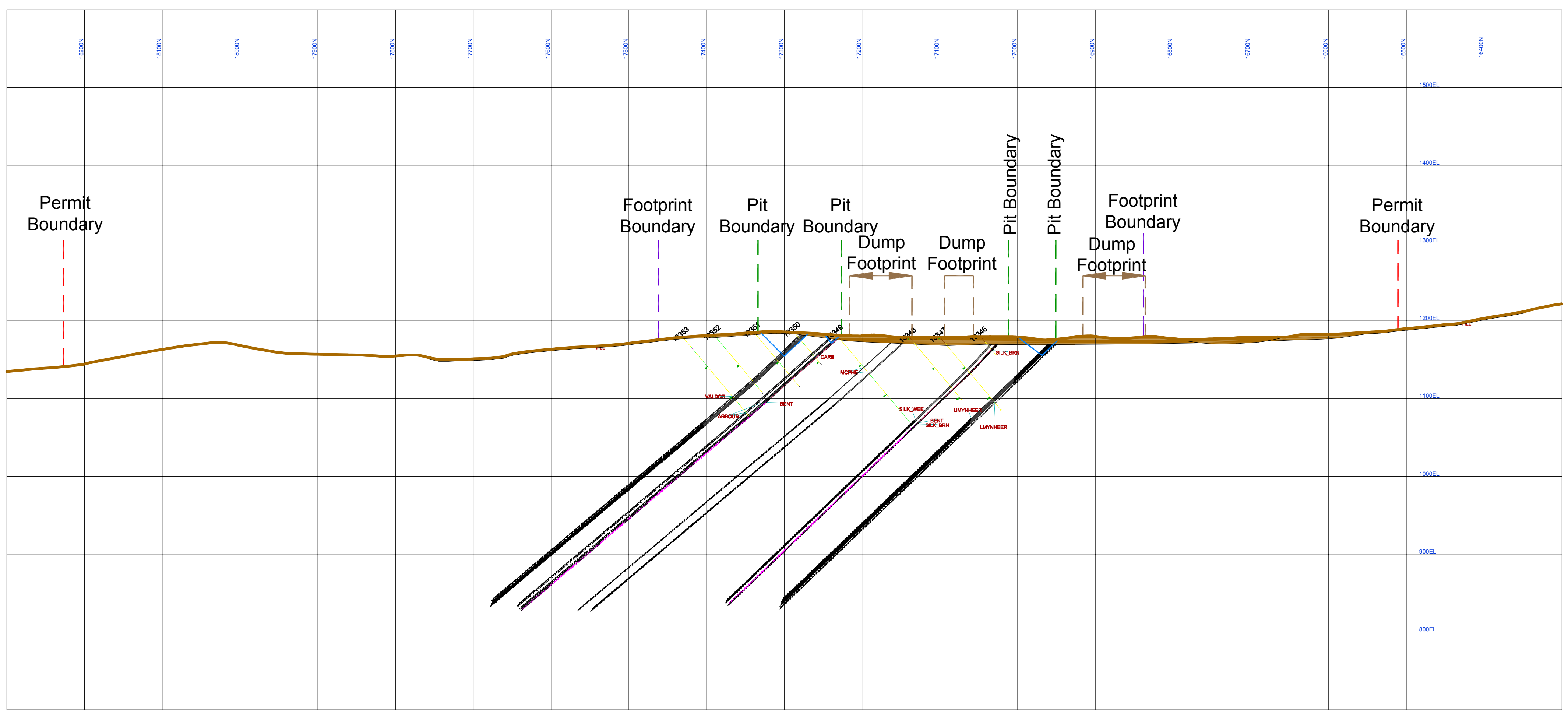

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-34

ROBB TREND
SEC 28500E
(Section Looking East)

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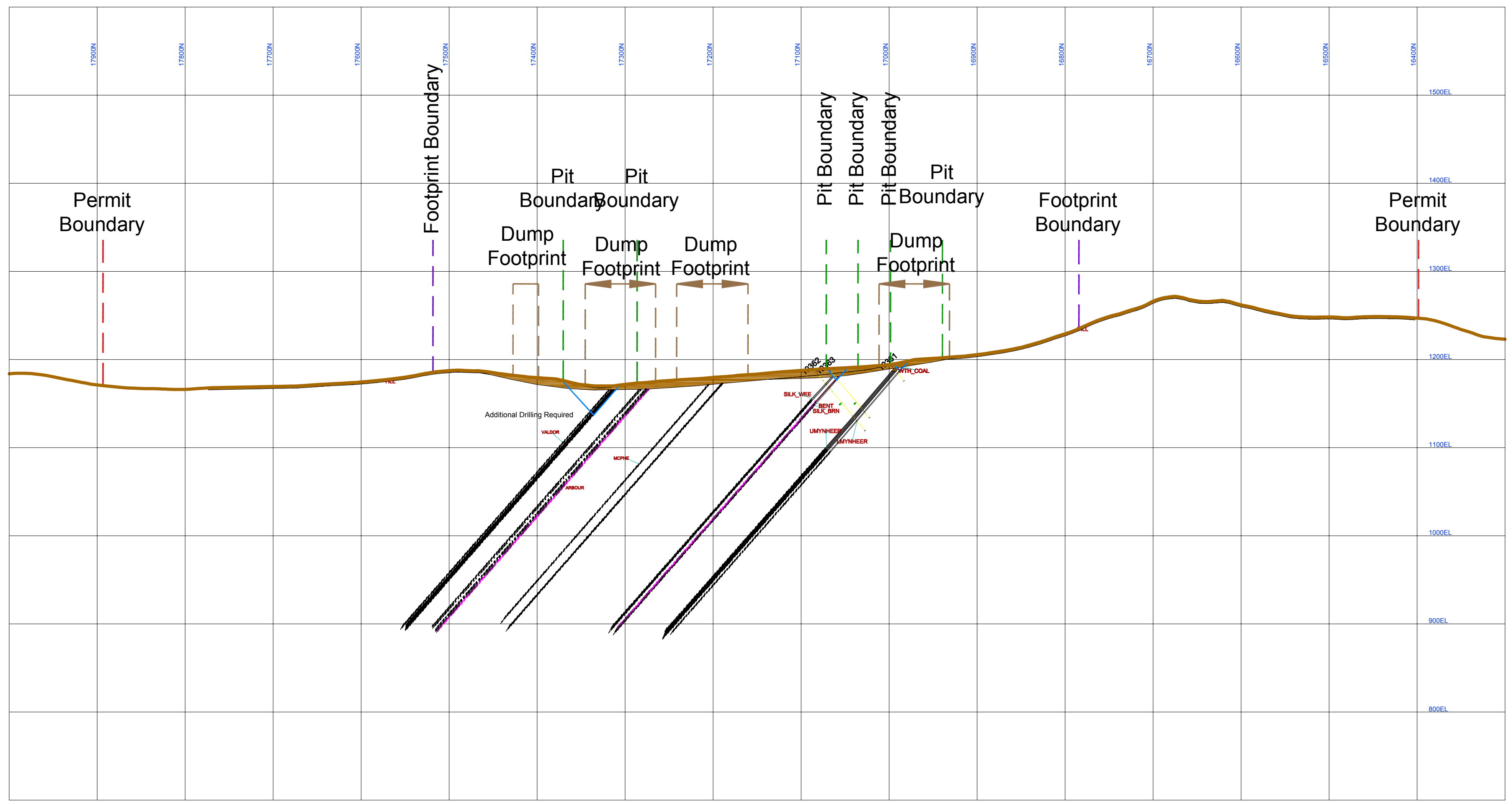

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-35

ROBB TREND

SEC 29500E

(Section Looking East)

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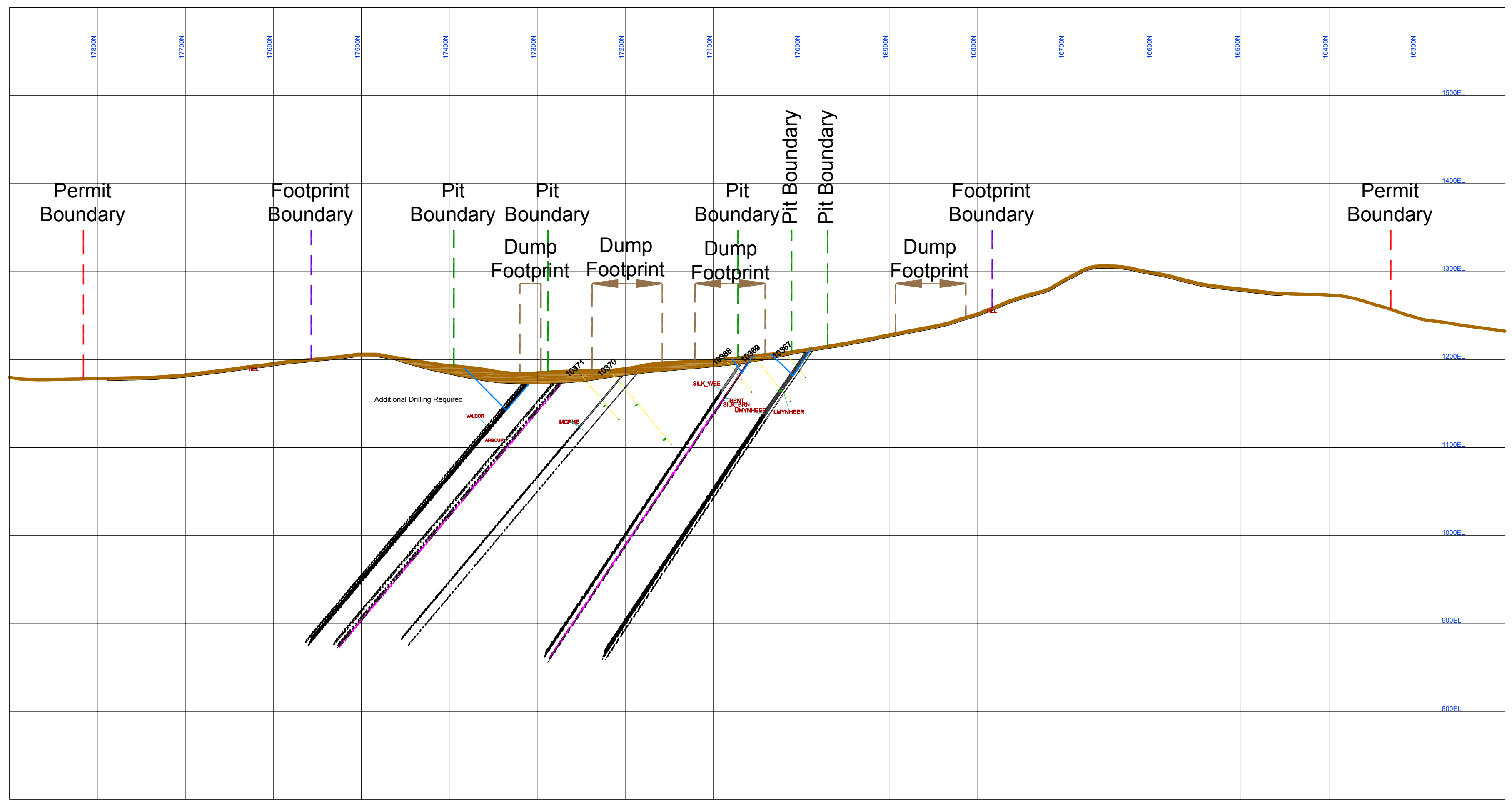

LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-36

ROBB TREND
SEC 30400E
(Section Looking East)

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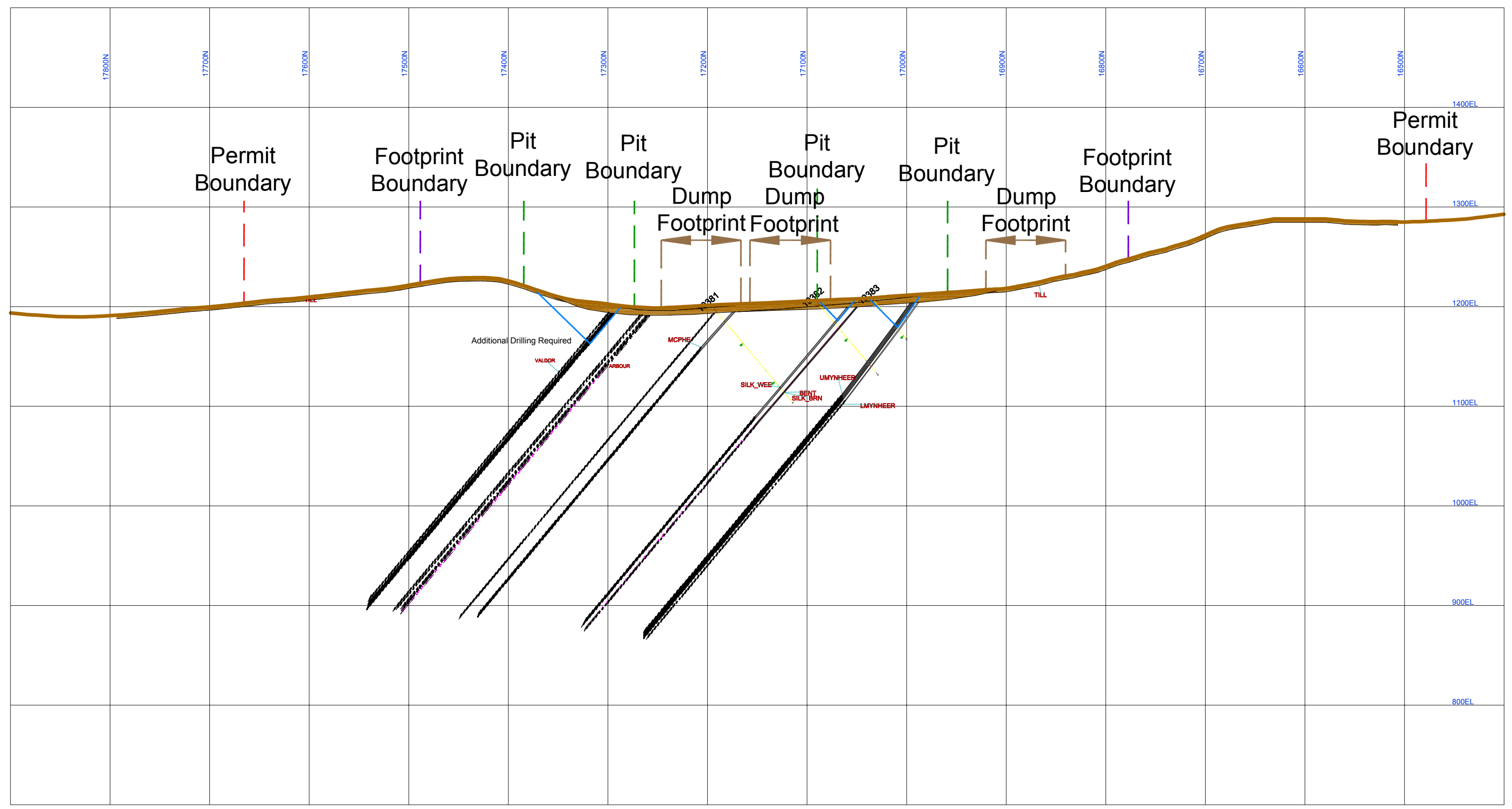

LEGEND

- Primary Coal
- Secondary Coal
- Tertiary Coal
- Inferred Lithology
- Glacial Till
- Sandstone
- Siltstone
- Bentonite
- Carby mudstone
- Burnt rock
- Mined out/Void
- Weathered Coal
- Fault
- Pit Design Surface
- Dump Design Surface

STRATIGRAPHY

Seam	Code
Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-37

ROBB TREND

SEC 31400E

(Section Looking East)

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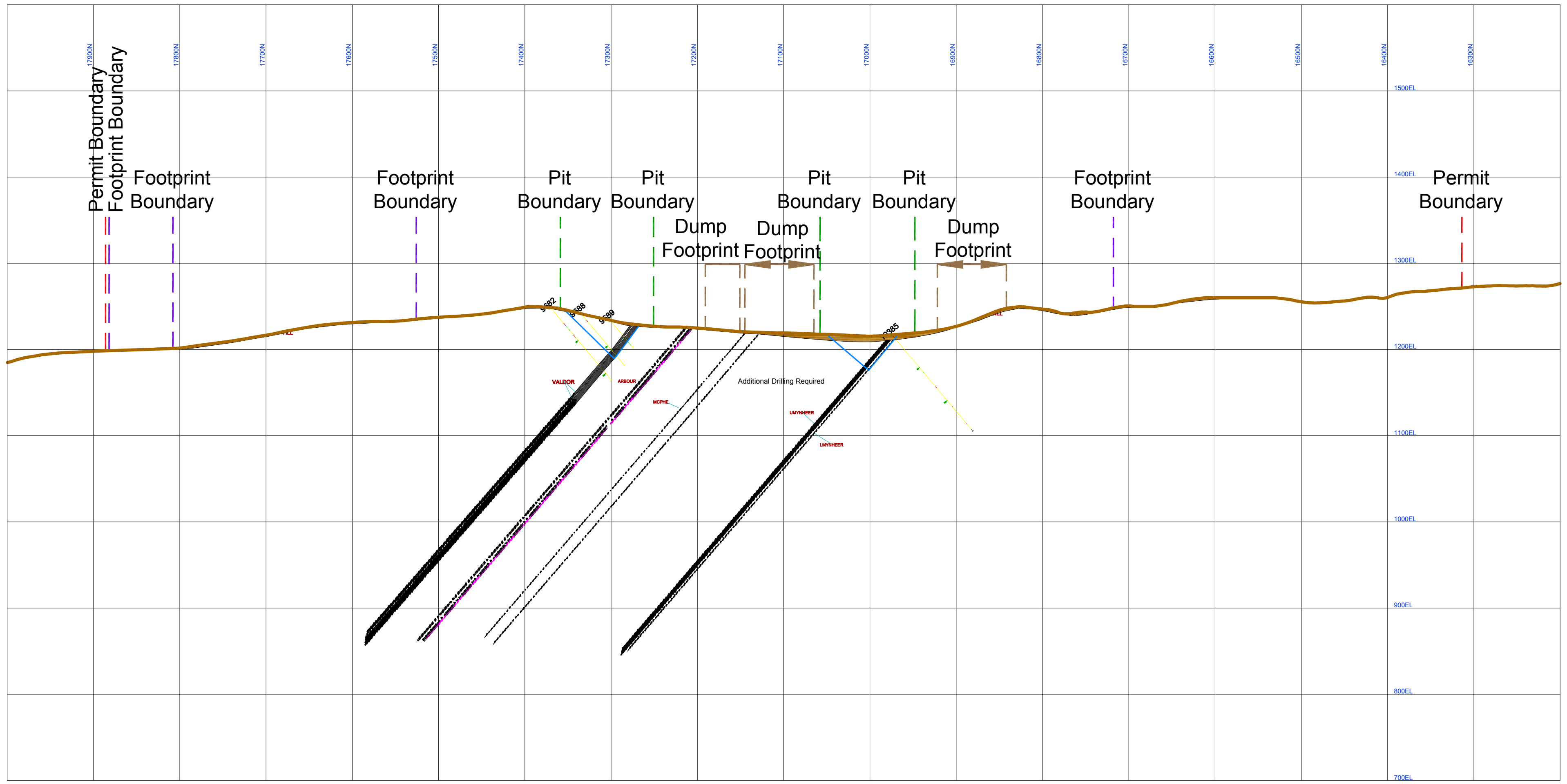

LEGEND

- Primary Coal
- Secondary Coal
- Tertiary Coal
- Inferred Lithology
- Glacial Till
- Sandstone
- Siltstone
- Bentonite
- Carby mudstone
- Burnt rock
- Mined out/Void
- Weathered Coal
- Fault
- Pit Design Surface
- Dump Design Surface

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-38

ROBB TREND

SEC 32200E

(Section Looking East)

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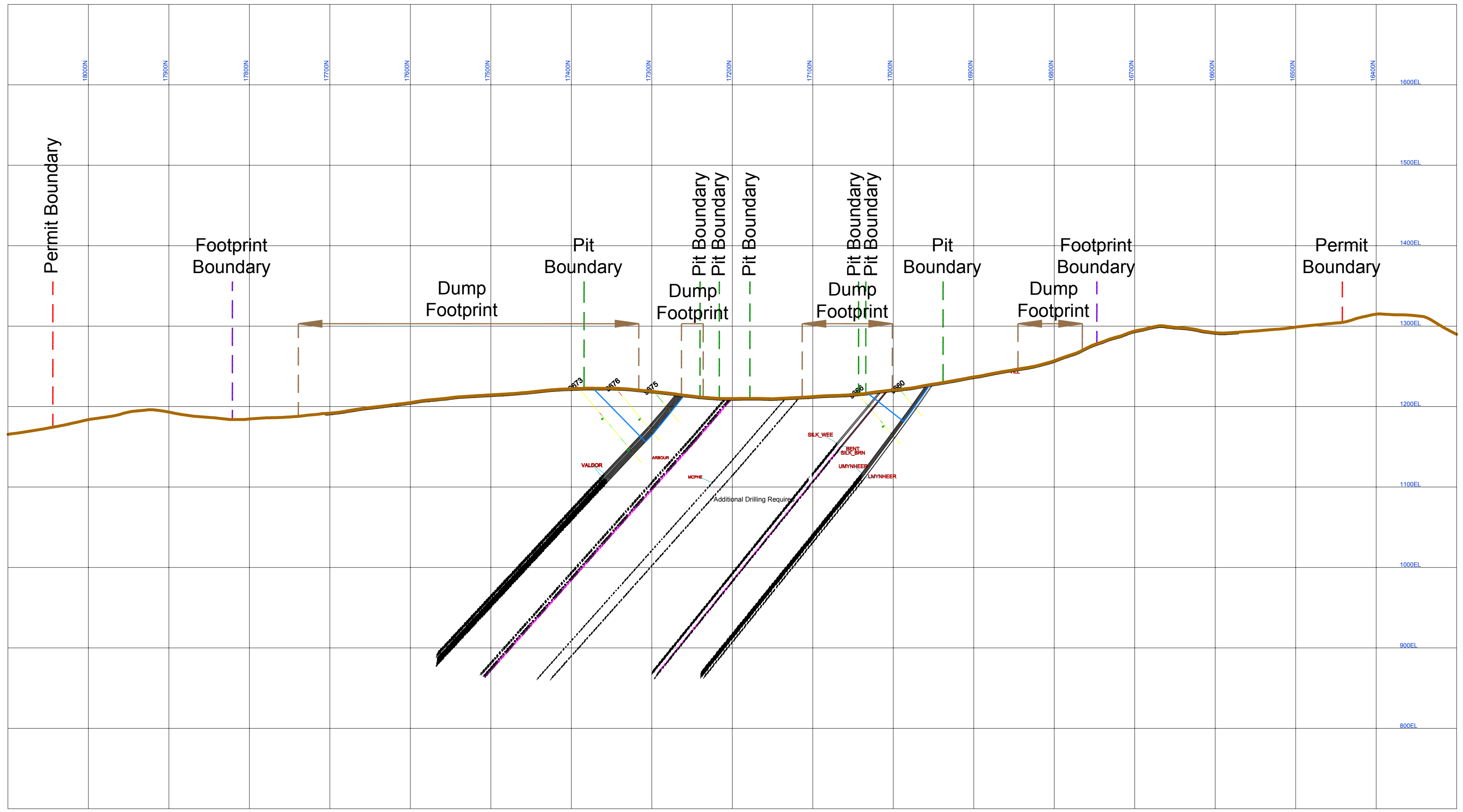

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-39

ROBB TREND
SEC 33000E
(Section Looking East)

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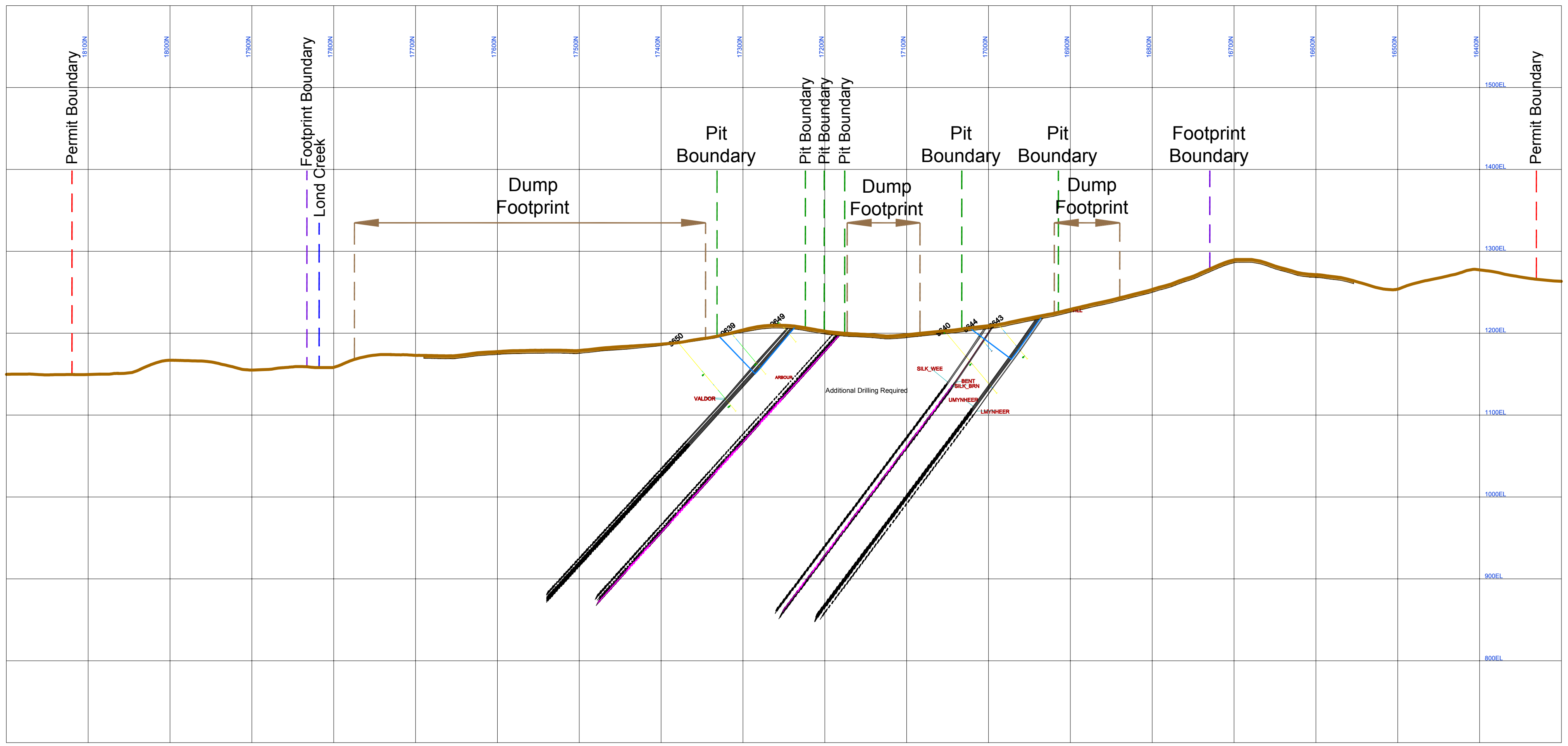

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LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-40

ROBB TREND
SEC 33800E
(Section Looking East)

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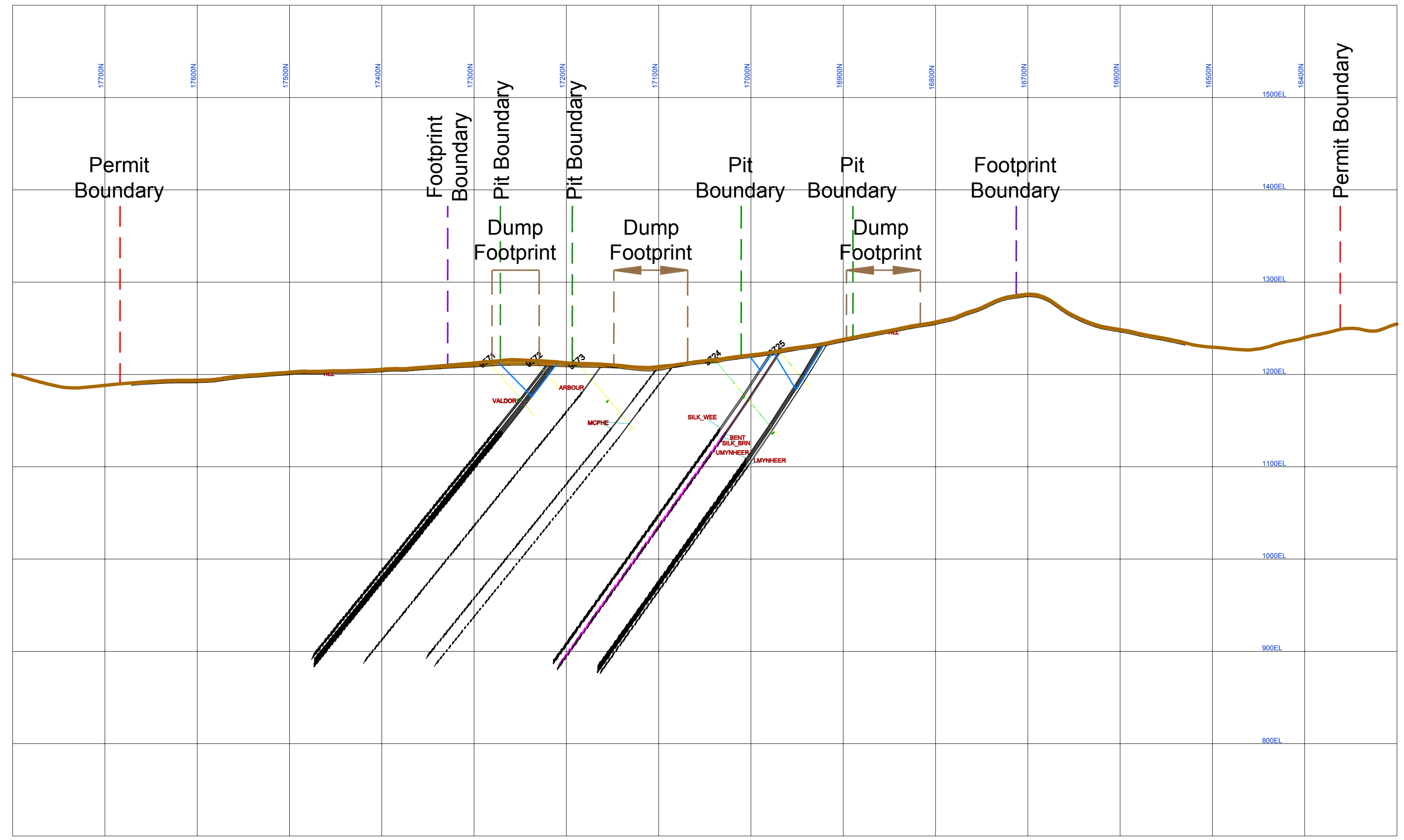

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-41

ROBB TREND
SEC 34800E
(Section Looking East)

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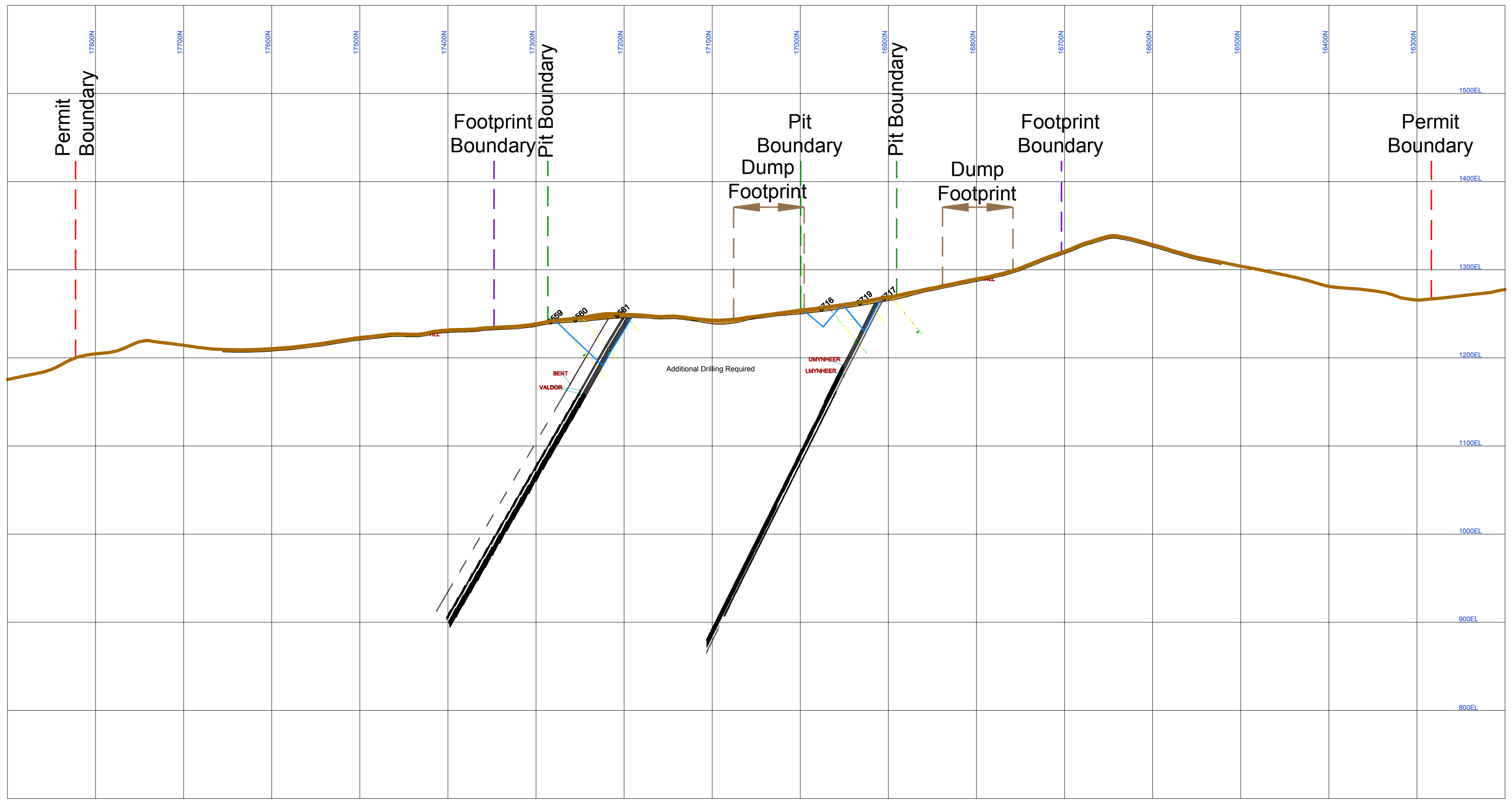

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-42

ROBB TREND
SEC 35600E
(Section Looking East)

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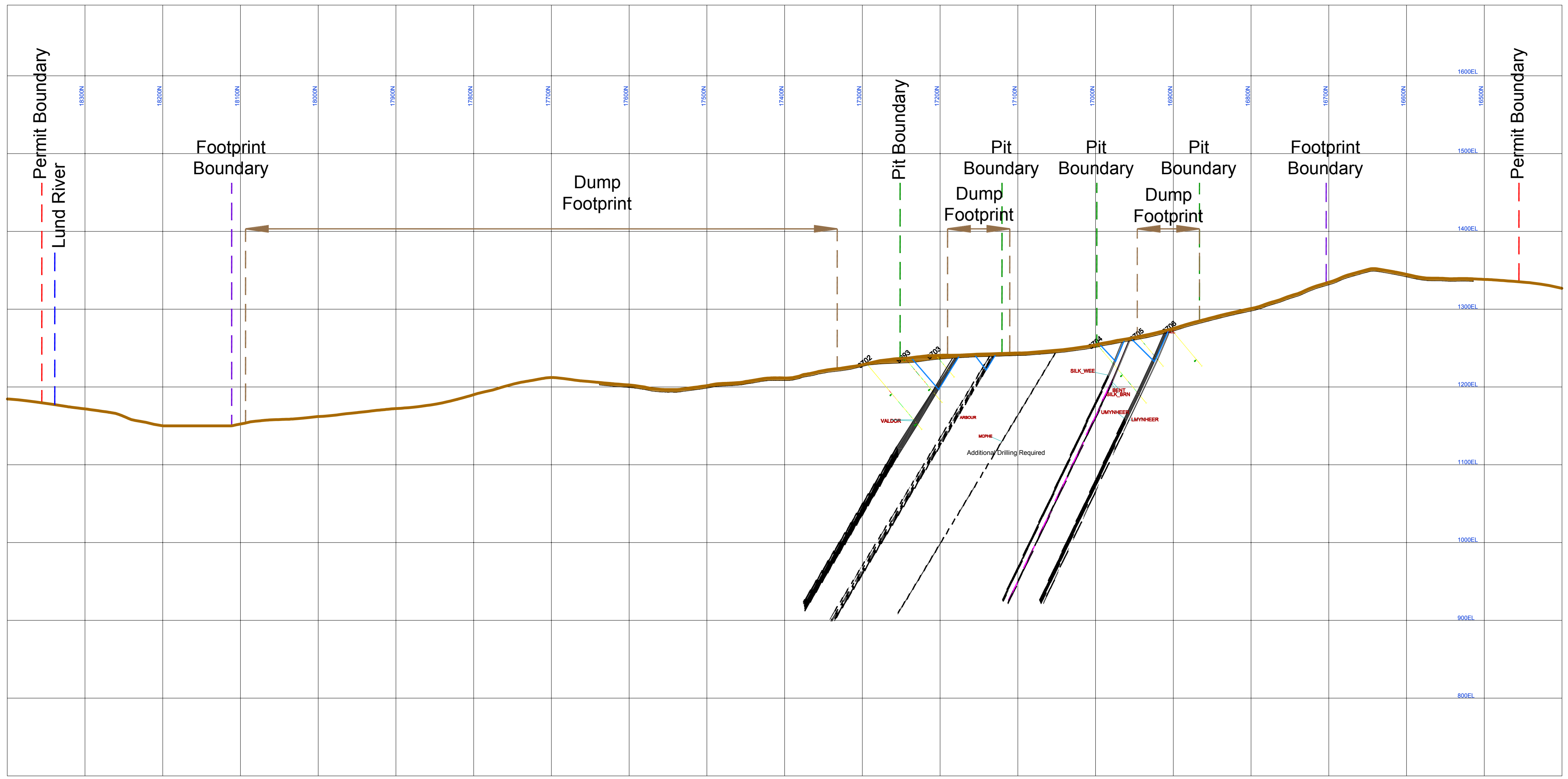

LEGEND

Lithology	Lithology	Lithology	Lines
Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Seam	Code
Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-43

ROBB TREND
SEC 36500E
(Section Looking East)

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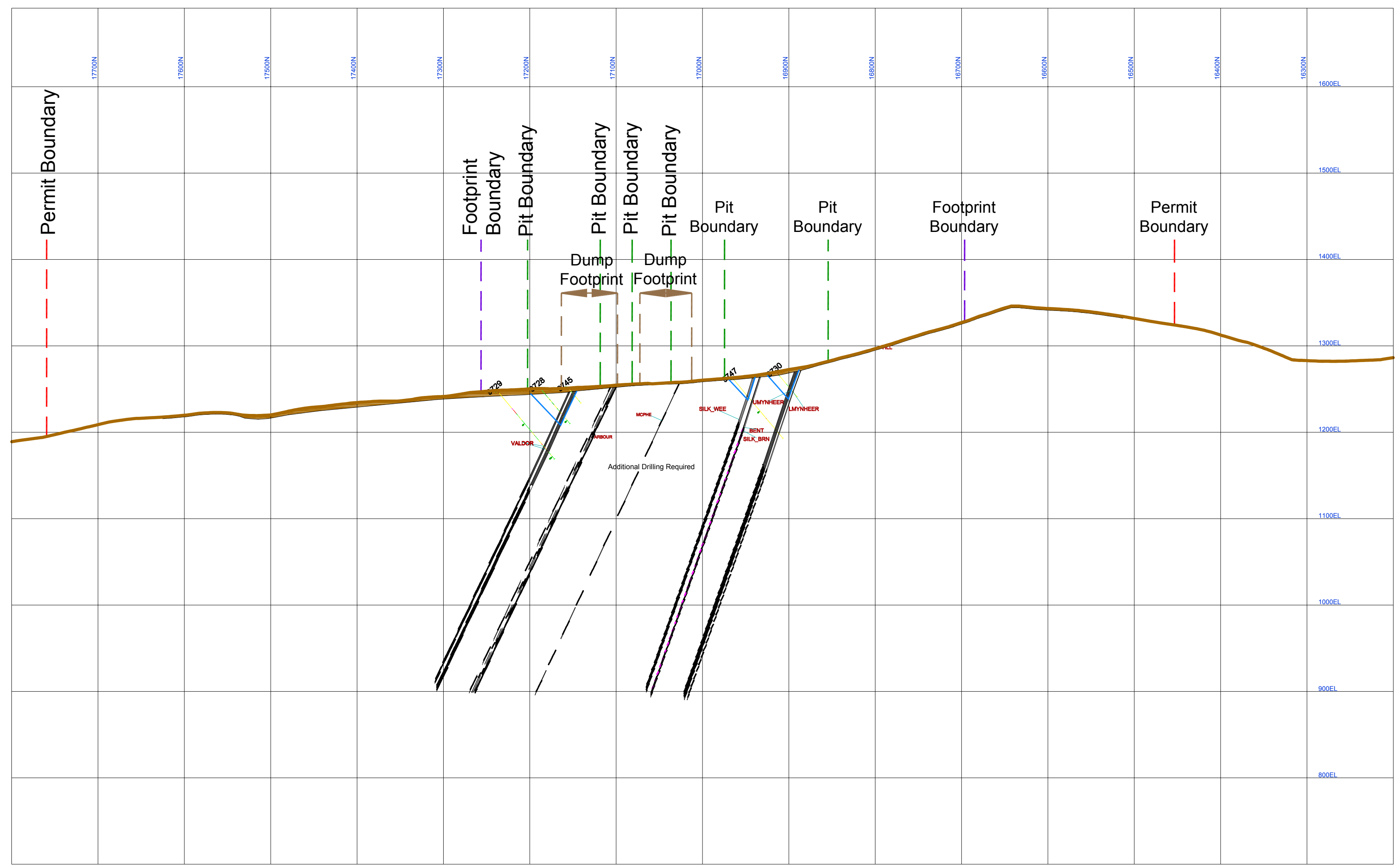

LEGEND

- Primary Coal
- Secondary Coal
- Tertiary Coal
- Inferred Lithology
- Glacial Till
- Sandstone
- Siltstone
- Bentonite
- Carby mudstone
- Burnt rock
- Mined out/Void
- Weathered Coal
- Fault
- Pit Design Surface
- Dump Design Surface

STRATIGRAPHY

Seam	Code
Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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ROBB TREND
SEC 37200E
(Section Looking East)

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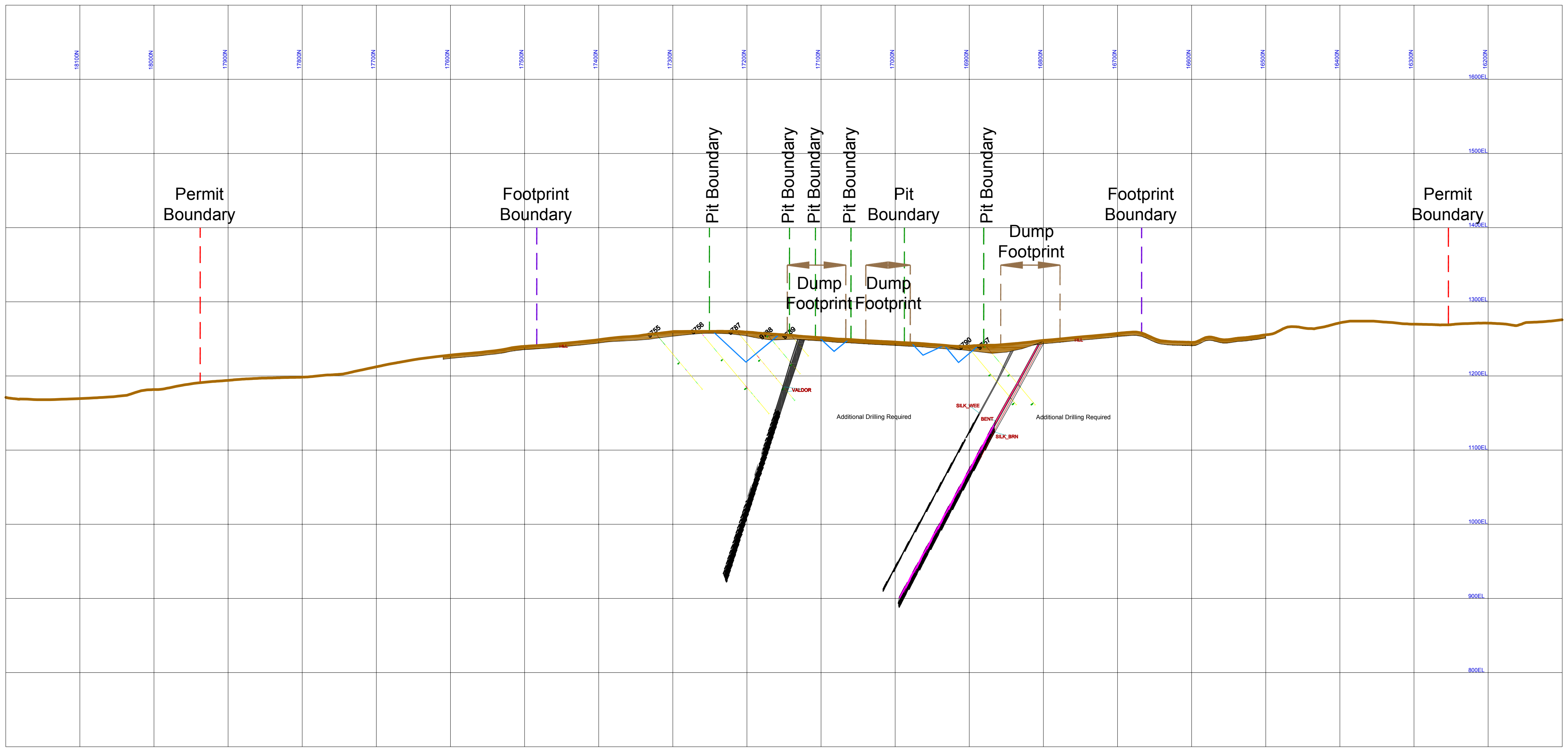

LEGEND

Primary Coal	Glacial Till	Burnt rock
Secondary Coal	Sandstone	Mined out/Void
Tertiary Coal	Siltstone	Weathered Coal
Inferred Lithology	Bentonite	
	Carby mudstone	

Fault

Pit Design Surface

Dump Design Surface

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-45

ROBB TREND

SEC 38000E

(Section Looking East)

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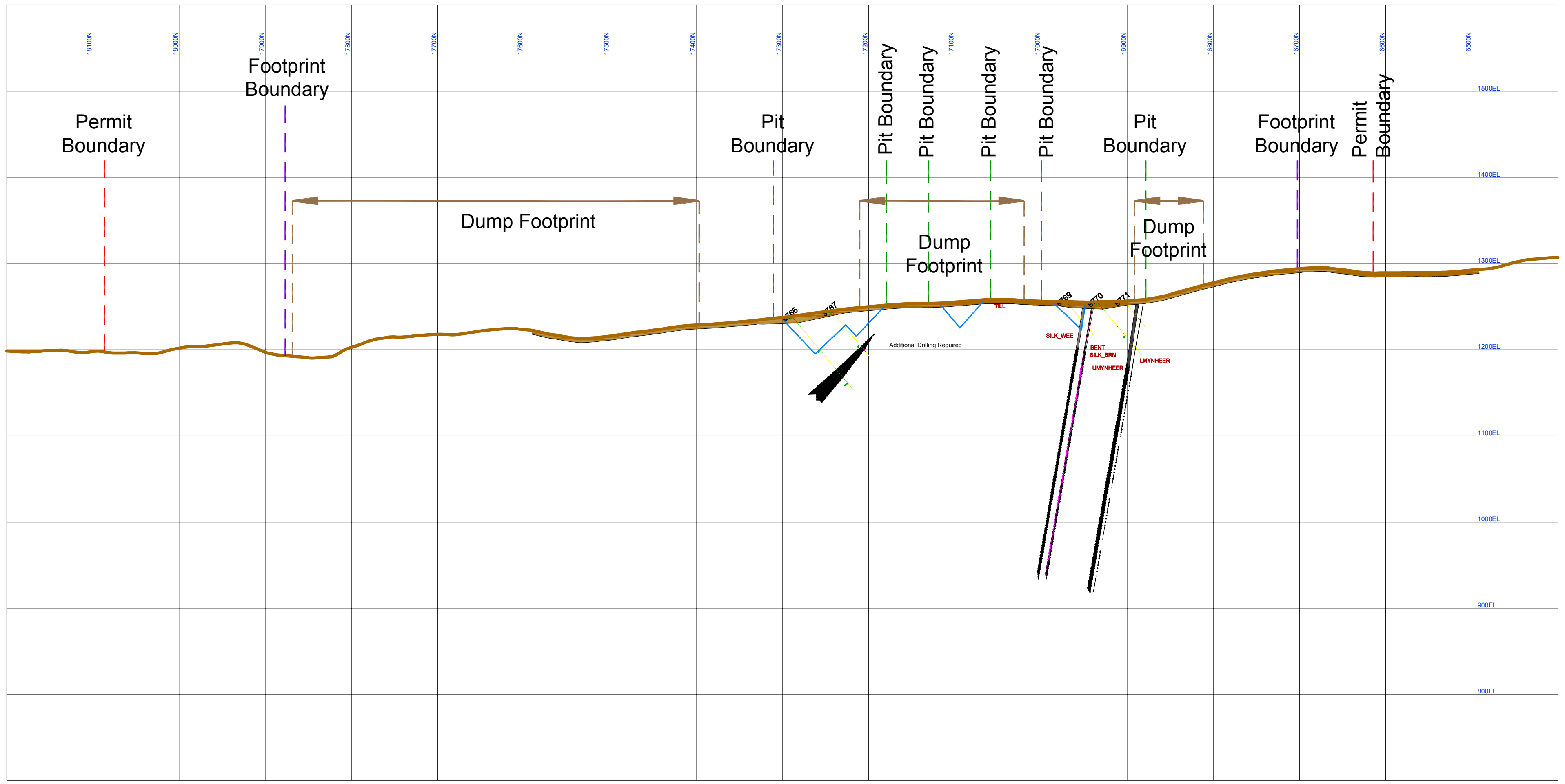

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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Fig 3-46

ROBB TREND
SEC 39000E
(Section Looking East)

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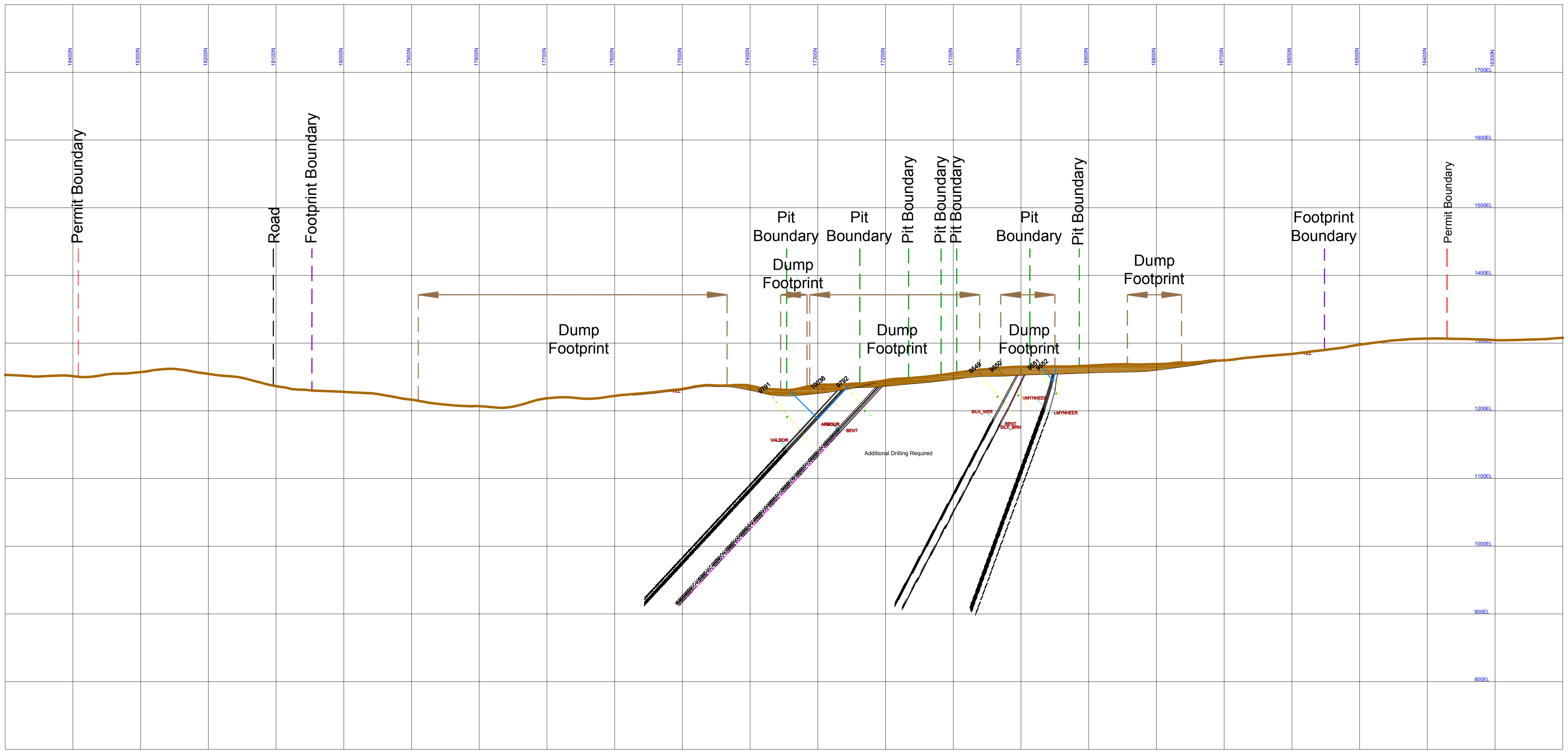

LEGEND

Lithology		Lithology		Lithology		Line	
Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Seam	Code
Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

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ROBB TREND COAL STRUCTURE

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Fig 3-47

ROBB TREND

SEC 39800E

(Section Looking East)

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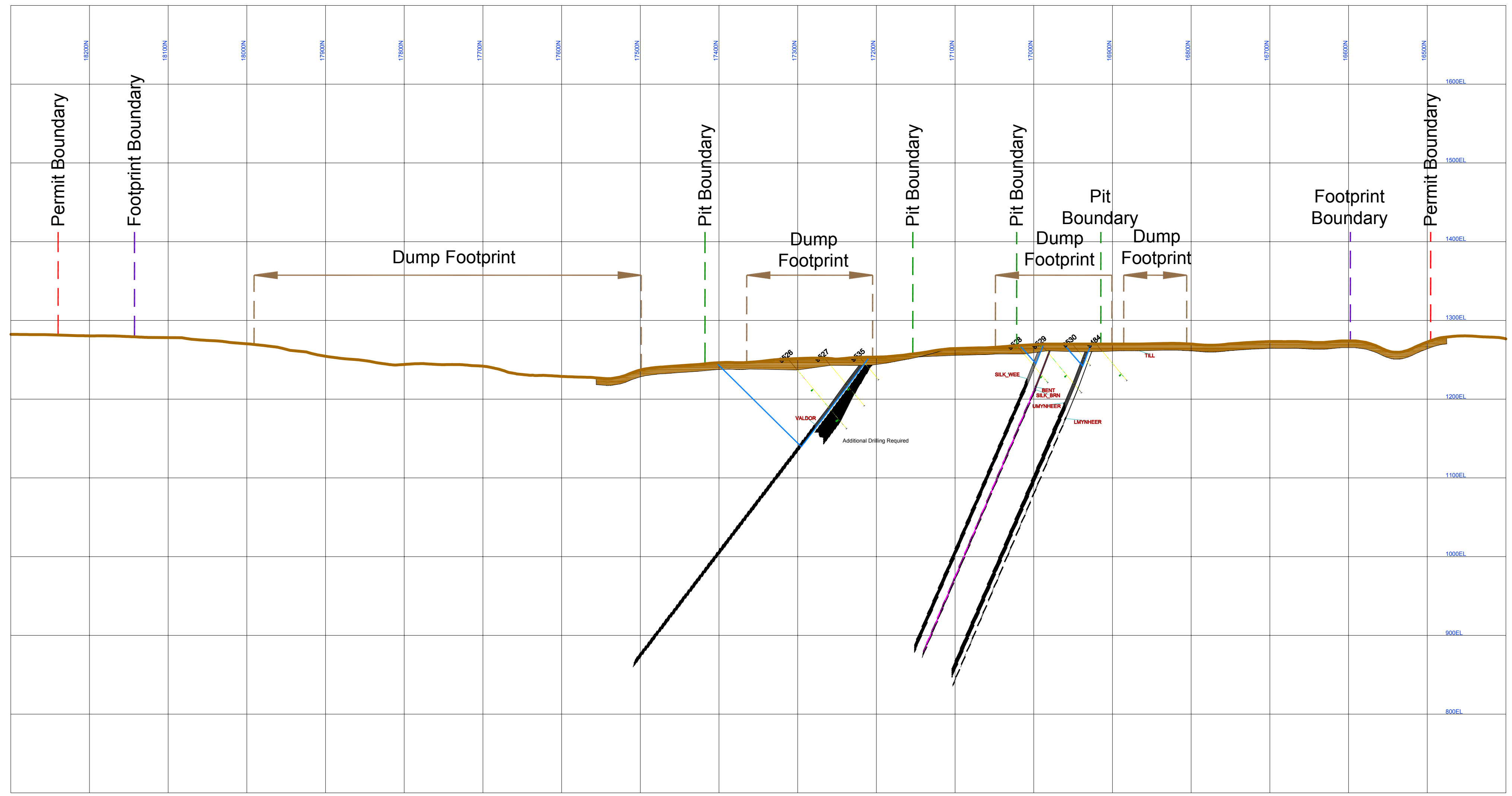

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

	BY	DATE
DRAWN	MD/JG/RS	Jun 6/13
CHECKED	SL	Nov 15, 2012

SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.

Fig 3-48

ROBB TREND

SEC 40800E

(Section Looking East)

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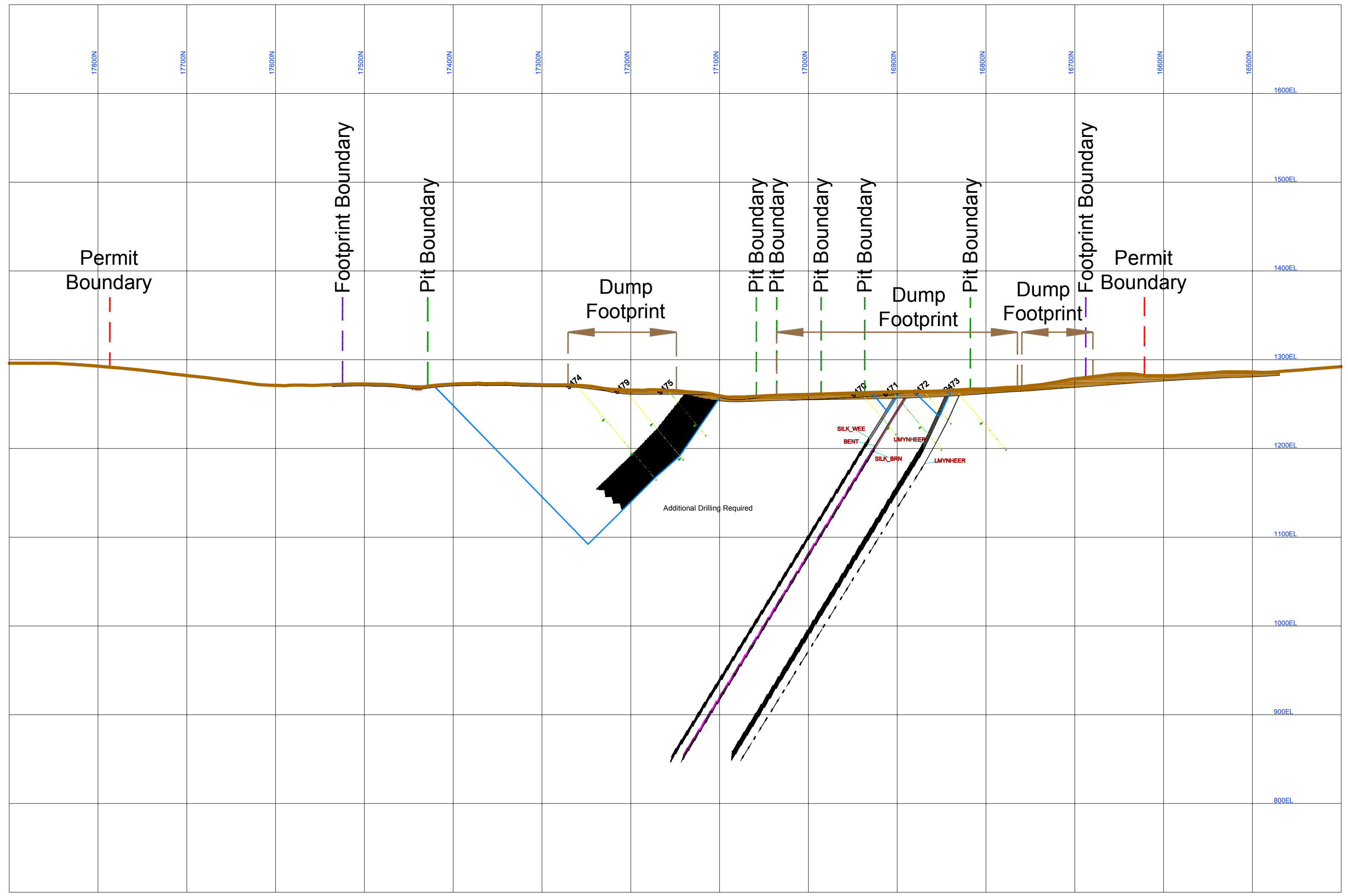

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

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NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-49

ROBB TREND
SEC 41800E
(Section Looking East)

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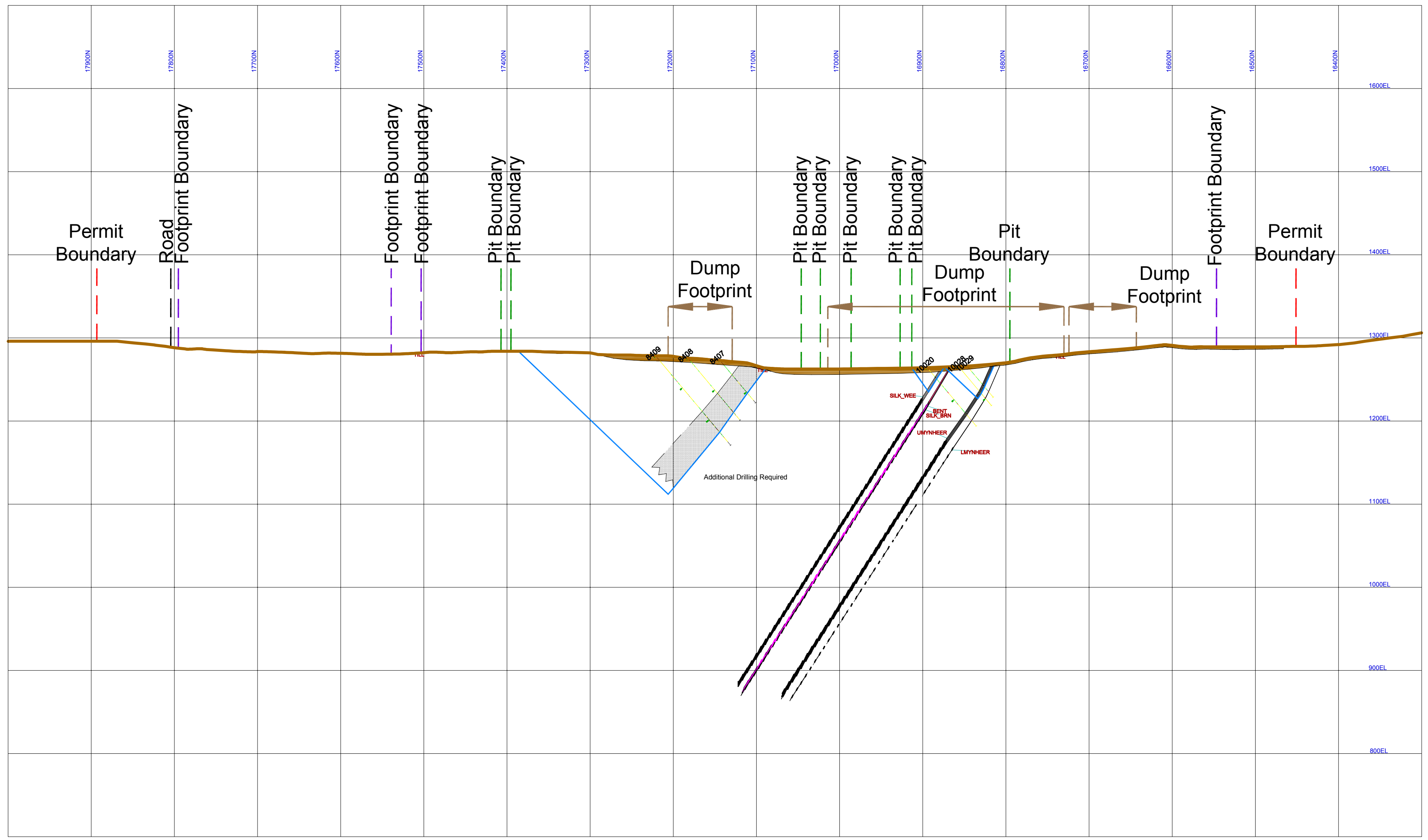

LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

cvri

	BY	DATE
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NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-50

ROBB TREND
SEC 42000E
(Section Looking East)

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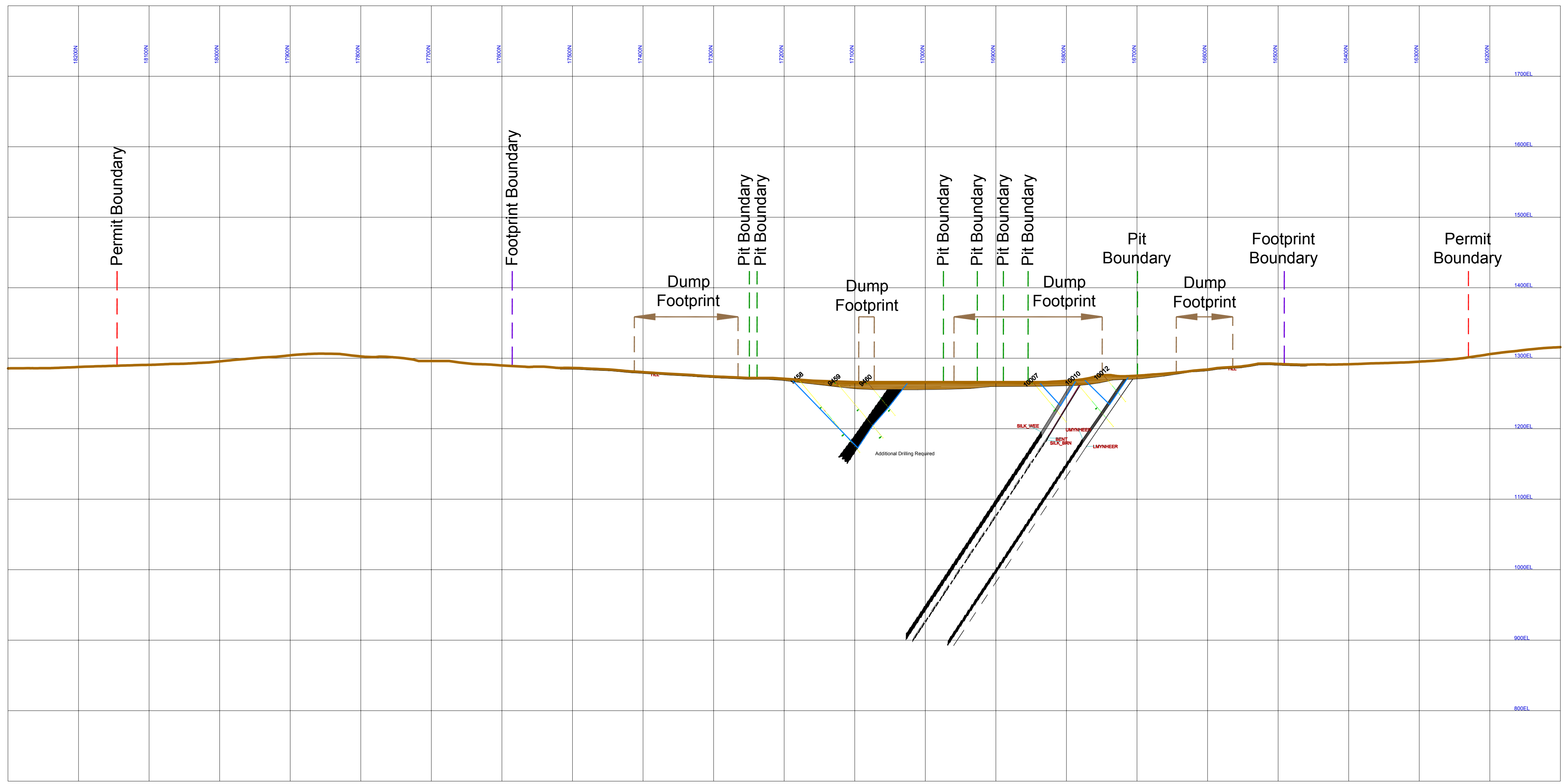

LEGEND

Primary Coal	Glacial Till	Burnt rock	Fault
Secondary Coal	Sandstone	Mined out/Void	Pit Design Surface
Tertiary Coal	Siltstone	Weathered Coal	Dump Design Surface
Inferred Lithology	Bentonite		
	Carby mudstone		

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

cvri

	BY	DATE
DRAWN	MD/JG/RS	Jun 14, 2013
CHECKED	SL	Nov 15, 2012

SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-51

ROBB TREND
SEC 42800E
(Section Looking East)

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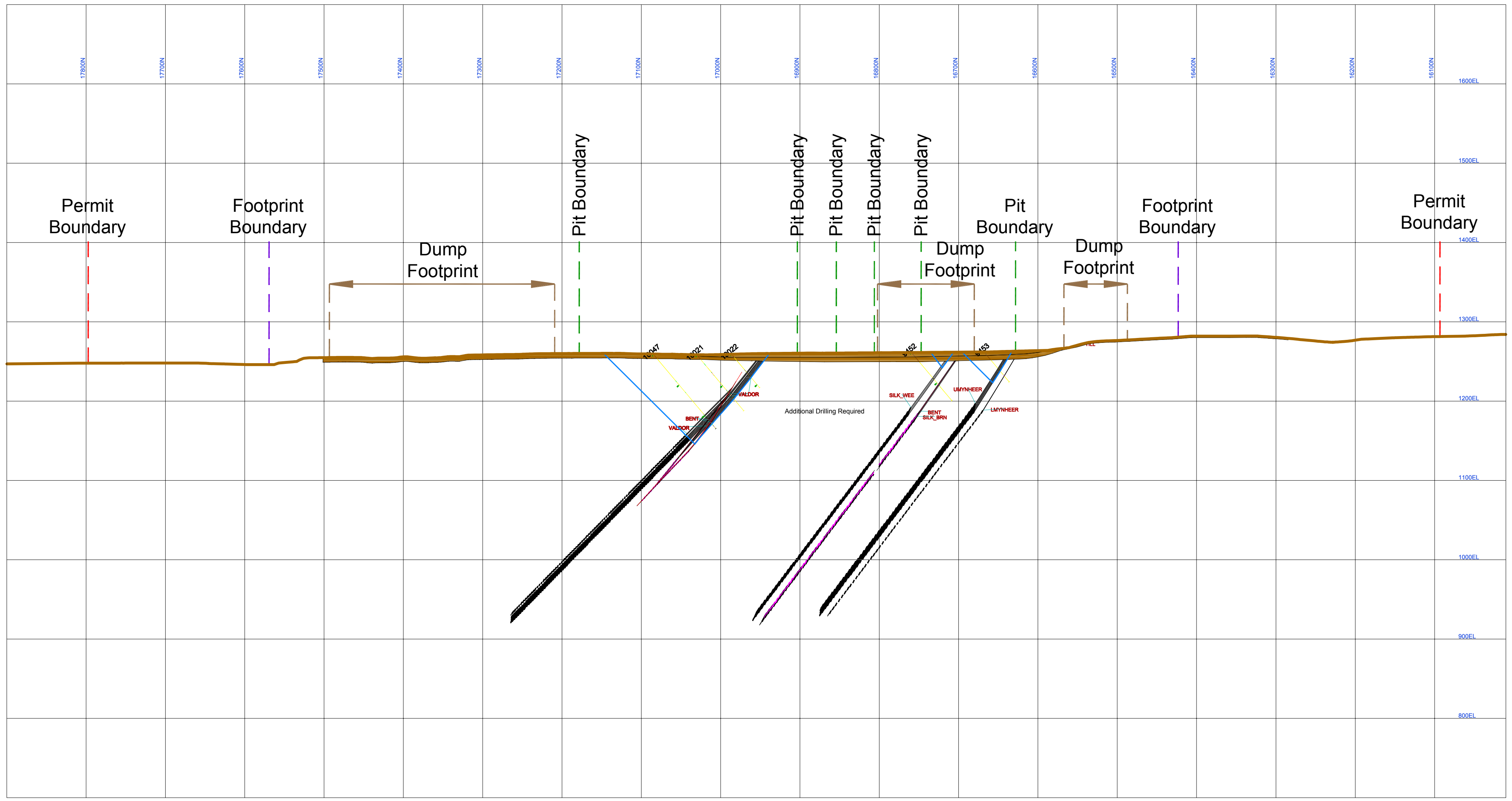

LEGEND

Primary Coal		Glacial Till		Burnt rock		Fault	
Secondary Coal		Sandstone		Mined out/Void		Pit Design Surface	
Tertiary Coal		Siltstone		Weathered Coal		Dump Design Surface	
Inferred Lithology		Bentonite					
		Carby mudstone					

STRATIGRAPHY

Val D'Or Seam	VALDOR
Arbour Seam	ARBOUR
McLeod Seam	MCLEOD
McPherson Seam	MCPHE
Silkstone - Wee Seam	SILK_WEE
Silkstone - Borne Seam	SILK_BRN
Mynheer Rider Seam	MYN_RIDE
Upper Mynheer Seam	UMYNHEER
Lower Mynheer Seam	LMYNHEER

TITLE

COAL VALLEY RESOURCES INC.
ROBB TREND COAL STRUCTURE

cvri

	BY	DATE
DRAWN	MD/JG/RS	Jun 6, 2013
CHECKED	SL	Nov 15, 2012

SCALE 0 200 400

NOTE: All coordinates and references are Coal Valley Mine Coordinates

DRAWING NO.
Fig 3-52

ROBB TREND
SEC 43600E
(Section Looking East)

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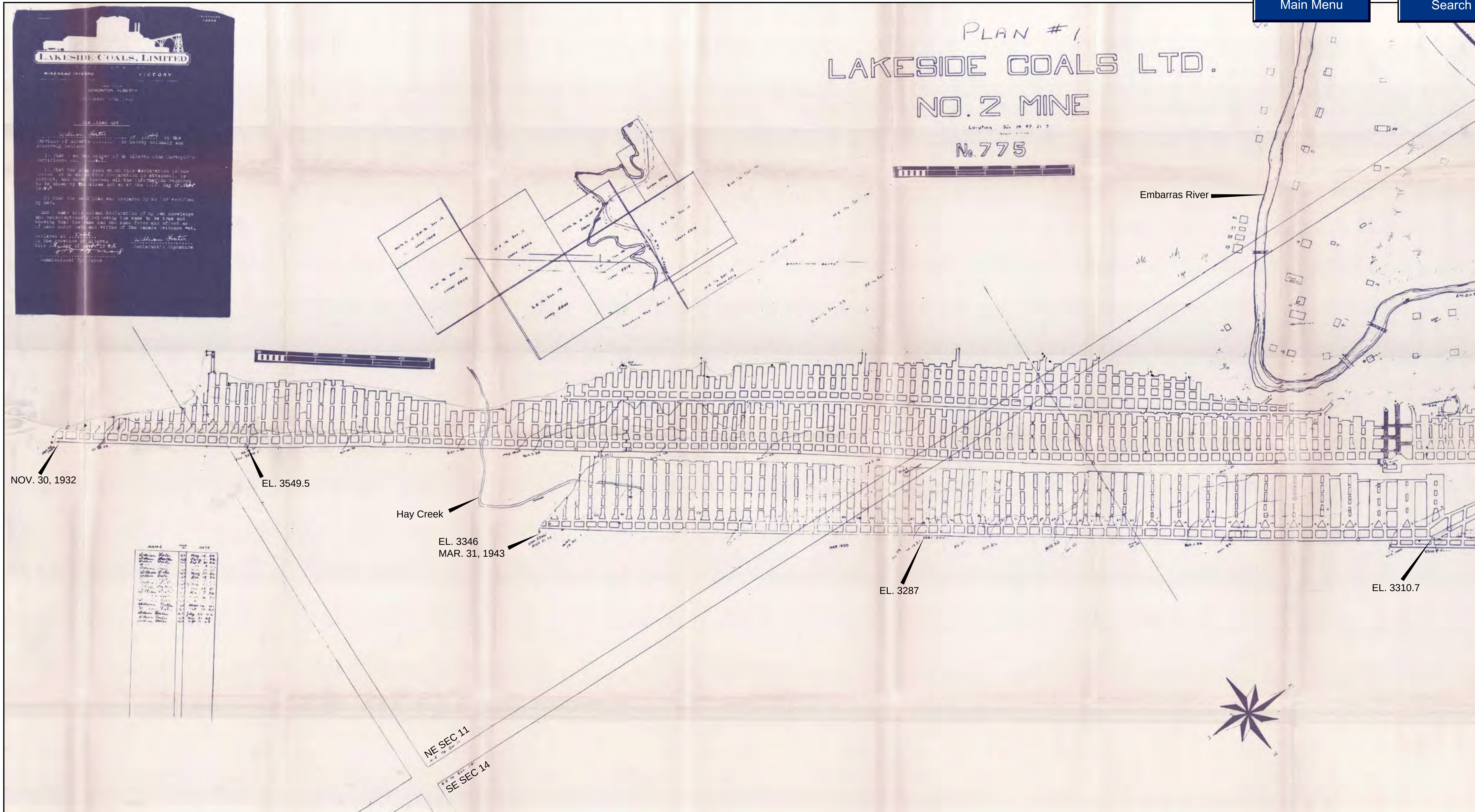

REF: CVRI, 2013.

PROJECT:

cvri

Coal Valley Mine
Robb Trend Project

MILLENNIUM
EMS Solutions Ltd.

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TITLE:

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DRAWN:	JG
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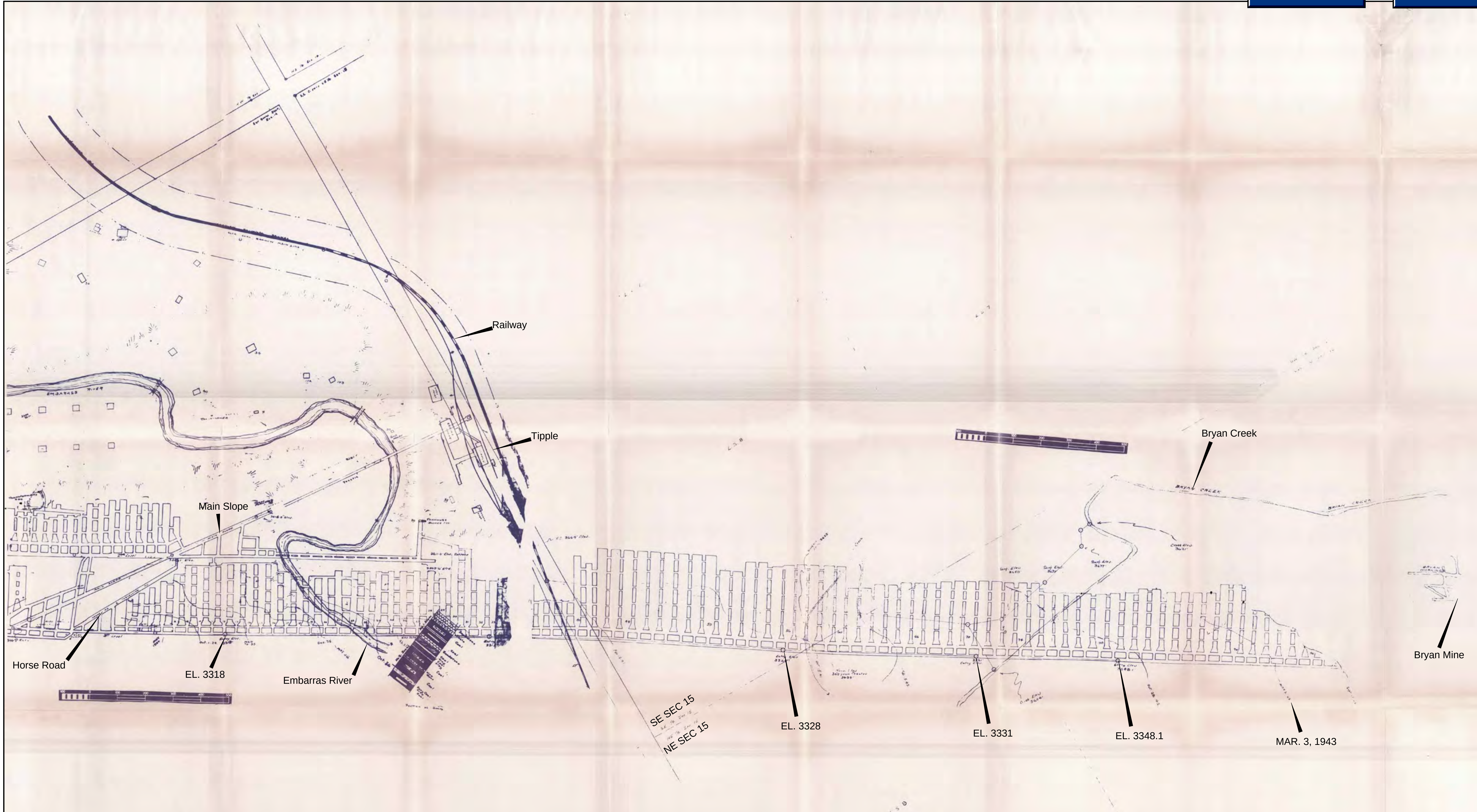
DATE:	May 10/13
PROJECT:	08-041b

FIGURE: □-□

Main Menu Search



PROJECT:

cvri

Coal Valley Mine
Robb Trend Project

MILLENNIUM EMS Solutions Ltd.

...Final Docs\08-041b\Bryan Mine.dwg

TITLE:

□a□eside - □ est

DRAWN: JG
CHECKED: KP
DATE: May 10/13
PROJECT: 08-041b

FIGURE: □-2

REF: CVRI, 2013.