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ANNEXE

F

STABILITÉ DES FOSSES

ANNEXE

F-1 *ANALYSES DE STABILITÉ FOSSE PAUL'S PEAK (PITEAU, 2016a)*

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GEOTECHNICAL STABILITY ASSESSMENTS FOR CONTINUED MINING OF THE SOUTH WALL IN PAUL'S PEAK PIT

Prepared by

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EXECUTIVE SUMMARY

This report details the geotechnical stability assessments for the continued mining of the south wall in Paul's Peak Pit. For the present geotechnical assessment, the structural database, engineering geology conditions, and rock mass strength parameters assessed by Piteau in 2010 were reviewed and validated, and a revised geologic interpretation, as presented in updated geologic sections provided by ArcelorMittal Mines Canada (AMMC), and updated pit plan (i.e., the 2015 South Wall Mine Plan) were reviewed. No additional information regarding rock mass strengths, structural fabric orientations, or discontinuity strengths were collected.

ENGINEERING GEOLOGY

The structural geology at the Mont-Wright area is complex due to tight folding caused by at least two major orogeny events. The end result of the folding is the creation of fold limbs that generally dip 40 to 50° to the west and northwest, with local variations including overturned sections in footwall areas of Paul's Peak and flattening in the hinge areas of the major folds.

Stratigraphy of the Mont-Wright deposit is relatively simple as there is little variation in the Iron Formation facies. The local sequence starts with gneiss rocks interpreted to be Archean in age overlain by the Wishart Formation quartzite. The Sokoman Iron Formation overlies the quartzite. A few relatively-thin quartz-muscovite schist bands are interlayered with the Iron Formation. The Iron Formation is overlain by graphite gneisses and schists that are the metamorphic equivalent of the Menihek Formation. Mafic sills that vary from 1m to more than 50m in thickness are found at different stratigraphic levels.

In the mine area, rock types consist of iron formation (IF), quartz rock mica schist (QRMS), quartzite (QR), and amphibolite (AMP). The QR and the AMP occur as different layers or bands within the geosynclinal sequence and have been termed QR-1, QR-2, QR-3, and AMP-1, AMP-2, AMP-3, respectively. Gneiss (GN) also occurs lower down in the sequence, but is not exposed in

the vicinity of the south wall in Paul's Peak Pit. For design purposes, four unique geotechnical units, primarily differentiated on the basis of lithology, have been identified; namely IF, QRMS, QR, and AMP geotechnical units.

While some faults have been interpreted on the regional scale, no major faults that could act as large-scale planes of weakness have been documented within the mine area.

For the present study, analysis of structural discontinuity data collected from structural mapping and drilling from past field investigations did not warrant the division of the south wall of Paul's Peak Pit into more than one structural domain, considering either lithologic or structural boundaries. Therefore, a single structural domain was assumed for this geotechnical stability assessment.

Rock mass strengths were assessed based on the results of geomechanical core logging, Point Load Index (PLI) testing, and laboratory strength testing of core from historical geotechnical drilling programs. Intact rock strengths were determined by correlating PLI testing to unconfined compressive strength (UCS) testing and subsequently logged Hardness (H) to UCS from PLI. Values for the m_i strength parameter were derived based on assessments of valid UCS and triaxial compressive strength (TCS) test results for each geotechnical unit. Discontinuity shear strengths were assessed based on the results of direct shear testing on representative natural discontinuities obtained from drill core.

Rock mass classification of the geotechnical units within Paul's Peak Pit was carried out according to the Bieniawski (1976) Rock Mass Rating (RMR) system. Because rock mass strength can vary based on spatial location, as evidenced by observed variations in rock mass strength on the south wall, the geomechanical database was assessed to determine if different strength zones existed within the rock mass. Up to four strength zones were subsequently defined within each geotechnical unit; namely West, Tower Cut, Central, and East strength zones.

Although no major faults were observed in the pit area, it is likely that some of the bedding and contact surfaces have undergone shearing during folding and deformation.

The development of soft infilling material, including clay, micaceous minerals, and subsequent alteration products have been noted along contact zones, and particularly along lithologic contacts involving amphibolite units. Contacts that were logged in core as weak or altered were identified and incorporated on the two-dimensional sections used for limit equilibrium stability analyses.

HYDROGEOLOGY

For the present study, 2015 piezometric data were collected and reviewed, and phreatic surfaces were reinterpreted along representative sections cut through the proposed 2015 South Wall Mine Plan. The updated piezometric data were used in conjunction with the hydrogeological model developed by Piteau in 2011 to predict water tables for the ultimate pit. Two cases were considered for the prediction. The first case considered groundwater responses to mining only with no dewatering wells or drains being taken into account (i.e., saturated conditions). For the second case, a series of 200 m-long horizontal drains were added to the base case; the drains were simulated along the bench faces of the south wall and were assumed to drain up to about half of their total length. This second case (i.e., depressurized conditions) is intended to approximate the levels of depressurization currently observed in the south wall with a similar drainage system installed.

SLOPE STABILITY ANALYSES AND DESIGN

Slope stability analyses for the proposed 2015 South Wall Mine Plan involved assessment of kinematically-possible failure modes exploiting geologic structural discontinuities that could result in shallow failure of individual benches and deeper failure of multi-bench slopes.

Based on structural geology conditions and slope performance to date, the identified bench-scale critical failure mode with respect to footwall slope design involves slab failure along discontinuities parallel to foliation (i.e., Set JS1), either due to undercutting of these discontinuities, or shearing through weak toe materials. The latter condition constitutes a failure mechanism know as *bilinear slab*. Results of bilinear slab failure assessments were used to develop recommendations for preliminary interramp slope angles (IRAs). Analyses were then conducted, in conjunction with assessments of rock mass quality, to assess the potential for deep-seated, structurally controlled and/or non-circular, rotational rock mass failure of interramp and overall slopes.

CONCLUSIONS AND RECOMMENDATIONS

Results of limit equilibrium stability analyses completed on eight cross sections along the south wall of Paul's Peak Pit indicate that Factor of Safety (FoS) values of 1.2 or greater can be achieved provided that the south wall is depressurized to a minimum horizontal depth of 55m (measured horizontally behind the pit face). Assuming a fully saturated slope (i.e., no depressurization measures are undertaken), the FoS drops to below 1.2 for five of the eight analysed sections, and below 1.0 on one section. Under saturated conditions, large strains, and potentially slope failure, could occur along lithologic contacts or shear planes parallel to foliation. Other than pore pressure, it is important to note that limit equilibrium analyses also indicate that stability of the south wall is strongly controlled by the configuration, location, and nature of the lithologic contacts. It is recommended that the geologic model be updated as the south wall is mined down and if significant deviation from the current geologic interpretation is recognized, slope designs should be reviewed and adjusted accordingly.

The ongoing development of the south wall of Paul's Peak Pit will require regular monitoring using a Slope Stability Radar (SSR) unit in combination with an observational approach to assess slope stability. The monitoring procedures currently undertaken by AMMC to monitor the south wall with an SSR unit are judged appropriate. However, the output of the SSR unit should be carefully determined to minimize false alarms (i.e., surficial slope movements related to ravelling and rockfall events). Other monitoring techniques, such as survey prisms, inclinometers, and time-domain reflectometry (TDR), may need to be incorporated into the monitoring system if the need arises.

For hydrogeological monitoring, regular reviews of piezometric data should be conducted to confirm that adequate depressurization is being achieved behind the south wall. Depending on the number and location of existing vibrating wire piezometers remaining on the south wall during and after mining, the installation of additional piezometers, either behind the final pit crest or installed from benches on the slope, could be required.

Regular inspection of the crest and exposed benches on the south wall should be carried out to identify any signs of tension cracking, increased raveling, or other signs of instability. The locations of observed tension cracks should be surveyed and added to the geotechnical plans to allow assessment of slope deformation with respect to the slope monitoring data and any

potential mechanism(s) of instability. Any unusual signs of slope raveling or distress should be communicated to the Mine Geotechnical Department and assessed accordingly.

Controlled blasting techniques are recommended on the final walls to minimize disturbance to the rock mass and preserve cohesion on discontinuity surfaces. Blast monitoring and pre/post blast inspections should be conducted to continually assess potential blast damage and improve blast performance.

As is normal practice at Mont-Wright, bench faces should be thoroughly scaled and bench toes and berms cleaned following excavation.

Optimization of open pit design requires an iterative approach, whereby designs are implemented, results are evaluated, and the design criteria are updated or modified based on experience. To achieve optimum interramp and overall slopes, an ongoing program of geotechnical data collection and evaluation is required during mining operations to document rock mass behaviour and verify or modify the design criteria as the mine is developed. This could consist of systematic bench face mapping and photogrammetry surveys.

Surface water control in Paul's Peak Pit should incorporate well maintained perimeter ditches behind the pit crest, adequate grading and ditching of haulroads, and collection and pumping of surface water in appropriately placed sumps.

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1. INTRODUCTION

1.1 MINE DESCRIPTION

Mining of iron ore in the Mont-Wright area, located approximately 375 km north of Port Cartier, Québec, has been in progress since early 1970s. The Mont-Wright Mine is currently operated by ArcelorMittal Mines Canada (AMMC), formerly Compagnie Minière Québec Cartier (CMQC) prior to January 2008. The Mont-Wright Mine consists of multiple deposits within a structurally complex sequence of metamorphosed sedimentary rocks. These various deposits are currently being mined (or have been mined in the past) in a series of open pits.

The current Paul's Peak Pit has a planned Life of Mine (LoM) extending to 2045. Paul's Peak Pit has been mined to various levels, ranging from the 518m level on the eastern part of the pit, known as mining area P1, to the 462m level on the western part of the pit, known as mining area P3. Mining area P2, which is located in the centre of the pit between P1 and P3, is at about the 476m level at the time of preparation of this report. The current mine plan indicates expansion of Paul's Peak Pit to the 350m level in the vicinity of the P1 mining area (Fig. 1), which corresponds to an increase in the south wall (i.e., the footwall) of about 170m to a total, ultimate height of about 500m. As requested by AMMC, Piteau Associates Engineering Ltd. (Piteau) has completed a geotechnical stability assessment for the continued mining of the south wall in Paul's Peak Pit in the vicinity of the P1 mining area.

1.2 SCOPE OF WORK

The scope of work for geotechnical stability assessments for the continued mining of the south wall in Paul's Peak Pit is outlined in Piteau's proposal dated August 28, 2015 (Piteau, 2015). In summary, the scope of work included the following main tasks:

i) Project management.
ii) Review of the proposed 2015 South Wall Mine Plan (AMMC, 2015a) to confirm that existing design criteria outlined by Piteau (2010) are met.
iii) Assessment of engineering geology conditions based on the 2007-2009 and the 2009 geotechnical drilling databases (Fig. 1).
iv) Review and validation of rock mass strength parameters assessed by Piteau (2010).
v) Reconciliation of historical drillhole intercepts (2007-2009 and 2009 drillhole databases) of weak or altered contact zones with the newly developed geologic interpretation completed by AMMC (2015c).
vi) Assessment of groundwater conditions (phreatic surfaces) based on the 2015 piezometric levels (AMMC, 2015b).
vii) Two-dimensional (2D) limit equilibrium analyses on eight cross sections incorporating the combined influence of adverse structural orientations and potential for shearing through intact rock mass.
viii) Three-dimensional (3D) limit equilibrium analyses of the south wall, if required based on conclusions from the 2D limit equilibrium analyses.
ix) Reporting.

Note that while the previous assessment looked at specific failure mechanisms related to cracking identified behind the crest of the south wall, those mechanisms will be mined out by the pushback proposed in the current mine plan (AMMC, 2015a). Furthermore, the 2010 study (Piteau, 2010) was phased to assess the following: i) achieve a minimum FoS of 1.2 for the current slope through implementation of an offload; ii) assess stability of continued mining down to the 462m elevation from the P1 area, out in front of the offload, and; iii) assess stability of a 2062yr mine plan continuing down to the 224m elevation, initiated behind the offload. The scope of the current study is to assess the stability of a single mine plan initiated at or close to the current crest down to about the 350m elevation. Thus, the scopes of the two studies are materially different.

2. ENGINEERING GEOLOGY

The following sections are included to provide a summary of the regional and local geology, rock mass conditions, and structural geology conditions on the south wall of Paul's Peak Pit. This summary is based on results from: the 1998 bench mapping campaign (Piteau, 1998a); the 2007-2009 and 2009 geotechnical drilling databases (Piteau, 2010); the 2010 geomechanical assessments carried out by Piteau for the South Wall Pit Slope Design (Piteau, 2010); and the 2015 updated geologic sections provided by AMMC (2015c), included in Appendix A. It is noteworthy that no new field investigations or reassessments of existing geomechanical data were carried out for this study; the assessment of geotechnical units, discontinuity strengths, and rock mass strengths is based primarily on work conducted for the 2010 design study, and is included herein for completeness.

The summary on the regional and local geology, provided in Section 2.1 below, is based on reports prepared by AMMC (2015d), Piteau (1998a, 2010), and others (Bourassa, 1977) involved in past phases of the project.

2.1 REGIONAL AND LOCAL GEOLOGY

2.1.1 Regional Geology

The Mont-Wright orebody is located in the Severson Range, in the southwestern portion of a 1,120 km long band of Proterozoic rocks known as the Québec-Labrador Trough. The oldest rocks are Archean granulites and acidic intrusives. These rocks are overlain by Proterozoic metasediments which are highly metamorphosed and exhibit complex structural deformation and fabric. The metasediments are cut by later granitic and gabbro intrusions. The gabbros form plugs, sills and dykes, which have been largely metamorphosed into foliated amphibolites.

2.1.2 Local Geology

The Iron Formation at Mont-Wright is the remnants of Proterozoic sediments that form the Mount Severson Hill Range extending from Fermont to Hessé Lake, and is part of the Sokoman Iron Formation which is included in the Ferriman Group.

The structural geology at the Mont-Wright area is complex due to tight folding caused by at least two major orogeny events. Lateral variations in stratigraphy, ore mineralogy, and ore thickness are due to a combination of depositional and structural features. Complex folding has created duplication of the iron bands sometimes resulting in ore lenses attaining 100m in thickness, as observed in some parts of the operating mines at Mont-Wright. The end result of the folding is the creation of fold limbs that generally dip 40 to 50° to the west and northwest, with local variations including overturned sections in footwall areas of Paul's Peak and flattening in the hinge areas of the major folds.

Stratigraphy of the Mont-Wright deposit is relatively simple as there is little variation in the Iron Formation facies. The local sequence starts with gneiss rocks interpreted to be Archean in age overlain by the Wishart Formation quartzite. The Sokoman Iron Formation overlies the quartzite. A few relatively-thin quartz-muscovite schist bands are interlayered with the Iron Formation. The Iron Formation is overlain by graphite gneisses and schists that are the metamorphic equivalent of the Menihek Formation. Mafic sills that vary from 1m to more than 50m in thickness are found at different stratigraphic levels.

While some faults have been interpreted on the regional scale, no major faults that could act as large-scale planes of weakness have been documented within the mine area.

In the mine area, rock types consist of iron formation (IF), quartz rock mica schist (QRMS), quartzite (QR), and amphibolite (AMP). The QR and the AMP occur as different layers or bands within the geosynclinal sequence and have been termed QR-1, QR-2, QR-3, and AMP-1, AMP-2, AMP-3, respectively. Gneiss (GN) also occurs lower down in the sequence, but is not exposed in the vicinity of the south wall in Paul's Peak Pit.

The ore occurs in iron rich units comprised essentially of specular hematite and quartz, with very little magnetite. Rocks containing greater than 15% hematite are defined as iron formation while rocks containing less than 15% hematite are defined as QRIF, QRMSIF or MSIF, depending on the host rock. For geomechanical characterization purposes, the QRIF and QRMSIF were grouped as QR and QRMS, respectively.

The IF is underlain by, and locally interbedded with, the Wishart Formation, a sequence comprised of slightly to moderately-foliated quartzite (QR), and more strongly-foliated quartz-mica and mica schist (QRMS). Gradational contacts frequently exist between these units, and with the overlying IF. The schistosity within the QRMS is typically well developed, and where the mica content is high (greater than 40%), the rock tends to be very fissile.

The AMP units are found intruding, and interbedded with, both the IF and QRMS rocks. The AMP is generally a medium-grained rock comprised of greenish amphibolite, feldspar, biotite, and garnet. Locally, the AMP unit has been argillically altered to soft, plastic clay, particularly along contact zones with the IF. This condition has been associated with several slope instabilities in open pit areas in the Mont-Wright Mine (Piteau, 1998b). The argillic alteration is not restricted to contacts with the IF; AMP can also show signs of alteration along contacts with the QR and QRMS. However, alteration along these contacts tends to be less continuous and thinner than along contacts with the IF.

2.2 GEOTECHNICAL UNITS

At least 13 distinct lithologies have been recognized in drill core and in outcrops on the project site (Piteau, 2010). Some of these units represent slight mineralogical gradations, and many are sufficiently similar to be considered as a single geotechnical unit. For design purposes, four unique geotechnical units, primarily differentiated on the basis of lithology, have been identified and are summarized in the table below.

Geotechnical Unit	Lithology
Iron Formation (IF)	This unit is comprised of the ore-bearing IF lithology and also contains a number of smaller, continuous and discontinuous bands of QRMS, AMP, and QR. The IF makes the majority of the rock mass in the fold hinge.
Quartz Rock Mica Schist (QRMS)	Consists of QRMS and QRMSIF lithologies that occur as inclusions within the IF and, depending on the location, as the first unit below the IF.
Quartzite (QR)	Consists of QR-1, QR-2, and QR-3 units of the QR and QRIF lithologies. Occur as inclusions within the IF and, depending on the location, as the first unit below the IF. At depth, it occurs as large units interbedded with AMP.
Amphibolite (AMP)	Consists of AMP-1, AMP-2, and AMP-3 units of the AMP lithology. Occur as inclusions within the IF and, depending on the location, as the first unit below the IF. At depth it occurs as large units interbedded with QR.

2.3 STRUCTURAL GEOLOGY

2.3.1 Rock Mass Discontinuities

General geometric relationships between the joint sets observed at Paul's Peak, namely bedding joints and cross joints, are similar to conditions observed in folded sedimentary and metasedimentary rocks in many other areas. That is, two main sets of cross joints seem to exist: one set that strikes approximately perpendicular to bedding and dips steeply to subvertically, and a second set that strikes essentially parallel to bedding and dips approximately normal to bedding. An additional one or two weakly-developed joint sets, which occasionally form a conjugate set, seem to occur locally.

Rock mass discontinuities mapped on surface and observed in drill cores from Paul's Peak generally consist of joints, bedding/foliation planes, and shears developed subparallel to the stratigraphy, and two joint sets that are roughly perpendicular to the bedding plane (Fig. 2). Most of the discontinuities mapped in the 1998 bench mapping campaign (Piteau, 1998a) were joints. Other types of discontinuities, such as faults, were insufficiently mapped to enable separate assessments of these discontinuity types. Therefore, for the current assessment, all discontinuity types were considered together and analyzed as joints.

Joint Set JS1 consists of joints and shears developed subparallel to stratigraphy. Discontinuities of this set were divided into tight, discontinuous bedding fabric (JS1), bedding joints (JS1A), and continuous shears (JS1B), which may be greater than 50m long. Individual discontinuities of set JS1B were observed to have both large and small-scale waviness resulting in variable dip angles due to the effects of folding. Spacing of the continuous JS1B Set was observed to be in the range of 2 to 5m. The JS1 Set was observed to have a peak dip direction of 300° with a dip of 37° towards the northwest, which is typically within 2 to 5° of the bedding foliation. A third subset of the JS1 Set (JS1C), which strikes obliquely to the stratigraphy and dips at a shallower angle (i.e., about 35°), was identified from surface mapping.

Joint Set JS2 consists of steeply dipping joints which strike approximately perpendicular to the main bedding orientations. Results of field mapping show a peak orientation of the

JS2 Set corresponding to a dip direction of 052° with a dip of 84° to the northeast. This discontinuity set generally has a planar geometry with rough surfaces, minimal infilling, and a continuity of several metres.

Joint Set JS3 consists of rough, discontinuous joints which trend generally parallel to bedding and dip approximately perpendicular to bedding, forming a general orthogonal relationship. Similar to the JS1 Set, a wide range in both strike and dip was apparent in the JS3 Set. Continuity along JS3 structures was observed to range from as little as 2m to greater than 10m. The JS3 Set was observed to have a peak dip direction of 131° with a dip of 59° towards the southeast.

At Paul's Peak, the spacing and intensity of fracturing observed appears to vary considerably in different pit areas and within different rock types. Although most rock masses are competent, the orientation of the various discontinuity sets with respect to specific wall orientations has contributed to bench-scale instability in many areas. At the overall slope scale, the main concern with regard to slope stability involves the location and orientation of lithologic contacts on the south wall of Paul's Peak Pit.

2.3.2 Faults and Contact Zones

Although no major faults were observed in the Paul's Peak area, it is likely that some of the bedding and contact surfaces have undergone shearing during folding and deformation. The development of soft infilling material, including clay, micaceous minerals, and subsequent alteration products, has been noted along contact zones, and particularly along lithologic contacts involving AMP units. Where daylighted by mining, this argillic alteration developed along contacts has resulted in slope instability on pit walls at Mont-Wright (e.g., the June 6, 1998 Pit B Ramp Instability (Piteau, 1998b)). A comparison of the updated geologic interpretation (AMMC, 2015c) with the interpretation available from the 2010 study was conducted. While some local variations in contact configuration and location were observed, these changes are not considered significant.

Based on observation of core from the 2009 drilling program, a number of drill intercepts through contact zones were characterized as weak or altered. The altered contact zones were primarily observed in contacts involving AMP. These altered zones typically were

composed of argillic clay and completely altered amphibolite, with an average thickness of about 0.5m, but up to about 1m in some drillholes. To develop an understanding of the extent of these weak contact zones and their potential implication on stability of the south wall, each drill intercept was plotted on structural contour plans of each contact. Contacts that were identified in core as weak or altered were then highlighted on these plans, and altered contact zones were outlined where numerous intercepts indicating weak material were adjacent. Finally, these altered contact zones were transferred to the appropriate contact on the 2015 updated geologic sections (AMMC, 2015c); altered contact zones are shown on the geologic sections included in Appendix A.

2.3.3 Structural Domains

For the present study, analysis of structural discontinuity data collected from mapping and drilling from the 1998, 2007-2009, and 2009 field investigations did not warrant the division of the south wall of Paul's Peak Pit into more than one structural domain, considering either lithologic or structural boundaries. Therefore, a single structural domain was assumed for this geotechnical stability assessment.

2.3.4 Assessment of Structural Anisotropy

Where a well-defined structural fabric exists, rock mass strength can be expected to vary (i.e., strength anisotropy) depending on the orientation and spacing of structural discontinuities with respect to the slope face.

The main discontinuity orientations mapped on surface or observed in drill cores were assessed to determine the potential for preferential shearing along discrete structural features such as joints, bedding, and lithologic contacts, defining shear strength anisotropy within the slopes. Joint Sets JS1 and JS3, which consist, respectively, of joints and shears subparallel to the stratigraphy and lithologic contacts, and cross joints dipping perpendicular to stratigraphy, were recognized to define potential shear orientations on the south wall.

The effects of shear strength anisotropy were incorporated at the bench and multi-bench scale by considering critical failure modes involving slab failures along the JS1 Set (in

particular the JS1B subset) and shearing along pre-existing discontinuities at the toe. This particular failure mechanism is known as bilinear slab failure and consists of an active block (i.e., the slab) and a passive, resisting block (i.e., the toe block); the interface between the two blocks is assumed to be formed by the JS3 Set.

At the interramp and overall scale, the effects of shear strength anisotropy were incorporated in deep-seated stability analyses by considering lithologic contacts as discrete features with joint strengths.

2.4 ROCK MASS STRENGTH ASSESSMENT

Assessment of the strength and competency of the rock mass is based on the strength of the intact rock material, the general quality of the rock mass, and the condition and spacing of discontinuities. An assessment of the relative strength of the various rock mass units was made (Piteau, 2010) based on the results of geomechanical core logging, PLI testing, and laboratory uniaxial and triaxial compressive strength testing of core samples.

2.4.1 Intact Rock Strength

A knowledge of the intact strength of the rock is necessary for basic rock mass classification and conventional assessments of overall rock mass shear strength. The methods used to evaluate intact rock strength were Hardness logging, PLI testing, UCS testing, and TCS testing.

i) Hardness (H)

Estimates of Hardness (H) were logged on a run-by-run basis according to ISRM Suggested Methods (1981), as illustrated graphically on the geomechanical core logs included in Appendix B of Piteau's 2010 report. As summarized in Table I, the weighted averaged H values ranged from 2.2 to 3.4 for IF, from 3.2 to 3.3 for QRMS, from 3.6 to 4.3 for QR (different layers), and from 2.8 to 3.6 for AMP (different layers). The lower average H value of 2.2 indicated for the IF unit is associated with the 2007-2009 drillholes which are concentrated in the southeastern portion of Paul's Peak Pit, where observations indicate extensive weathering or alteration of the IF unit.

ii) Degree of Alteration (DOA)

Degree of Alteration (DOA) is a simple visual and mechanical classification based on how altered or weathered the rock appears, relative to a fresh specimen. For example, a DOA of A corresponds to residual soil, with original fabric destroyed, while a DOA of F corresponds to fresh and unweathered rock, with possible improvement in rock competency due to alteration (e.g., silicification). As summarized in Table I, average DOA ratings range between E (slightly weathered/altered) and D (moderately weathered/altered). Results of DOA logging are graphically illustrated on geotechnical logs included in Appendix B of Piteau's 2010 report.

iii) Point Load Index (PLI) Testing

Point Load Index (PLI) testing was conducted on core samples from the 2009 geotechnical drillholes and four of the drillholes from the 2007-2009 drilling (Piteau, 2010). Diametral tests (i.e., conducted across the diameter of the core) and axial tests (i.e., conducted parallel to the core axis) were typically carried out at approximately 3m and 9m intervals, respectively. In rock types that displayed obvious strength anisotropy (i.e., bedding foliation), diametral tests were conducted approximately parallel to the foliation and axial tests were conducted approximately perpendicular to the foliation. Approximately 5,562 valid tests, performed by Piteau and AMMC personnel, are included in the PLI database. Valid individual PLI results, normalized to an equivalent 50mm core diameter ($I_{S(50)}$), are shown on the geotechnical core logs included in Appendix B of Piteau's 2010 report.

The Strength Anisotropy Index ($I_{a(50)}$) is the ratio of $I_{S(50)}$ measured perpendicular to or across foliation to $I_{S(50)}$ measured parallel to or along foliation. Values close to 1 are considered to be representative of isotropic rocks and higher values are representative of anisotropic rocks (ISRM, 1985). Strength Anisotropy Indices for each geotechnical units are summarized in the table below.

Geotechnical Unit	Strength Anisotropy Index ($I_{a(50)}$)
IF	1.3
QRMS	1.9
QR	1.0
AMP	1.5

Results indicate that the QR unit, which is typically massive, is isotropic, while the QRMS unit is strongly anisotropic. The IF and AMP units are slightly and moderately anisotropic, respectively.

iv) Unconfined Compressive Strength (UCS) Testing

Forty uniaxial compressive strength (UCS) tests were conducted on core samples from the 2009 drilling program representing the main geotechnical units expected to be encountered in the south wall. All UCS tests were considered to be valid tests (Piteau, 2010). The UCS test results for the various geotechnical units are summarized in Table I. A detailed laboratory test report is included in Appendix C of Piteau's 2010 report.

v) Development of PLI to UCS Correlation Factors

Correlation factors were derived to estimate UCS from PLI ($I_{S(50)}$) values, according to ISRM Suggested Methods (1985). To determine a correlation factor specific to a given rock type, UCS test results are correlated with PLI test results for the same geotechnical unit. This was conducted by performing approximately 10 additional PLI tests within plus or minus 5m of each UCS sample, and correlating the mean $I_{S(50)}$ value for each suite to the corresponding UCS test value. Separate correlations developed for each geotechnical unit are summarized in the table below and illustrated on Fig. 3. Only valid UCS and PLI test results were used to establish the PLI correlation factor (K).

Geotechnical Unit	PLI Correlation Factor, K
IF	30
QRMS	11.5
QR	30
AMP	13.5

The above correlation factors were subsequently applied to all valid PLI test results for estimation of UCS from PLI (UCS_{PLI}), and the results are summarized in Table I.

vi) Assessment of Hardness-UCS Relationships

Logged H values were used to provide site-specific estimates of UCS. Correlations were developed between UCS values estimated from PLI tests (UCS_{PLI}, as determined above) and corresponding average H values. Separate correlations were developed for each geotechnical unit as graphically illustrated on Figs. 7 through 10 in Piteau's 2010 report. These correlations were subsequently applied to all geomechanical core logging data to enable estimation of UCS from H on a run-by-run basis. The results are summarized in Table I and graphically illustrated on Fig. 4.

vii) Triaxial Compressive Strength (TCS) Testing

A total of 24 TCS tests, with confining pressure ranging from 2.5 to 20 MPa, were carried out on representative samples of IF, QRMS, QR, and AMP (Piteau, 2010). Mohr-Coulomb shear strength envelopes derived from TCS and UCS tests are reproduced on Figs. B1 to B4 included in Appendix B. A detailed laboratory test report is included in Appendix C of Piteau's 2010 report.

The TCS testing program, in conjunction with the UCS tests, was carried out to derive Hoek-Brown m_i material constants (Hoek et al., 2002) for the various geotechnical units expected to be encountered in the south wall of Paul's Peak Pit, as briefly described in the section below.

viii) Determination of Hoek-Brown Material Constant (m_i)

Hoek-Brown (2002) m_i material constants were derived based on assessments of valid UCS and TCS test results for each geotechnical unit using the computer program RocLab® (Rocscience, version 1.0). The resulting m_i values are reproduced on Figs. B1 to B4, included in Appendix B, and are summarized below.

Geotechnical Unit	Hoek-Brown Constant, m_i
IF	25
QRMS	14
QR	23
AMP	15

2.4.2 Shear Strength of Discontinuities

Direct shear strength testing of natural discontinuities was conducted on 20 representative rock specimens obtained from drill core (Piteau, 2010). The rock specimens were selected to represent a variety of Joint Conditions (JC as per Bieniawski, 1976). Test results are reproduced on Figs. B5 to B8, included in Appendix B, and are summarized below. A detailed testing laboratory report is included in Appendix C of Piteau's 2010 report.

Geotechnical Unit	Basic Shear Strength		Average Shear Strength		Peak Shear Strength	
	c' (kPa)	ϕ' (°)	c' (kPa)	ϕ' (°)	c' (kPa)	ϕ' (°)
IF	0	30	0	35	50	40
QRMS	0	22.5	0	27	50	30
QR	0	29	0	35	50	37
AMP	0	28	0	34	50	40
Altered Contact Zone	-	-	45	25	75	28

The shear strength parameters summarized above were interpreted for each geotechnical unit based on the results of direct shear testing, field core logging, and mapping data. The *basic* shear strength along JS1 for each geotechnical unit represents the approximate lower-bound of direct shear testing results and does not include the effects of surface roughness or waviness on a larger scale. The *average* shear strength along JS1 includes the effects of waviness and roughness on a larger scale, yielding friction angles (ϕ') that are approximately 5 to 6° greater than the basic shear strengths. The *peak* shear strength along JS1 includes the effects of waviness and roughness on a larger scale and also incorporates a nominal cohesion (c') of 50 kPa, yielding ϕ' values that are approximately 7 to 12° greater than the basic shear strengths. In practical terms, basic and average shear strengths are considered to be representative of discontinuities on which some movement has occurred, resulting in loss of cohesion.

The shear strength of altered contact zones was estimated based on previous experience at Mont-Wright and on consolidated undrained (CU) triaxial testing conducted on three samples, two involving material from QRMS/AMP contacts and one on sandy altered IF. Details of the CU triaxial testing can be found in Piteau's 2010 report.

Shear strengths values selected for design are presented in Table II.

2.4.3 Rock Mass Classification

Rock mass classification of the geotechnical units within Paul's Peak Pit was carried out according to the Bieniawski (1976) Rock Mass Rating (RMR) system. This system requires evaluation of five interrelated rock mass parameters: intact rock strength, Rock Quality Designation (RQD; Deere et al., 1967), joint spacing (or its inverse, fracture frequency), Joint Condition (JC), and groundwater conditions[1]. Each parameter is assigned a weighted numerical value and the sum of these values determines the RMR; RMRs between 8 and 100 are possible. For RMRs greater than 25, RMR is equivalent to the Hoek-Brown (2002) Geological Strength Index (GSI).

The intact rock strength component of RMR was derived from H-UCS_{PLI} relationships, as defined above. Note that because PLI testing was not conducted for the 2007-2009 drilling program, RMRs based on UCS_{PLI} could not be calculated for this database. Calculated RMRs for each core run in the 2009 database are shown graphically on the geotechnical logs in Appendix B of Piteau's 2010 report. Average RMR values based on H-UCS_{PLI} relationships and UCS_{PLI} are summarized in Table I.

A review of the RMR data from the two databases (i.e., 2007-2009 and 2009 databases), both in terms of average values presented in Table I and in terms of frequency distribution as presented in Appendix E of Piteau's 2010 report, indicates that the RMR values are generally consistent between the 2007-2009 and 2009 databases. However, the IF and the QRMS units exhibit lower RMR values in the 2007-2009 database than in the 2009 database. The 2007-2009 drillholes are concentrated in the southeastern portion of Paul's Peak Pit, where observation indicates extensive weathering or alteration of the IF and QRMS units, whereas the 2009 drillholes were more evenly distributed throughout the pit. The differences between the two databases are slightly more pronounced in intact rock strength. Ultimately, design RMR and UCS values were selected by considering both the 2007-2009 and 2009 databases.

[1] Groundwater conditions are typically assumed to be dry for calculating RMR; piezometric conditions are modelled explicitly in limit equilibrium stability analyses, as described in Section 3.4.

Failure mechanisms in rock slopes generally tend to exploit weak zones; therefore, average or median rock mass parameters can potentially be too high for stability assessments. Back analyses carried out by Piteau as part of the South Wall Pit Slope Design (Piteau, 2010) indicated that more representative rock mass values correspond to the 35th percentile range. Therefore, as shown in Appendix C and in Table II, design values for the current assessments were selected using the 35th percentile of RMR and UCS.

2.4.4 Rock Mass Shear Strength

As reported in Table II and graphically illustrated on Figs. 5 to 8, isotropic Hoek-Brown (2002) rock mass strengths were derived using RMR and UCS values based on the 35th percentile. These design rock mass strengths assume a Disturbance (D) of 0.85, signifying partially disturbed conditions, up to 50m behind the pit wall[2]. This D value corresponds to a moderate level of disturbance that would be consistent with stress relief induced by mining and the implementation of controlled blasting measures adjacent to the pit walls, as is currently implemented at Mont-Wright. Beyond this depth limit, a D of 0.7 was assumed.

Shear strengths of contact zones were estimated based on the weakest JS1 discontinuity structure of the two units forming the contact. For example, the peak shear strength of the weaker QRMS-JS1 structure was used to model the QRMS/IF contact (i.e., c' of 50 kPa and ϕ' of 30°). The shear strength of altered contact zones was assumed to be characterized by peak shear strength (i.e., c' of 75 kPa and ϕ' of 28°).

2.4.5 Strength Zonation of Geotechnical Units

Because rock mass strength parameters can vary based on spatial location, as evidenced by observed variations in rock mass strength on the south wall, the geomechanical database was assessed to determine if different strength zones existed within the rock mass. To accomplish this, average rock mass and intact rock strength values were summarized for each geotechnical unit within each drillhole. These average RMR and

[2] Measured perpendicular to the slope face from bench toes.

strength values were then compared to like geotechnical units in adjacent drillholes, and then were either combined if similar or kept separate. Up to four strength zones were subsequently defined within each geotechnical unit, based on the spatial relationships of the drillholes (Piteau, 2010). These strength zones are briefly described below for each geotechnical unit. Average RMR and intact rock strength values for each geotechnical unit and strength zone are summarized in Table II. The strength zones are shown conceptually on the 483m level plan (Fig. 9). Rock mass strength envelopes for each geotechnical unit per strength zone are graphically illustrated on Figs. 5 through 8.

i) Iron Formation (IF)

In the vicinity of the Tower Cut, the IF unit is weaker than in the rest of Paul's Peak Pit. This zone, essentially in the southern limb of the syncline, is defined between A3100 and A3400 up to the surface location of the fold axis, currently around the 0 Baseline; this zone is referred to as the Tower Cut Zone. To the west, between A2800 and A3100 and as far north as about 200 South (referred to as the West Zone), and east of A3700 (referred to as the East Zone), strength of the IF unit is about average in terms of relative rock mass quality; IF in the West Zone being stronger than IF in the East Zone. North and east of the Tower Cut Zone (i.e., north of South 200 between A2800 and A3100, north of 0 Baseline between A3100 and A3400, and between A3400 and A3700), the IF unit is relatively strong compared to elsewhere in the south wall; this zone is referred to as the Central Zone (the Central Zone is only defined in IF).

ii) Quartz Rock Mica Schist (QRMS)

The QRMS unit is located stratigraphically beneath the IF unit, and in some cases beneath the AMP-1 unit as well, depending on its location. Similar to the IF, the QRMS is weaker within the Tower Cut Zone and typically weathers into a medium to fine sand. The QRMS unit is slightly stronger in the West Zone, west of A3100, and in the East Zone, east of A3400. The QRMS unit is continuous for the full height of the slope.

iii) Quartzite (QR-1)

The QR-1 unit is located stratigraphically beneath the QRMS. As with the QRMS, the QR-1 is weaker within the Tower Cut Zone and can weather into a medium to fine sand. The QR-1 unit is slightly stronger in the West Zone, west of A3100, and in the East Zone, east of A3400. The QR unit is continuous for the full height of the slope; however, its thickness is highly variable and in some locations it pinches out completely.

iv) Amphibolite (AMP-1)

The AMP-1 unit is only present west of about A2900, in the West Zone, situated between IF and the QRMS units below. East of this zone, AMP-1 pinches out within the IF. AMP-1 only occurs below about the 600m elevation. This band of AMP is slightly weaker in strength and rock mass quality than the other amphibolites (i.e., AMP-2 and AMP-3).

v) Quartzite (QR-2 and QR-3) and Amphibolite (AMP-2 and AMP-3)

The next four bands in the stratigraphic sequence, which are fully continuous across the slope, are AMP-2, QR-2, AMP-3, and finally QR-3. These units, while unique, are relatively uniform in terms of rock mass quality. The QR-3 unit is marginally better than the QR-2 unit, whereas the amphibolites (AMP-2 and AMP-3) are essentially the same.

2.5 HYDROGEOLOGY

Previous hydrogeological assessments for dewatering of Paul's Peak Pit were carried out by Piteau in 2008 and 2011 (Piteau, 2008 and 2011). Conceptual hydrogeological models were then prepared, including phreatic surfaces on representative sections through the then-current pits.

For the present study, 2015 piezometric data (AMMC, 2015b) were collected and reviewed, and phreatic surfaces were reinterpreted along representative sections cut through the proposed 2015 South Wall Mine Plan. The updated piezometric data were used in conjunction with the hydrogeological model developed in 2011 (Piteau, 2011) to predict water tables for the ultimate pit. Two cases were considered for the prediction. The first case considered groundwater responses to mining only with no dewatering wells or drains being taken into account (i.e., saturated conditions). For the second case, a series of 200 m-long horizontal drains were

added to the base case; the drains were simulated along the bench faces of the south wall and were assumed to drain up to about half of their total length. This second case (i.e., depressurized conditions) is intended to approximate the levels of depressurization currently observed in the south wall with a similar drainage system installed. The predicted water tables are presented on the geologic sections included in Appendix A.

3. SLOPE STABILITY ANALYSIS AND DESIGN

3.1 BASIC SLOPE DESIGN CONSIDERATIONS

Slope stability analyses for the proposed 2015 South Wall Mine Plan involved assessment of potential kinematically possible failure modes exploiting geologic structural discontinuities that could result in shallow failure of individual benches and deeper failure of multi-bench and interramp slopes (see Section 3.3 below). Results of these assessments were used to develop recommendations for preliminary interramp slope angles (IRAs). Analyses were then conducted, in conjunction with assessments of rock mass quality, to assess the potential for deep-seated, structurally controlled and/or non-circular, rotational rock mass failure of interramp and overall slopes (see Section 3.4 below). The IRAs were adjusted where necessary to reflect the recommended slope designs assuming a minimum required FoS of 1.2 for interramp and overall slopes. This is the same acceptability criteria used in the previous assessment of the south wall in Paul's Peak Pit.

Note that while the 2010 offload study (Piteau, 2010) looked at specific failure mechanisms related to cracking identified behind the crest of the south wall, those mechanisms will be mined out by the pushback proposed in the current mine plan (AMMC, 2015a), and thus the previous assessment and the current assessment are not exactly comparable. Specifically, the 2010 study was based on back analysis of the south wall which indicated (based on a review of historical monitoring data, mapped tension cracks, and other field observations) that slope movement was most likely to be along the QR-1/AMP-2 contact, whereas the current assessment is based on a mine plan in which this contact is mined out, and any potential failure mechanisms are deeper in the stratigraphic sequence.

3.2 BASIC SLOPE GEOMETRY

The basic parameters that are used to describe the geometry of a benched mine slope are shown on Fig. 10 and summarized in the following table.

Bench Height (BH)	14m (single benches), 28m (double benches), 42m (triple benches), 56m (quadruple benches), and 70m (quintuple benches) depending on the design BFA.
Design Bench Face Angle (BFA)	Design BFA incorporating allotment for expected breakback.
Effective Catch Bench Width (w_{eff})	Minimum effective catch bench width for rockfall protection.
Interramp Slope Angle (IRA)	Maximum bench toe-to-toe or crest-to-crest slope angle.
Interramp Slope Height (IRH)	Maximum allowable IRH defined by kinematics and rock mass stability analyses.
Ramp/Stepout Width	Haul ramp widths are usually dependent on mining equipment specifications; stepout or geotechnical berm widths can vary and are dependent on operational considerations, slope access requirements, stability assessments, etc.
Overall Slope Angle	Angle from the crest to the toe of the pit.
Design Sector	Slope areas that have in common some or all of the following: slope dip direction; structural geology conditions (i.e., structural domain); rock mass properties; and interramp or bench controls.

3.3 BENCH GEOMETRY ASSESSMENTS

Bench geometry assessments were previously conducted as part of the South Wall Pit Slope Design process for Paul's Peak Pit carried out in 2010 (Piteau, 2010). For the present assessment, analysis methodology, assumptions, and results published in 2010 were verified and validated in light of the updated 2015 geologic sections provided by AMMC (2015c). No additional information regarding joint fabric orientation, spacing, and strength were collected for the present assessment. Based on extensive experience acquired by Piteau during site inspections at Mont-Wright, conducted over the last years, it is judged that general geometric relationships (orientation and spacing) and shear strengths of bedding and joints assessed in 1998 and 2010 (Piteau, 1998a and 2010), are still applicable to the current assessment.

3.3.1 Bilinear Slab Analysis Methodology and Assumptions

Limit equilibrium stability analyses were conducted for south wall (i.e., footwall) areas to assess potential failure modes affecting individual bench slopes, whether single or multiple bench heights. The objective of these analyses was to determine allowable bench heights between catchment berms. Based on the structural geology conditions and performance of slopes to date, the critical failure mode with respect to footwall slope

design involves slab failures along the JS1 Set (in particular the JS1B subset), either due to undercutting of this set, or shearing through weak toe materials. The latter condition constitutes a failure mechanism know as *bilinear slab*.

The bilinear slab-type failure mechanism consists of an active driving block and a passive resisting block. The back plane of the driving block is assumed to be formed by structures of the JS1 Set, the interface between the two blocks is assumed to be formed by structures belonging to the JS3 Set, and the breakout plane is assumed to develop through the rock mass in the toe, or possibly along a pre-existing structure. The bilinear slab failure geometry is illustrated on Fig. 11.

Based on results of direct shear strength testing, analysis of the bilinear slab failure mechanism was carried out using a discontinuity shear strength frictional value, ϕ' of 22.5° with no cohesion for the back plane. This strength is the basic, or lower-bound, shear strength determined for joints in the QRMS unit, and represents a conservative but practical approach to bench design. For JS3 cross joints, a ϕ' of 33° with no cohesion was used. For the breakout plane, both shear failure thought intact rock mass and failure along a pre-existing discontinuity were considered. Failure along a discontinuity was found to be more conservative and was therefore used for bench design. A ϕ' of 35° and c' of 125 kPa, which correspond to the upper range of direct shear testing of JS1 discontinuities, were selected as discontinuity shear strength for the breakout plane along an existing discontinuity.

Due to the observed success of drainholes in the south wall, the assessed location of the updated water table, and the relatively-shallow scale of expected slab-type failures (i.e., on the order of 2 to 5m), it is expected that JS1 discontinuities located near the slope face will be drained. Therefore, analysis of bilinear slab-type failure was conducted assuming drained conditions.

3.3.2 Bilinear Slab Analysis Results

A detailed assessment of potential bilinear failure mechanisms was carried out by assessing the potential for slab instability to occur for varying slope heights, dip angles,

and spacing of the JS1 discontinuity set (i.e., slab thickness). Based on the 1998 field mapping (Piteau, 1998a) and slope performance to date, spacing between continuous JS1 structures is expected to be in the range of 2 to 5m. Spacing of less than 2m for the JS1 Set was considered to be infrequent on continuous structures. Moreover, potential slabs with thickness of less than 2m will have a lower consequence of failure (relative to thicker slabs) and should be readily accommodated through the use of adequate catchment berms. Also, analyses indicate that increasing thickness of the potential failure slab corresponded to increasing stability. Therefore, a slab thickness of 2m was identified as the critical design condition.

Bilinear slab analyses were based on a 2D limit equilibrium approach assuming dry conditions. For the 2m-thick potential slab, a minimum FoS of 1.2 was selected as the design criteria (see discussion below in Section 3.4.1 on acceptability criteria). This approach yielded a range of design bench heights for the south wall (i.e., footwall), and provided general bench design criteria for the range of structural geology conditions observed in the current south wall, as well as anticipated conditions, based on review of the geologic sections. The bench design criteria developed based on the bilinear limit equilibrium analyses are summarized in Table III.

For the purposes of preparing the footwall slope designs, the average dip of JS1 and/or lithologic contacts in any given area should be considered as being representative of the BFA in that portion of the pit slope. In other words, bench faces need to be excavated at the actual dip angle of JS1. If JS1 is undercut by mining (i.e., the bench face is excavated steepen than JS1), bench-scale failures could occur, leading to loss of catchment, increased risk to personnel and equipment working below, and, potentially, development of larger-scale instabilities. If, on the other hand, bench faces are excavated flatter than JS1, the slope design may not be optimized and could lead to loss of ore. Transitions in slope design between steeper and flatter areas of average dip (i.e., changes in the design bench stack height), either laterally along slope or vertically down slope, should be conducted in the area of steeper dip (i.e., where the maximum bench stack height will be lower). In areas where the design would leave thin, unstable slivers of rock above a major contact, a wider safety berm than recommended in the design criteria should be planned to remove the thin slab.

A review of the mine plan proposed by AMMC (2015a) indicates that the 2015 South Wall Mine Plan meets the design criteria summarized in Table III, in terms of bench face angle versus bench height relationships. The only exception is the last bench above the pit bottom. This last bench has a BFA of 30° and, based on the design criteria summarized in Table III, the maximum bench stack height for an FoS of 1.2 should be limited to 70m. A review of the 2015 South Wall Mine Plan indicates that this bench is 84m high, which is 14m higher than allowed by the proposed design criteria. However, considering that this is the last bench above the pit bottom and that enough catchment is available, the risk associated with this deviation from the design criteria is judged acceptable. Furthermore, the dip of JS1 in question is on the limit of two designs; if the actual dip of JS1 encountered in the field is flatter than 30°, the current mine plan will be acceptable. Note that the review of the mine plan did not explicitly look at the dip of JS1 as represented in the geologic model. Because the design is highly dependent on the geologic interpretation, it is recommended that the mine plan be continually reviewed during the short-range design process and during mining, and any changes to the geologic interpretation (in particular, to the dip of JS1) be incorporated into the mine plan with consideration given to economic and operational issues. The objective of the design process is to avoid undercutting bedding, or lithological contacts, at the bench scale.

3.4 DEEP-SEATED 2D LIMIT EQUILIBRIUM ANALYSES

Two-dimensional limit equilibrium analysis of slopes using the method of slices is an established and accepted analysis methodology for assessment of slopes in both soil and rock. While it is often the only methodology used on many mining projects due to its relative simplicity, cost effectiveness, and widespread acceptance, it is most justified for slopes that are relatively straight in plan view (i.e., slopes that do not have a significant radius of curvature), as the 2D method assumes a section of unit thickness with no lateral effects or hoop stresses that may be present in a circular pit or tight corner. This might imply, in some cases, the requirement for adequate lateral release to allow freedom of movement in the downslope direction.

While Piteau's proposal (Piteau, 2015) suggested the possibility of conducting 3D limit equilibrium stability analyses, we assessed the results of the 2D stability analyses and determined that 3D assessments were not necessary. Due to the long and linear configuration of the south wall of Paul's Peak Pit (Fig. 1) and the presence of structural discontinuities that can act as release

features (i.e., JS2 structures), 2D limit equilibrium analyses were judged appropriate on their own. In addition, the complexity of creating a reliable 3D model based on sections and plans (i.e., no available 3D geologic solids model) and determining and creating a representative 3D groundwater surface further validated the decision not to conduct 3D analyses.

3.4.1 2D Limit Equilibrium Stability Analysis Methodology, Acceptability Criteria, and Analysis Approach

i) Limit Equilibrium Analysis Methodology

Deep-seated limit equilibrium analyses were carried out with SLIDE® (Rocscience, version 6.0), using the Generalized Limit Equilibrium (GLE) method of slices (Fredlund and Krahn, 1977) to determine the minimum static FoS for the slope. The GLE method is a rigorous analysis approach that accounts for both force and moment equilibria. Non-circular searches were conducted to identify the critical shear path (i.e., the potential failure path with the lowest FoS) in all cases. Non-circular searches are well-suited for modelling specific geologic structures or structural fabric trends along the failure path to simulate shear strength anisotropy. For all critical analysis cases, block search analyses were used to refine the shape of the critical non-circular shear surface defined using the path search optimizer function in SLIDE®. This was done through a process of placing block search boxes along the inflections of the minimum FoS shear path defined with the optimizer function turned on, then running the block search analysis with the optimizer turned off. This approach is considered appropriate to define repeatable analysis results.

For this study, analyses were carried out on eight representative geotechnical cross sections constructed based on the 2015 updated geologic sections provided by AMMC (2015c). Cross section locations are shown on Fig. 1 and included in Appendix A. The slope geometry was defined based on the proposed 2015 South Wall Mine Plan (AMMC, 2015a). Design rock mass shear strength parameters were assigned to each geotechnical unit included in the analysis models. Contacts were modelled using design discontinuity shear strengths, equivalent to JS1 strengths, of the weaker of the two rock mass units forming the contact. Where contacts were interpreted to be altered, altered contact zone shear strengths were applied. Design rock mass shear strengths and discontinuity shear strengths are presented in Table II.

ii) Acceptability Criteria

Industry standards for acceptable levels of safety (i.e., minimum FoS values) are not clearly established in the literature, as a single value usually does not reflect all risks, consequences, and uncertainties associated with slope design. Historically, the most frequently used values range from 1.1 to 1.5 depending on the scale of the slope being analysed (i.e., bench, interramp, overall) and the criticality of the slope design (i.e., consequence of failure) (Read and Stacey, 2009).

From the geotechnical perspective, the choice of a minimum FoS to be used in a specific project generally involves technical aspects such as: the level of confidence in the geotechnical and hydrogeological databases; data coverage; complexity of the geotechnical, geologic, and hydrogeological models; previous experience onsite; etc. Nonetheless, the selection of minimum acceptability criteria is also a management decision which is likely to be governed by a complex mixture of company culture, risk acceptance, legislative requirements, economics, and social views.

The south wall of Paul's Peak Pit has been inspected annually by Piteau since 1998. In addition, two design studies have been completed by Piteau for the Paul's Peak Pit (Piteau, 1998a and 2010). These studies included one bench mapping campaign carried out in 1998, a geotechnical drillhole campaign carried out in 2009, relogging of drillholes from exploration programs carried out between 2007 and 2009, and laboratory testing programs on rock and soil samples. For the current assessment, the geologic model has been updated by AMMC, and reconciliation of historical drillhole intercepts of weak or altered contact zones with respect to the newly developed geologic model has been carried out. Furthermore, AMMC has implemented a monitoring protocol for the south wall of Paul's Peak Pit which includes, among others, the allocation of a Slope Stability Radar (SSR) unit to constantly monitor the south wall.

Based on Piteau's acquired experience on the south wall, the high level of confidence in the structural and geotechnical databases, and the fact that the proposed 2015 South Wall Mine Plan will mine out the probable failure mechanism identified in 2010, an acceptability criteria using an FoS of 1.2 was deemed appropriated for the present assessment. Also, an FoS of 1.2 has historically been successfully incorporated in all pit

designs at Mont-Wright. Furthermore, it is assumed that monitoring of the south wall with an SSR unit will be continued at all times.

iii) Limit Equilibrium Analysis Approach

Stability analyses were initially run assuming depressurized slopes; that is, levels of depressurization that could likely be achieved with the installation of 200m-long horizontal drainholes during mining of the south wall (as discussed in Section 2.5). Sensitivity analyses were run to assess the adverse effect of water pressures on slope stability assuming fully saturated slopes. For analysis results with a minimum FoS greater than 1.2 for depressurized conditions (i.e., assuming the installation of 200 m-long horizontal drainholes), additional sensitivity analyses were run to assess the minimum level of depressurization required to achieve an FoS of 1.2.

3.4.2 2D Limit Equilibrium Stability Analysis Results

Analyses of the proposed 2015 South Wall Mine Plan were carried out to determine the minimum FoS values for each stability analysis section. Selected limit equilibrium analysis results are shown on Figs. D1 to D64 in Appendix D. The minimum FoS for each analysed section is summarized below.

Section	Slope Interval (m)	Minimum FoS		Approximate Depth of Depressurization for FoS = 1.2	Figure
		Depressurized Slope[2]	Saturated Slope		
1	448 to 658	1.40	1.05	23m	D1 and D2
3150	434 to 826	1.25	0.98	54m	D12 and D13
3300	616 to 728	1.35	1.35	n/a	D22 and D23
3450	434 to 616	1.28	1.02	11m	D28 and D29
3600	350 to 616	1.97	1.64	n/a	D36 and D37
3750	350 to 460	1.66	1.41	n/a	D45 and D46
3900	364 to 560	1.27	1.03	14m	D53 and D54
7	364 to 504	1.51	1.07	14m	D59 and D60

Note: 1. FoS values less than 1.2 are shown in red font.
2. This level of depressurization corresponds to lowering the water table approximately 80 to 90m, measured horizontally behind the pit face, with the use of 200m-long horizontal drainholes.

Results summarized above indicate that for depressurized slopes (i.e., assuming the use of 200m-long horizontal drainholes), all FoS values are greater than 1.2. If depressurization measures are not undertaken (i.e., for saturated slopes), the FoS values

would fall below 1.2 for five of the eight analysed sections, and below 1.0 for Section 3150. Under saturated conditions, large strains, and potentially slope failure, could occur along lithologic contacts or shear planes parallel to foliation.

Sensitivity analyses to assess the level of depressurization of the slopes indicate that an FoS of 1.2 could be achieved provided that the south wall is depressurized to a minimum horizontal depth of 55m (measured horizontally behind the pit face). Assuming drainholes will effectively drain up to about half their length, which is a reasonable assumption based on experience at Paul's Peak, this level of depressurization could be achieved with the installation of 110 m-long horizontal drainholes drilled from successive benches of the south wall as the slope is mined down. Based on the predicted post-mining water table, as shown on the geologic sections included in Appendix A, the initial elevation for the installation of drainholes varies depending on location in the slope, ranging from as high as the 728m level in the east (i.e., on Sections 7, A3750, and A3600) to about the 574m level in the west (i.e., on Section 1). Length, spacing (both lateral and vertical), and pattern of drainholes should be optimized, based on previous experience, to intersect as many water-bearing features and areas as possible.

Other than pore pressure, it is important to note that limit equilibrium analyses also indicate that stability of the south wall is strongly controlled by the configuration, location, and nature (i.e., weak contacts characterized by argillic alteration versus unaltered contacts) of the lithologic contacts. Undulated and kinked (or closely folded) contacts could force potential shear surfaces to cross the stronger rock mass in order to bridge the gap between two adjacent weak contact zones along the failure surface, increasing stability. Conversely, smooth contacts would maximize the potential for the shear surface to follow the weak contact as much as possible, reducing stability. All being equal, a critical shear surface following a lithologic contact closer to the slope face would tend to result in a lower FoS as compared to a critical shear surface following a lithologic contact located deeper into the slope (assuming that the lithologic contact does not daylight). In other words, the stability models and analysis results are only as good as the available geologic model, and it is recommended that the geologic model be updated as the south wall is mined down. If significant deviation from the current geologic interpretation is recognized, slope designs should be reviewed and adjusted accordingly.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

4.1.1 Engineering Geology

i) Structural Geology and Rock Mass Anisotropy

The structural geology at the Mont-Wright area is complex due to tight folding caused by at least two major orogeny events. The end result of this complex folding is the creation of fold limbs that generally dip 40 to 50° to the west and northwest, but with local variations, including overturned sections in footwall areas of Paul's Peak Pit, and flattening in the hinge areas of major folds. While some faults have been interpreted on the regional scale, no major faults that could act as large-scale planes of weakness have been documented within the mine area.

Geometric relationships between the joint sets observed at Mont-Wright, namely bedding joints (JS1) and cross joints (JS2 and JS3), are similar to conditions observed in folded sedimentary and metasedimentary rocks in many other areas. That is, two main sets of cross joints seem to exist; one set that strikes approximately perpendicular to bedding and dips steeply to subvertically (JS2), and a second set that strikes essentially parallel to bedding and dips approximately normal to bedding (JS3).

Although no major faults were observed in the Paul's Peak area, it is likely that some of the bedding and contact surfaces have undergone shearing during folding and deformation. Based on observation of core from the 2009 drilling program, a number of drill intercepts through contact zones were characterized as weak or altered, and incorporated as weak zones in the limit equilibrium analyses.

Joint sets were recognized to define potential shear orientations on the south wall. The effects of shear strength anisotropy were incorporated at the bench and multi-bench scale by considering critical failure modes involving slab failures along the JS1 Set (in particular the JS1B subset) and shearing at the toe along a pre-existing discontinuity. This particular failure mechanism is known as bilinear slab and consists of an active block and

a passive resisting block; the interface between the two blocks is assumed to be formed by the JS3 Set.

ii) Rock Mass Strength

In the mine area, rock types consist of iron formation (IF), quartz rock mica schist (QRMS), quartzite (QR), and amphibolite (AMP). The QR and the AMP occur as different layers or bands within the geosynclinal sequence and have been termed QR-1, QR-2, QR-3, and AMP-1, AMP-2, AMP-3, respectively.

The rock mass quality of the geotechnical units encountered in the south wall is generally competent; however, local variations were observed as conceptually shown on Fig. 9. In the vicinity of the Tower Cut, the IF unit is weaker than in the rest of Paul's Peak Pit. To the west and east of the Tower Cut, in the West and East zones respectively, the strength of the IF unit is about average in terms of relative rock mass quality. North and east of the Tower Cut Zone, in the Central Zone, the IF unit is relatively strong compared to elsewhere in the south wall. Similar to the IF, the QRMS and QR are weaker within the Tower Cut Zone and typically weather into a medium to fine sand. The QRMS and QR are slightly stronger in the West and East zones. The strength of the AMPs is essentially the same across all zones within the south wall.

iii) Hydrogeology

Piezometric data from 2015 were collected and reviewed, and phreatic surfaces were interpreted along representative sections cut through the proposed 2015 South Wall Mine Plan. The updated piezometric data were used in conjunction with the hydrogeological model developed in 2011 to predict water tables for the ultimate pit floor. Two cases were considered: the first case considered groundwater responses to mining only (i.e., saturated condition), while the second case simulated a series of 200 m-long horizontal drains installed along the bench faces and were assumed to drain up to about half of their total length (i.e., depressurized conditions). This second case is intended to approximate current conditions observed in the south wall.

4.1.2 Open Pit Stability Analysis Results and Design Criteria

Open pit design criteria for the south wall of Paul's Peak Pit were developed based on limit equilibrium analyses. Maximum allowable bench stack height (for bench design) on the south wall was assessed assuming a bilinear failure mechanism involving slab failures along the JS1 Set (in particular the JS1B subset), either due to undercutting of this set, or shearing through a pre-existing discontinuity at the toe. Overall slope stability was assessed based on 2D limit equilibrium analyses assuming non-circular failure mechanisms following lithologic contacts. Acceptability criteria for the 2015 South Wall Mine Plan included a minimum FoS of 1.2 for interramp and overall slopes.

i) Bench Design Criteria

Bilinear failure mechanism with shearing through a pre-existing discontinuity or weak toe materials is the critical failure mode for bench design. Sensitivity analyses on the spacing of the JS1 discontinuity set (i.e., slab thickness) indicate that slabs with thickness of less than 2m will have a lower consequence of failure (relative to thicker slabs) and should be readily accommodated through the use of adequate catchment berms. Also, analyses indicate that increasing thickness of the potential failure slab correlate to increasing stability. Therefore, a slab thickness of 2m was identified as the critical design condition.

This approach yielded a range of design bench heights for the south wall (i.e., footwall) corresponding to the dip of foliation, and provided general bench design criteria for the range of structural geology conditions observed in the current south wall, as well as anticipated conditions based on review of the geologic sections. The bench design criteria developed based on the bilinear limit equilibrium analyses are summarized in Table III.

ii) Overall Slope Design Criteria

The 2015 South Wall Mine Plan meets the requirements outlined by the slope design criteria summarized in Table III. The only exception is the last bench above the pit bottom. This last bench is designed with a BFA of 30°, and based on the criteria outlined in Table III, the maximum bench stack height for an FoS of 1.2 should be limited to 70m.

A review of the 2015 South Wall Mine Plan indicate that this bench is 84m high, which is 14m higher than the proposed design. However, considering that this is the last bench above the pit bottom and that enough catchment is available, the risk associated with this deviation from the design criteria is judged to be acceptable. Furthermore, the dip of JS1 in question is on the limit of two designs; if the actual dip of JS1 encountered in the field is flatter than 30°, the current mine plan will be acceptable.

Where contacts occur in the vicinity of the final south wall, it is recommended that the pit plan be modified locally to mine back the contact as much as possible in order to avoid localized and shallow failures involving single or multiple benches. Because this process is highly dependent on the geologic interpretation, it is recommended that plans be continually reviewed during the short-range design process and during mining, and any changes to the geologic interpretation be incorporated into the mine plan.

Results of limit equilibrium stability analyses completed on eight cross sections along the south wall of Paul's Peak Pit indicate that FoS values of 1.2 or greater can be achieved provided that the south wall is depressurized to a minimum horizontal depth of 55m (measured horizontally behind the pit face). Assuming drainholes will effectively drain up to about half of their length, which is a reasonable assumption based on experience, this level of depressurization can be achieved with the installation of 110 m-long horizontal drainholes. The initial elevation required for the installation of the 110 m-long drainholes vary depending on the section, ranging from as high as the 728m level in the east (i.e., on Sections 7, A3750, and A3600) to about the 574m level in the west (i.e., on Section 1). Length, spacing (both lateral and vertical), and pattern of drainholes should be optimized, based on previous experience, to intersect as many water-bearing features and areas as possible.

In the case of fully saturated slopes (i.e., no depressurization measures are undertaken), the FoS drops to below 1.2 for five of the eight analysed sections, and below 1.0 on Section 3150. Under fully saturated conditions, large strains, and potentially slope failure, could occur along lithologic contacts or shear planes parallel to foliation.

Other than pore pressure, it is important to note that limit equilibrium analyses also indicate that stability of the south wall is strongly controlled by the configuration, location, and nature of the lithologic contacts. It is recommended that the geologic model be updated as the south wall is mined down and if significant deviation from the current geologic interpretation is recognized, slope designs should be reviewed and adjusted accordingly.

iii) Blending and Finalizing Designs

For the purposes of preparing the slope designs, the average dip of JS1 in any given area should be considered as being representative of the BFA in that portion of the pit slope. Transitions in slope design between steeper and flatter areas of average dip, either laterally along slope or vertically down slope, should be conducted in the area of steeper dip (i.e., where the maximum bench stack height will be lower). In areas where the design would leave thin, unstable slivers of rock above a major contact, a wider safety berm than recommended in the design criteria should be planned to remove the thin slab.

4.2 GENERAL RECOMMENDATIONS

4.2.1 Slope Monitoring

The ongoing development of the south wall of Paul's Peak Pit will require regular monitoring using an SSR unit in combination with an observational approach to assess slope stability. The monitoring procedures currently undertaken by AMMC, which includes the use of an SSR unit and regular bench inspections, are judged appropriate. However, the output of the SSR unit should be continuously reviewed to minimize false alarms (i.e., surficial slope movements related to ravelling and rockfall events).

In order to augment the quality and the range of the monitoring system, the installation of survey prisms, Time Domain Reflectometers (TDRs), and inclinometers is recommended but not mandatory. Prisms, TDRs, and inclinometers could be used to complement the SSR monitoring system providing for long-term records of movement and calculation of vector displacements. This additional monitoring data is often useful for the identification of failure mechanisms, depth of failure, and movement triggers. Should operational

limitations and weather conditions allow the installation of prisms, TDRs, and/or inclinometers, the following recommendations are made.

i) Prisms

If possible, prisms should be established on catch benches as the south wall is developed, at a nominal lateral spacing of 100m. Vertically, the prisms should be staggered to form a diamond pattern; vertical spacing would depend on the height of benches according to the bench design.

ii) TDRs and/or inclinometers

Inclinometers and TDRs could be used to augment SSR monitoring in areas of observed deformation. A coaxial cable should be installed simultaneously with inclinometer casing for TDR monitoring. This allows for continued monitoring in the event that the inclinometer instrument is no longer able to pass down the inclinometer casing. Consideration should be given to installing inclinometers/TDRs at the crest of the south wall and on one or two catch benches at about mid-slope (i.e., possibly from the 700 and 532m elevation benches). As it is assumed that these inclinometer/TDR locations would not be accessible in the long term, inclinometer and co-installed TDR cables could be extended, with suitable protection, to the west or east to a location where the inclinometers and TDRs could be monitored.

4.2.2 Hydrogeological Monitoring

Regular reviews of piezometric data should be conducted to confirm that adequate depressurization is being achieved. Depending on the number and location of existing vibrating wire piezometers remaining on the south wall during and after mining, the installation of additional piezometers, either behind the final pit crest or installed from benches on the slope, could be required. As for the inclinometers/TDRs, cables could be extended, with suitable protection, to the west or east to a location where the piezometers could be monitored.

4.2.3 Visual Inspection Monitoring

Regular inspection of the crest and exposed benches on the south wall should be carried out to identify any signs of tension cracking, increased ravelling, or other signs of instability. The locations of observed tension cracks should be surveyed and added to the geotechnical plans to allow assessment of slope deformation with respect to the slope monitoring data and any potential mechanism(s) of instability. Any unusual signs of slope raveling or distress should be communicated to the Mine Geotechnical Department and assessed accordingly.

4.2.4 Controlled Blasting

Controlled blasting techniques are recommended on the final walls to minimize disturbance to the rock mass and preserve cohesion on discontinuity surfaces, in particular JS1 Set. Blast monitoring and pre/post blast inspections should be conducted to continually assess potential blast damage and improve blast performance.

4.2.5 Bench Scaling and Cleaning Catch Berms

As is normal practice at Mont-Wright, bench faces should be thoroughly scaled and bench toes and berms cleaned following excavation. This is particular important on final slopes where access may be limited. The need for additional scaling and periodic cleaning of berms to minimize potential for rockfall hazards and maintain the berms for effective rockfall catchment and monitoring instrumentation should be assessed by mine personnel on an ongoing basis.

4.2.6 Ongoing Data Acquisition, Verification, and Updating Designs

Optimization of open pit design requires an iterative approach, whereby designs are implemented, results are evaluated, and the design criteria are updated or modified based on experience. To achieve optimum interramp and overall slopes, an ongoing program of geotechnical data collection and evaluation is required during mining operations to document rock mass behaviour and verify or modify the design criteria as the mine is developed. This could consist of systematic bench face mapping and photogrammetry surveys. Furthermore, any future drainholes or exploration drillholes should be

geotechnically logged (to obtain all parameters to assess RMR according to Bieniawski, 1976) to provide updates to the geologic and geomechanical models. If any significant variation in bedding or lithologic contact location is noticed, slope designs should be adjusted accordingly.

4.2.7 Surface Water Control

Surface water control in Paul's Peak Pit should incorporate well maintained perimeter ditches behind the pit crest, adequate grading and ditching of haulroads, and collection and pumping of surface water in appropriately placed sumps.

5. LIMITATIONS AND CLOSURE

In preparing the stability assessments, conclusions, and recommendations contained herein, Piteau has relied on information and interpretations provided by others. Piteau is not responsible for any errors or omissions in this information. This report is comprised of text, tables, figures, and appendices, and all components must be read and interpreted in the context of the whole report. This report has been prepared for the sole use of ArcelorMittal Mines Canada and no representation of any kind is made to any other party.

Conclusions and recommendations made in this report are based on information available prior to January 29, 2016.

6. ACKNOWLEDGEMENTS

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We trust the above is adequate for your present needs. Please contact us if you have any questions, comments or concerns.

Respectfully submitted,

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7. REFERENCES

ArcelorMittal, 2015a. "MurSud_Final_PP_courbe7m." Electronic mail from ArcelorMittal, August 17.

ArcelorMittal, 2015b. "Paul's Peak offload piezometers data." Electronic mail from ArcelorMittal including compiled piezometric data, October 3.

ArcelorMittal, 2015c. "Paul's Peak section review." Electronic emails from ArcelorMittal including eight geologic cross sections (section_bla_a_3150.dxf, section_bla_a_3300.dxf, section_bla_a_3450.dxf; section_bla_a_3600.dxf, section_bla_a_3750.dxf, section_bla_a_3900.dxf, section_1_utm, section_7_utm) cut through the south wall of Paul's Peak Pit. October 9 and 14.

ArcelorMittal, 2015d. "Geology_MW.doc." Summary of geological setting at Mont-Wright. Electronic file provided by ArcelorMittal by electronic mail, November 19.

Bieniawski, Z.T., 1976. "Rock Mass Classification in Rock Engineering." Proceedings Symposium on Exploration for Rock Engineering, ed. Z.T. Bieniawski, Balkema, Rotterdam, pp. 97-106.

Bourassa, P.J., 1977. "The Mount-Wright Story – History and Development of Mount-Wright." CIM Bulletin, April, pp. 75-82.

Deere, D.U., Hendron, A.J., Patton, F.D., and Cording, E.J., 1967. "Design of Surface and Near Surface Construction in Rock." Procs. 8th U.S. Symposium on Rock Mechanics, AIME, New York, pp. 237-302.

Fredlund, D.G. and Krahn, J., 1977. "Comparison of Slope Stability Methods of Analysis." Canadian Geotechnical Journal, Volume 14, pp. 429-439.

Hoek, E., Carranza-Torres, C., and Corkum, B., 2002. "Hoek-Brown Failure Criterion – 2002 Edition." Proc. North American Rock Mechanics Society Meeting, Toronto, July.

ISRM, 1981. "Rock Characterization Testing and Monitoring: ISRM Suggested Methods", ed. E.T. Brown, Pergamon Press.

ISRM, 1985. "Suggested Methods for Determining Point Load Strength." International Society for Rock Mechanics, Lisbon, 8p.

Piteau, 1998a. "Paul's Peak Slope Design Study." Report to Compagnie Minière Québec Cartier – Mont-Wright Mine, November, 58p.

Piteau, 1998b. "Slope Instability in Pit B and at the Mont-Wright Mine." Letter report to: Pierre Casgrain, Compagnie Minière Québec Cartier, December.

Piteau, 2008. "Preliminary Hydrogeological Assessment for Paul's Peak Pit Dewatering." Report to Compagnie Minière Québec Cartier, December, 62p.

Piteau, 2010. "South Wall Pit Slope Design for the Paul's Peak Pit." Report to ArcelorMittal Mine Canada, July.

Piteau, 2011. "Pilot Hole and Test – Dewatering Well Program – Paul's Peak Dewatering." Report to ArcelorMittal Mines Canada, May, 22p.

Piteau, 2015. "Paul's Peak P1 Offload – Scope and Estimated Costs for Design Review." Memorandum to ArcelorMittal Mine Canada, August 28, 4p.

Read and Stacey, 2009. "Guidelines for Open Pit Slope Design." CRC Press, 496p.

TABLES

TABLE I
WEIGHTED AVERAGE GEOMECHANICAL CORE LOGGING PARAMETERS[1]

GEOTECHNICAL UNIT	DATABASE	LENGTH DRILLED (m)	RECOVERY (%)	RQD[2] (%)	FF[3] (#/m)	DOB[4]	JC[5]	DOA[6]	H[7] (R)	INTACT ROCK STRENGTH					RMR[11]	
										FROM HARDNESS[8] (MPa)	FROM POINT LOAD INDEX (PLI)[9] Diametral (MPa)	Axial (MPa)	Average (MPa)	FROM UCS TESTING[10] (MPa)	FROM HARDNESS	FROM PLI
IF	2009	3741.00	91	84	3.7	D	17.6	D+	3.4	150.0	155.3	201.3	178.2	219.5	75.1	77.6
			22	28	4.8	E / C	5.3	E+ / C+	1.0	70.4	90.3	106.0	92.2	84.2	18.3	16.5
	2007-2009	93.00	58	31	12.5		14.2		2.2	67.0					46.1	
			31	32	5.7		3.8		1.2	71.0					16.2	
QRMS	2009	1144.64	96	91	2.6	D+	16.8	D+	3.3	43.2	36.7	70.6	53.6	78.9	71.2	71.6
			13	19	3.7	E+ / C+	5.9	E / D-	0.7	11.7	19.8	25.2	18.9	28.4	14.5	14.6
	2007-2009	445.90	94	83	4.1		15.7		3.2	42.8					64.1	
			13	22	3.7		3.3		0.7	12.5					11.9	
QR-1	2009	649.23	89	79	5.1	D-	17.5	D+	3.6	198.8	186.8	163.6	176.1		72.4	71.0
			24	29	5.2	E- / C-	4.3	E / D-	1.0	72.7	101.2	94.1	95.0		16.1	16.7
	2007-2009	599.00	93	86	3.4		18.4		3.7	194.1					76.9	
			16	22	3.8		2.3		0.7	73.9					13.8	
QR-2	2009	553.46	97	90	3.1	D	18.9	E-	3.9	222.4	223.5	227.7	226.6	229.7	79.9	80.0
			10	17	3.4	E- / C	3.9	E+ / D	0.5	42.9	69.6	65.5	57.8	85.5	11.8	11.8
	2007-2009	562.51	96	90	3.2		18.7		3.9	216.7					78.6	
			11	18	3.1		1.8		0.6	60.6					10.2	
QR-3	2009	309.21	98	95	2.1	D+	19.7	E-	4.3	255.2	251.6	249.2	255.3		85.0	84.6
			8	11	2.4	E / D-	3.5	E / D+	0.3	23.1	59.3	60.4	45.7		9.9	10.0
	2007-2009	852.06	96	90	2.8		19.0		4.0	222.5					80.2	
			12	18	3.2		2.7		0.7	68.9					12.8	
AMP-1	2009	159.51	99	95	1.4	E-	16.8	D+	2.8	64.5	63.3	121.5	91.1		76.5	78.4
			3	18	2.5	E+ / D	5.9	E / D-	0.7	23.4	30.9	44.2	34.3		14.0	14.2
	2007-2009	< 20 m														
AMP-2	2009	1080.88	99	95	1.2	E-	19.1	E-	3.3	78.5	74.8	110.6	92.7	119.1	80.5	81.3
			3	14	1.8	E+ / D	5.6	E+ / D	0.7	22.5	30.0	40.2	30.6	24.8	12.5	12.5
	2007-2009	1191.19	99	95	1.4		18.9		3.6	87.2					80.0	
			6	16	1.9		3.6		0.8	19.9					11.2	
AMP-3	2009	419.05	99	97	0.8	E	20.6	E-	3.5	84.3	73.9	110.3	92.2		84.1	84.3
			3	14	1.6	E+ / D+	5.3	E+ / D	0.7	19.8	22.0	32.9	24.7		11.6	11.4
	2007-2009	878.01	99	94	1.5		18.7		3.4	81.0					79.7	
			4	19	2.6		4.6		0.9	23.0					13.6	

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NOTES:
1. Values reported in red are standard deviations corresponding to weighted average values based on interval length.
2. Rock Quality Designation (RQD): as per Deere, et al., 1967.
3. Fracture Frequency (FF): number of natural fractures per metre.
4. Degree of Breakage (DOB): total number of all fractures per metre (includes both natural and mechanical breaks prior to core handling). A = fault gouge, B = crushed and broken rock (no gouge), C = mean fracture spacing 5 to 10 cm, D = mean fracture spacing 10 to 20 cm, E = mean fracture spacing greater than 20 cm. Only logged in the 2009 database.
5. Joint Condition (JC): as per Bieniawski, 1976.
6. Degree of Alteration (DOA): DOA ratings: A = residual soil, B = completely altered, C = highly altered, D = moderately altered, E = slightly altered, F = fresh and unweathered. Only logged in the 2009 database.
7. Hardness (H): as per ISRM (1981) field hardness scale.
8. Unconfined compressive strength (UCS) estimated from field specific Hardness curves developed based on correlations with field PLI and laboratory UCS tests.
9. Unconfined compressive strength (UCS) estimated from PLI tests averaged by rock mass units and correlated to UCS strength based on the correlation factor (K).
10. Unconfined compressive strength (UCS) estimated from UCS laboratory test results averaged by geotechnical units.
11. Rock Mass Rating, as per Bieniawski, 1976.
12. Table originally published in Piteau, 2010.
13. This table is an integral part of Piteau's report dated January 2016 (file: 1846-16_R01-Paul's Peak) and must be read and interpreted in the context of that report. Provided for exclusive use of ArcelorMittal Mines Canada and Mont Wright Mine, and may not be modified or used by any other party without the expressed approval of Piteau Associates Engineering Ltd.

TABLE I
WEIGHTED AVERAGE GEOMECHANICAL CORE LOGGING PARAMETERS

TABLE II
SUMMARY OF DESIGN SHEAR STRENGTH PARAMETERS[1]

GEOTECHNICAL UNIT	STRENGTH ZONE	DATABASE	LENGTH DRILLED (m)	AVERAGE RMR[2] FROM HARDNESS[3]	AVERAGE RMR[2] FROM PLI[4]	AVERAGE INTACT ROCK STRENGTH FROM HARDNESS (MPa)	AVERAGE INTACT ROCK STRENGTH FROM PLI (MPa)	DESIGN ROCK MASS SHEAR STRENGTHS[5] 35th Percentile RMR[2]	UCS (MPa)	Depth of Disturbance	Disturbance[6] (D)	m_i[7]	DESIGN DISCONTINUITY SHEAR STRENGTHS[8] c' (kPa)	ϕ' (°)
IF	WEST	2009	405.50	70.8 17.2	70.7 18.1	128.9 58.1	144.6 87.3	70	90	0-50m	0.85	25	50	40
		2007-2009	no data							>50m	0.70			
	TOWER CUT	2009	378.50	57.4 24.2	57.2 23.8	92.8 81.4	95.6 94.6	45	30	0-50m	0.85			
		2007-2009	no data							>50m	0.70			
	CENTRAL	2009	1976.21	80.6 14.4	81.0 14.2	174.9 62.6	197.3 79.1	78	170	0-50m	0.85			
		2007-2009	< 20 m							>50m	0.70			
	EAST	2009	980.79	72.5 17.9	72.6 18.0	130.3 63.4	141.7 82.4	50	55	0-50m	0.85			
		2007-2009	87.00	44.0 14.4		57.8 63.7				>50m	0.70			
QRMS	WEST	2009	214.50	69.5 10.2	69.9 10.3	46.5 10.5	53.9 16.2	66	45	0-50m	0.85	14	50	30
		2007-2009	165.00	71.4 8.7		49.2 11.1				>50m	0.70			
	TOWER CUT	2009	204.35	59.0 17.1	58.9 17.1	36.0 15.8	37.4 21.0	56	30	0-50m	0.85			
		2007-2009	no data							>50m	0.70			
	EAST	2009	534.79	74.6 12.6	75.2 12.5	45.6 9.7	56.6 14.4	65	40	0-50m	0.85			
		2007-2009	280.90	59.8 11.5		39.0 11.7				>50m	0.70			
QR-1	WEST	2009	291.39	73.9 16.0	73.4 16.5	196.3 68.0	187.9 83.3	75	180	0-50m	0.85	23	50	37
		2007-2009	178.96	86.1 6.4		252.3 23.1				>50m	0.70			
	TOWER CUT	2009	290.89	69.6 16.8	66.7 16.9	197.1 81.2	125.8 79.9	65	75	0-50m	0.85			
		2007-2009	29.19	74.8 11.1		212.5 57.1				>50m	0.70			
	EAST	2009	52.50	74.5 9.5	75.6 11.0	210.9 57.6	238.2 56.2	73	125	0-50m	0.85			
		2007-2009	390.85	72.9 14.4		166.7 74.6				>50m	0.70			
QR-2	ALL	2009	553.46	79.9 11.8	80.0 11.8	222.4 42.9	220.0 56.1	76	200	0-50m	0.85			
		2007-2009	562.51	78.6 10.2		216.7 60.6				>50m	0.70			
QR-3	ALL	2009	309.21	85.0 9.9	84.6 10.0	255.2 23.1	251.0 47.3	80	225	0-50m	0.85			
		2007-2009	852.06	80.2 12.8		222.5 68.9				>50m	0.70			
AMP-1	WEST	2009	159.51	76.5 14.0	78.4 14.2	64.5 23.4	91.1 33.5	75	70	0-50m	0.85	15	50	40
		2007-2009	< 20 m							>50m	0.70			
AMP-2	ALL	2009	1080.88	80.5 12.5	81.3 12.5	78.5 22.5	92.0 30.3	77	80	0-50m	0.85			
		2007-2009	1191.19	80.0 11.2		87.2 19.9				>50m	0.70			
AMP-3	ALL	2009	419.05	84.1 11.6	84.3 11.4	84.3 19.8	89.2 26.0	81	75	0-50m	0.85			
		2007-2009	878.01	79.7 13.6		81.0 23.0				>50m	0.70			
ALTERED CONTACT ZONES	ALL	-											75	28

H:\Project\1846\2015-08 P1 Offload review\Geomech\[Rock Mass Strengths Table_Final.xls]Table II

NOTES:
1. Values reported in red are standard deviations corresponding to weighted average values based on interval length.
2. Rock Mass Rating (RMR), as per Bieniawski, 1976.
3. RMR estimated from field specific Hardness curves developed based on correlations with field Point Load Index (PLI) and laboratory Unconfined Compressive Strength (UCS) tests.
4. RMR estimated from field Point Load Index (PLI) tests averaged by rock mass units and correlated to laboratory Unconfined Compressive Strength (UCS) tests based on the correlation factor (K).
5. Rock mass shear strengths were derived using RMR and UCS values from the drilling geomechanical database based on the 35th percentile.
6. Hoek-Brown Disturbance factor (D), as per Hoek et al. (2002).
7. Hoek-Brown material constant m_i, as per Hoek et al. (2002).
8. For unaltered contacts between rock mass units, the lower discontinuity shear strength of the two units was used.
9. Table originally published in Piteau, 2010.
10. This table is an integral part of Piteau's report dated January 2016 (file: 1846-16_R01-Paul's Peak) and must be read and interpreted in the context of that report. Provided for exclusive use of ArcelorMittal Mines Canada and Mont Wright Mine, and may not be modified or used by any other party without the expressed approval of Piteau Associates Engineering Ltd.

TABLE III

RECOMMENDED SLOPE DESIGNS FOR THE SOUTH WALL OF PAUL'S PEAK PIT

Bench Face Angle (average dip of JS1)	Maximum Bench Stack Height (m)	Berm Width (m)
<30°	Unbenched	-
30° to 42°	70m (5 benches)	12m
42° to 52°	56m (4 benches)	13m
52° to 65°	42m (3 benches)	13m
>65°	28m (2 benches)	13m

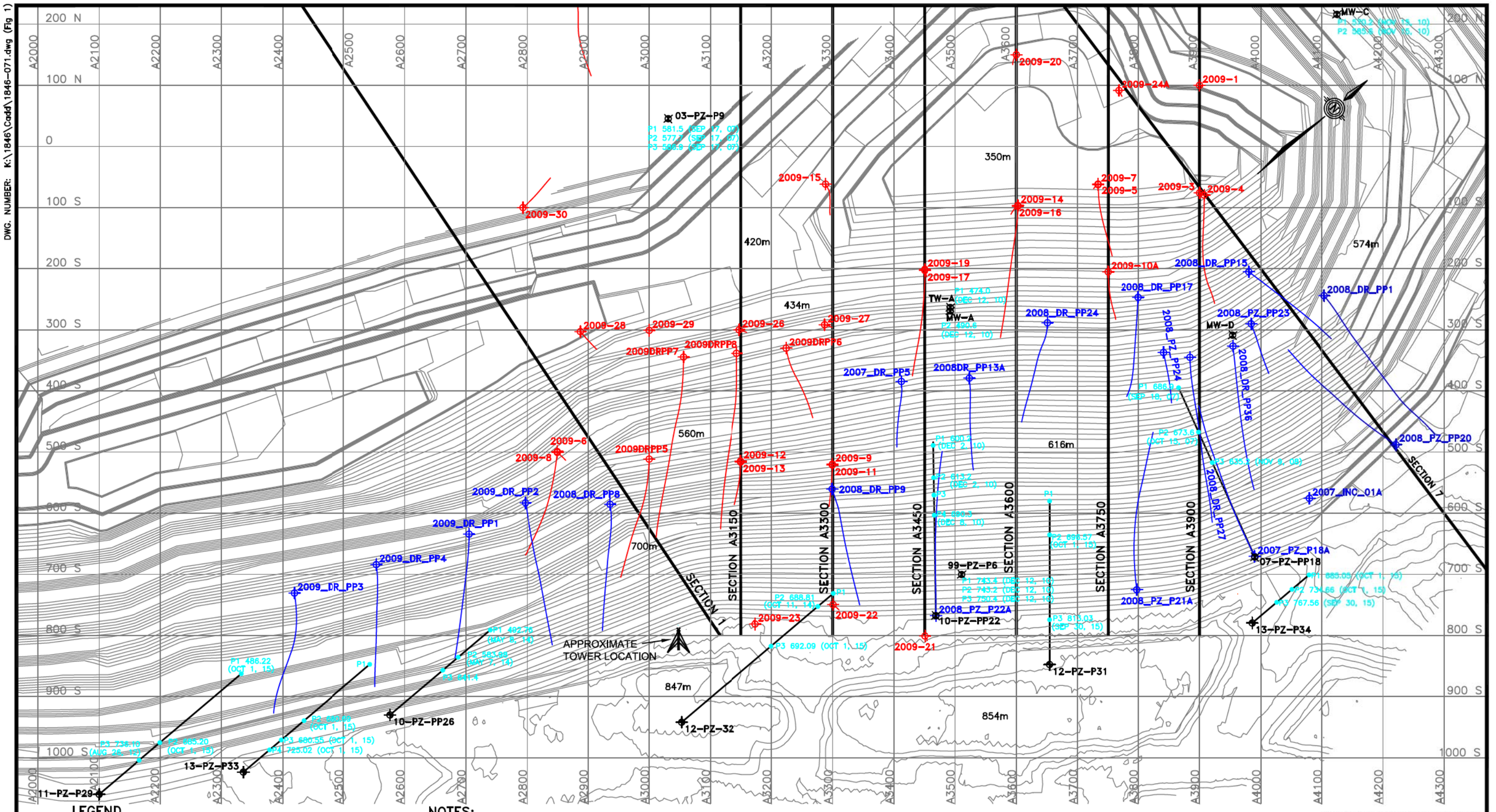
H:\Project\1846\2015-08 P1 Offload review\Excel\[Recommended Slope Designs_Final.xls]TABLE III

NOTES: 1. This table is an integral part of Piteau's report dated January 2016 (file: 1846-16_R01-Paul's Peak) and must be read and interpreted in the context of that report. Provided for exclusive use of ArcelorMittal Mines Canada and Mont Wright Mine, and may not be modified or used by any other party without the expressed approval of Piteau Associates Engineering Ltd.

2. Table originally published in Piteau, 2010.

FIGURES

DWG. NUMBER: K:\1846\Cadd\1846-071.dwg (Fig 1)



LEGEND

2009-29	DRILLHOLE FROM 2009 DRILLING PROGRAM
2008_DR_PP8	DRILLHOLE FROM PREVIOUS DRILLING PROGRAMS IN 2007, 2008, OR EARLY 2009
SECTION 1	GEOLOGIC SECTION
P2 583.98 (MAY 7, 14)	PIEZOMETER WITH RECENT HEAD POSTED
10-PZ-PP26	PIEZOMETER LOCATION

NOTES:

1. PAUL'S PEAK MINE PLAN (MurSud_Final_PP_courbe7m.dxf) PROVIDED BY ARCELORMITTAL ON AUG 17, 2015.
2. DRILLHOLES FROM THE 2009 PROGRAM WERE COMPLETED BETWEEN JUNE AND OCTOBER 2010; TOPOGRAPHY SHOWN MAY NOT REFLECT THE ACTUAL ELEVATION OF THE DRILLHOLE.
3. GEOLOGIC SECTIONS PROVIDED BY ARCELORMITTAL ON OCTOBER 9 AND 14, 2015.
4. PIEZOMETER DRILLHOLE TRACE PROJECTED AS A STRAIGHT LINE.
5. MINE GRID SHOWN.

0 100 200 300m

SCALE 1:6000

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

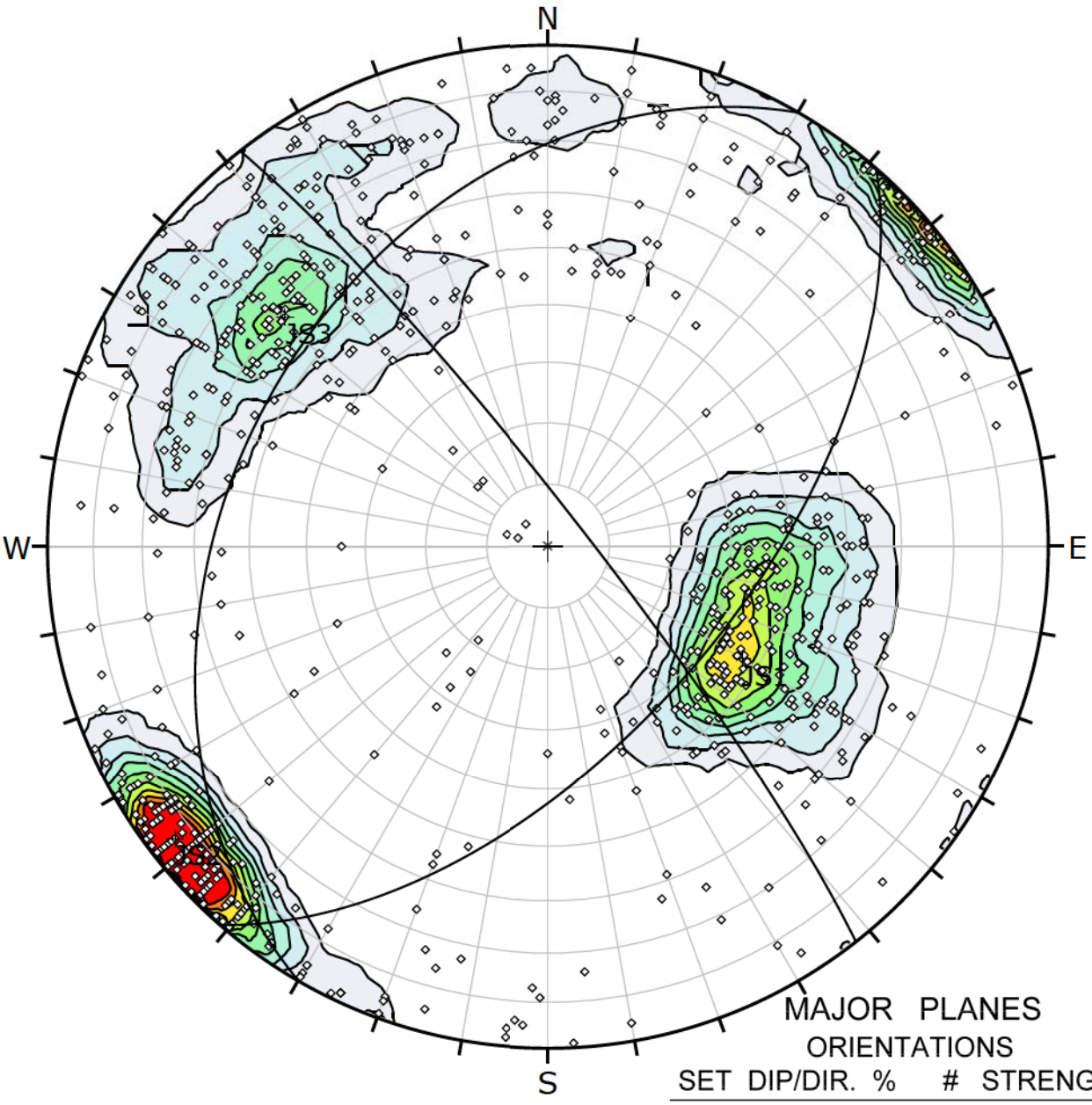
2015 SOUTH WALL MINE PLAN SHOWING
DRILLHOLE AND SECTION LOCATIONS

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	1

H:\Project\18462\2015-08 P1 Offload review\DIPS\PPKFW_ALL.gpf

EQUAL AREA
LOWER HEMISPHERE

800 Poles Plotted
800 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1	37/300	7.5	60	M
JS2	84/052	12.75	102	S
JS3	59/131	5.5	44	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	=	1.0
Contour Interval	=	1.0
Max.Concentration	=	12.75

NOTES:
1. The relative weighting of each discontinuity set was defined by subdividing the peak population percentage into approximate thirds to characterize weak (W), moderate (M), and strong (S) sets.
2. Figure originally published in Plteau, 1998a.

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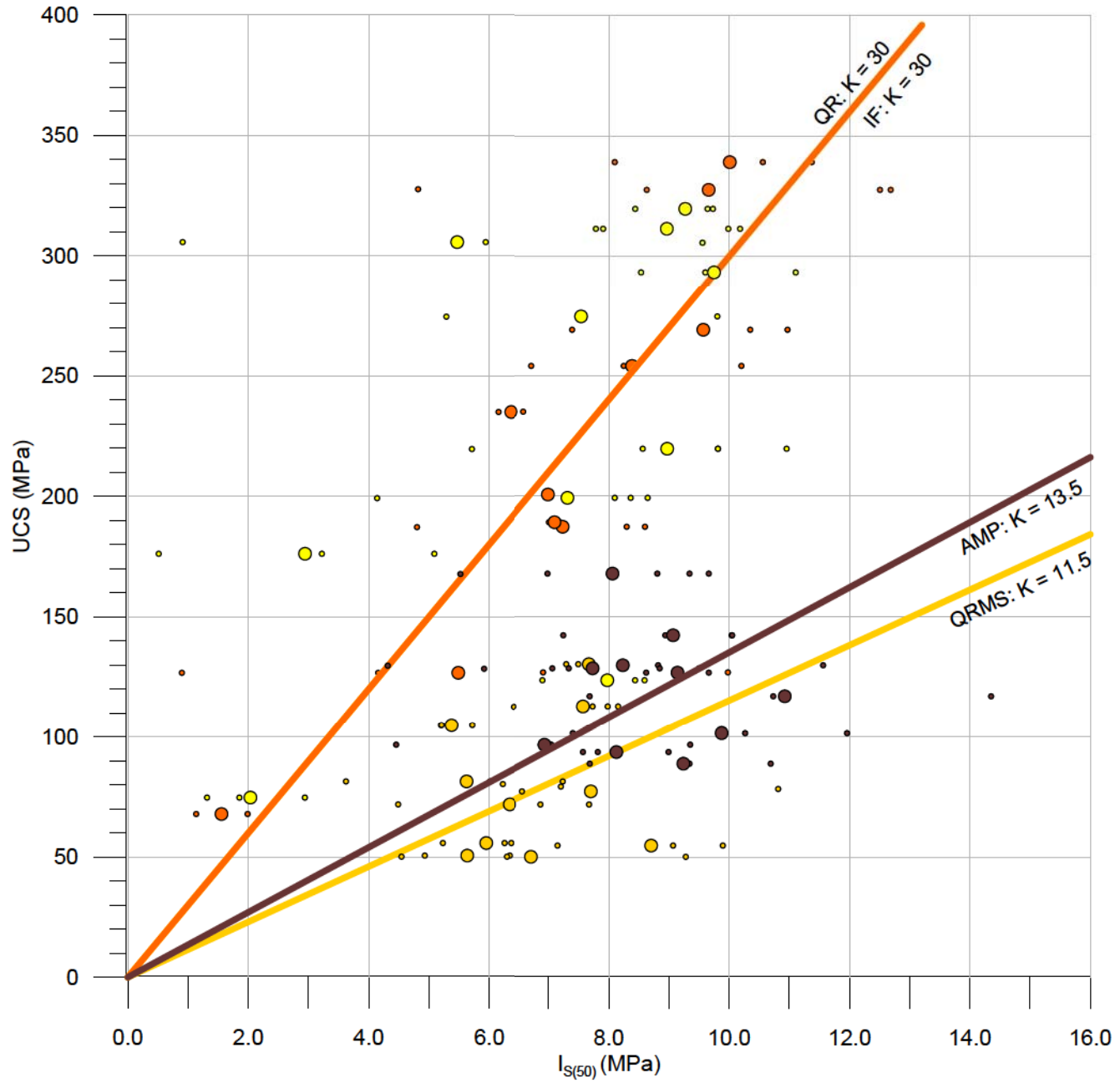
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

PITEAU ASSOCIATES
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STRUCTURAL ANALYSIS OF JOINTS
PAUL'S PEAK - FOOTWALL AREA
1998 TRAVERSE MAPPING DATA

BY:	DATE:
RS	DEC 15
APPROVED:	FIG:
GG	2

H:\Project\1848\2015-08 P1 Offload review\Testing\PLI\UCS_IS50_ALL.grf



LEGEND

- Individual $I_{s(50)}$ Test Value
- Mean $I_{s(50)}$ Value

NOTES:
1. $I_{s(50)}$ values shown for valid PLI tests according to ISRM (1985).
2. Correlation factor (K) is based on a linear best fit of UCS versus $I_{s(50)}$ mean values.
3. Figure originally published in Piteau, 2010.

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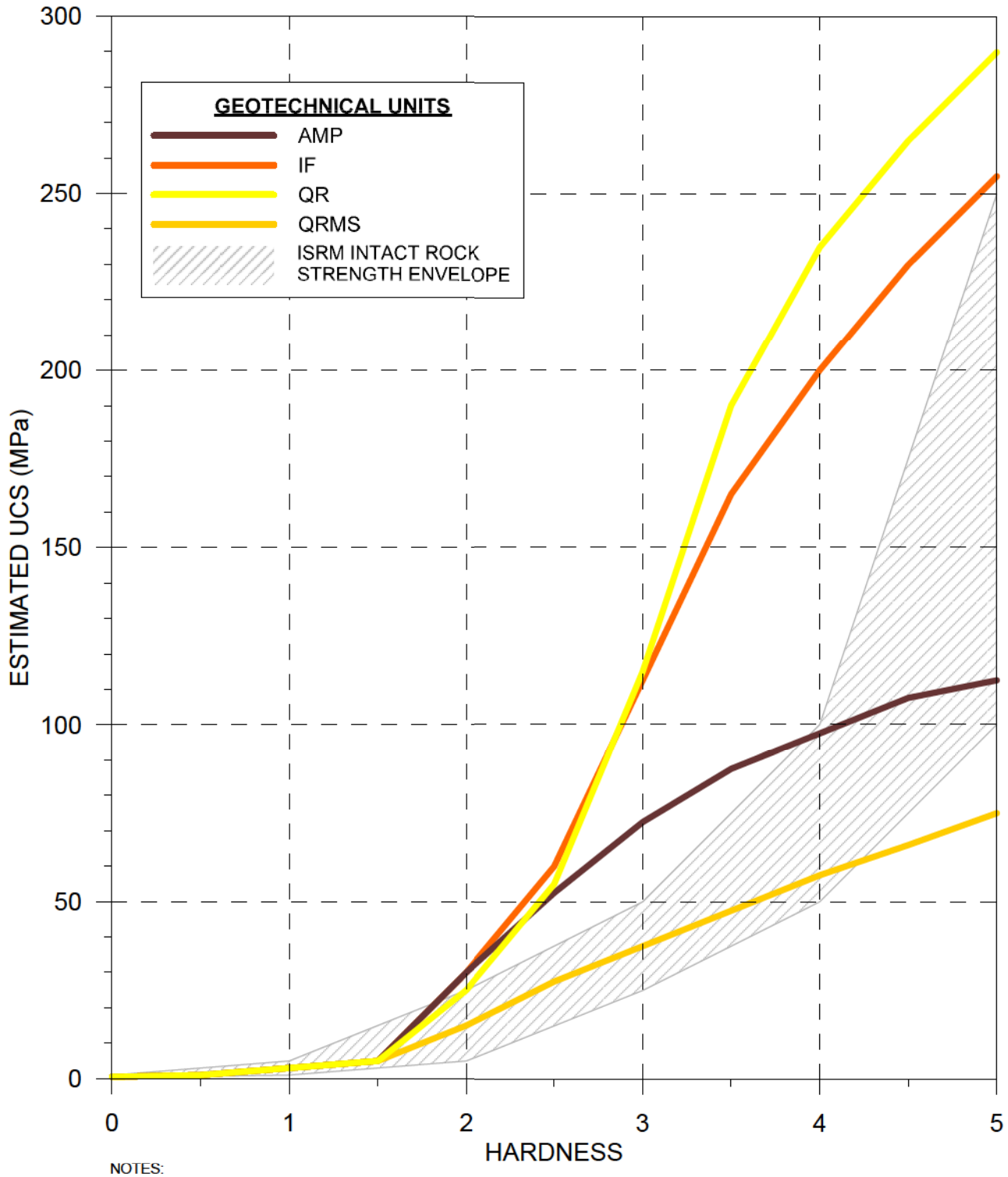
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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CORRELATION OF UNIAXIAL COMPRESSIVE STRENGTH VERSUS POINT LOAD INDEX (IS(50)) FOR THE IF,QRMS,QR AND AMP GEOTECHNICAL UNITS

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	3

H:\Project\1846\2015-08 P1 Offload review\Testing\PLI\H_vs_UCS_SUMMARY_figure.grf



NOTES:
1. Only valid point load tests were used in derivation of curves.
2. Correlation factors derived by Piteau are as follows:
   IF/QR: K = 30 AMP: K = 13.5 QRMS: K = 11.5
3. Correlation factors K used to convert Point Load $I_{s(50)}$ to estimated UCS: $UCS_{estimated} = I_{s(50)} \times K$
4. Hardness was estimated on a run-by-run basis according to ISRM (1981).
5. Figure originally published in Piteau, 2010.

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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

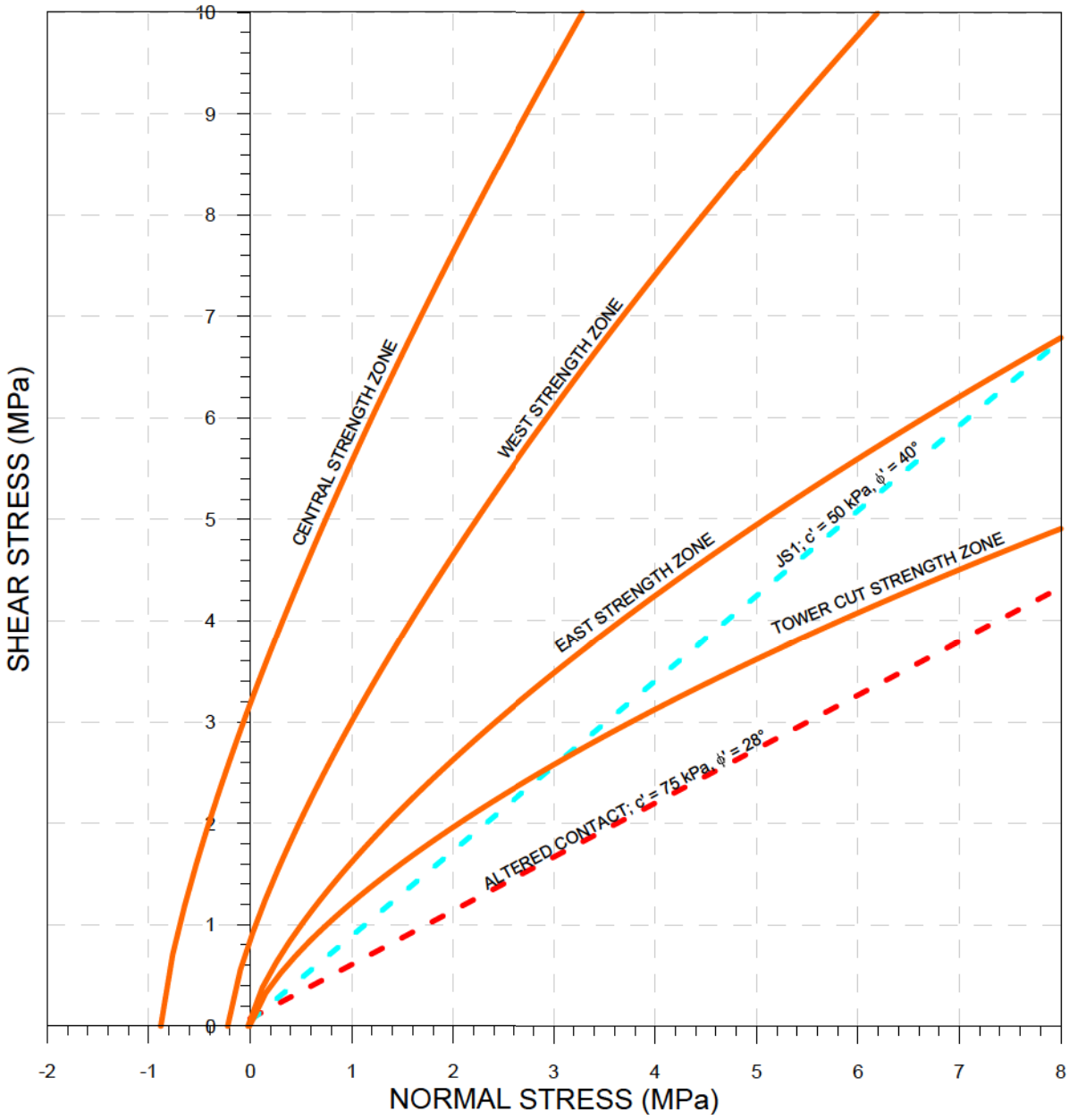
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RELATIONSHIP BETWEEN UNCONFINED COMPRESSIVE STRENGTH (ESTIMATED FROM PLI TESTS) AND HARDNESS FOR THE IF, QRMS, QR AND AMP GEOTECHNICAL UNITS

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	4

H:\Project\1846\2015-08 P1 Offload review\Geomech\rock mas strength curves\IF rock strength curves.grf

IRON FORMATION (IF)



NOTES:
1. Based on the 35th percentile and assuming a disturbance D value of 0.85.
2. Figure originally published in Piteau, 2010.

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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

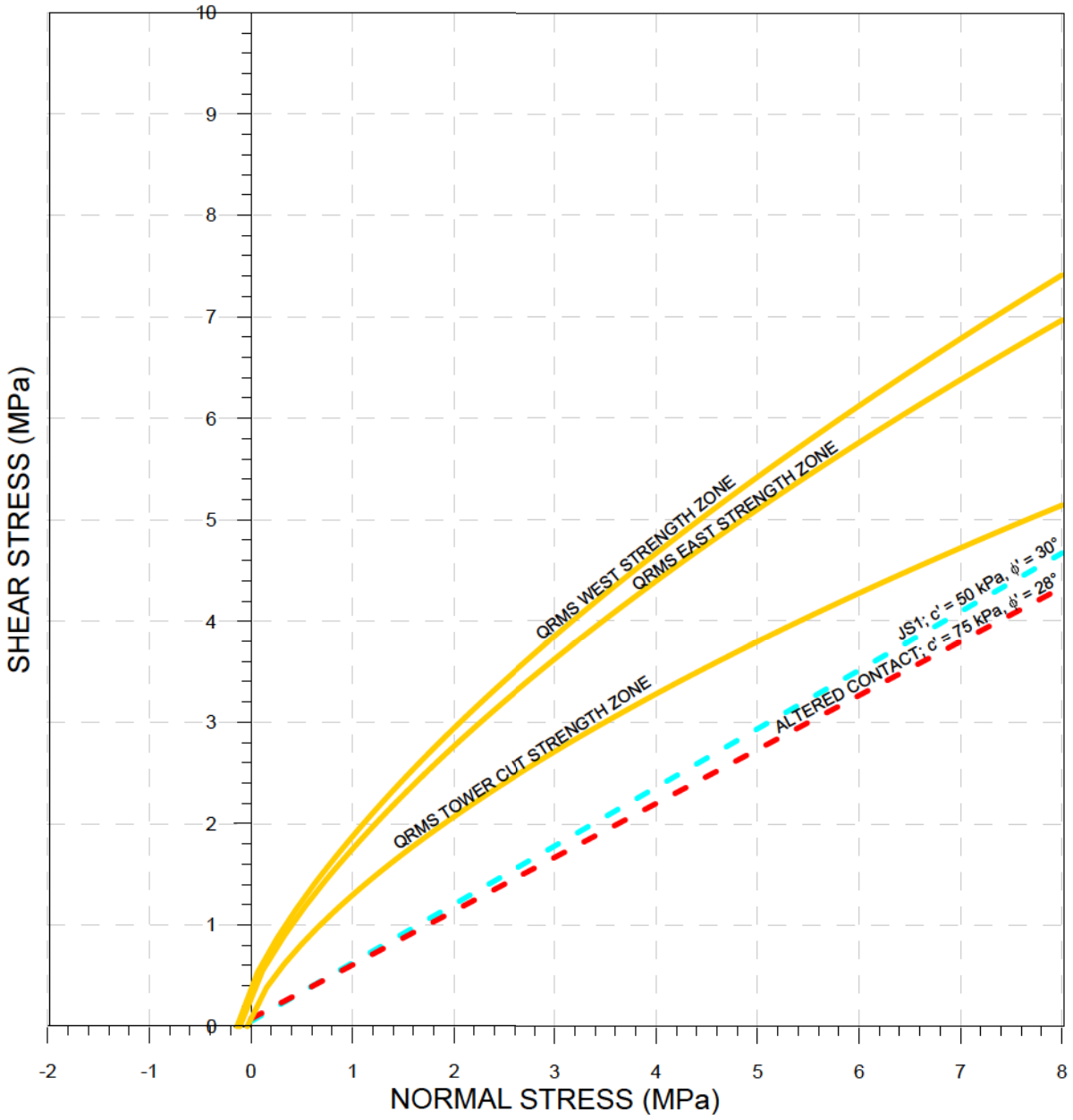
PITEAU ASSOCIATES
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ROCK MASS AND DISCONTINUITY SHEAR STRENGTH ENVELOPE FOR IRON FORMATION (IF)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	5

H:\Project\1846\2015-08 P1 Offload review\Geomech\rock mass strength curves\QRMS rock strength curves.grf

QUARTZ ROCK MICA SCHIST (QRMS)



NOTES:
1. Based on the 35th percentile and assuming a disturbance D value of 0.85.
2. Figure originally published in Piteau, 2010.

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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

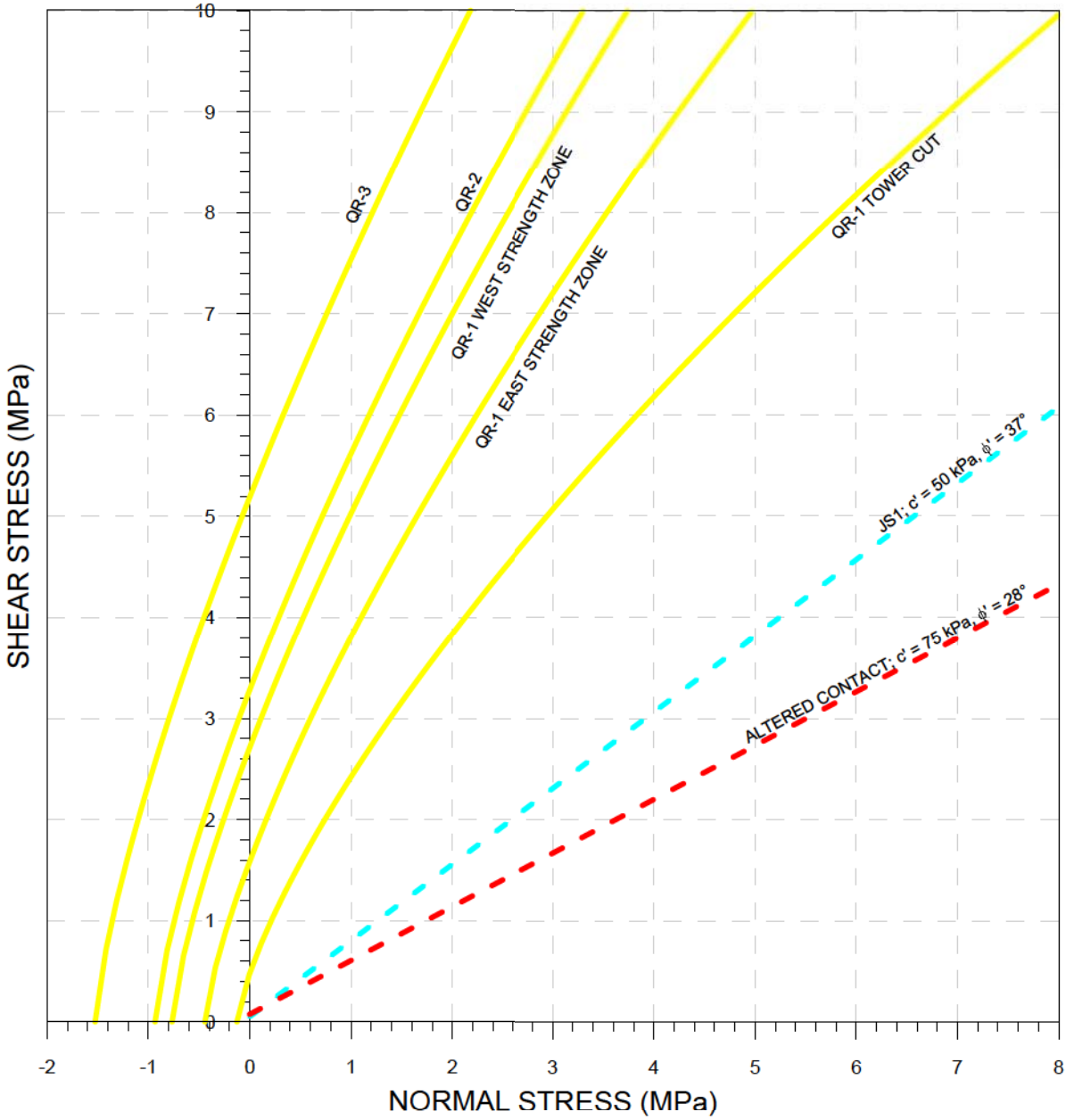
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ROCK MASS AND DISCONTINUITY
SHEAR STRENGTH ENVELOPE
FOR QUARTZ ROCK MICA SCHIST (QRMS)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	6

H:\Project\1846\2015-08 P1 Officad review\Geomech\rock mass strength curves\QR rock strength curves.grf

QUARTZITE (QR)



NOTES:
1. Based on the 35th percentile and assuming a disturbance D value of 0.85.
2. Figure originally published in Piteau, 2010.

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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

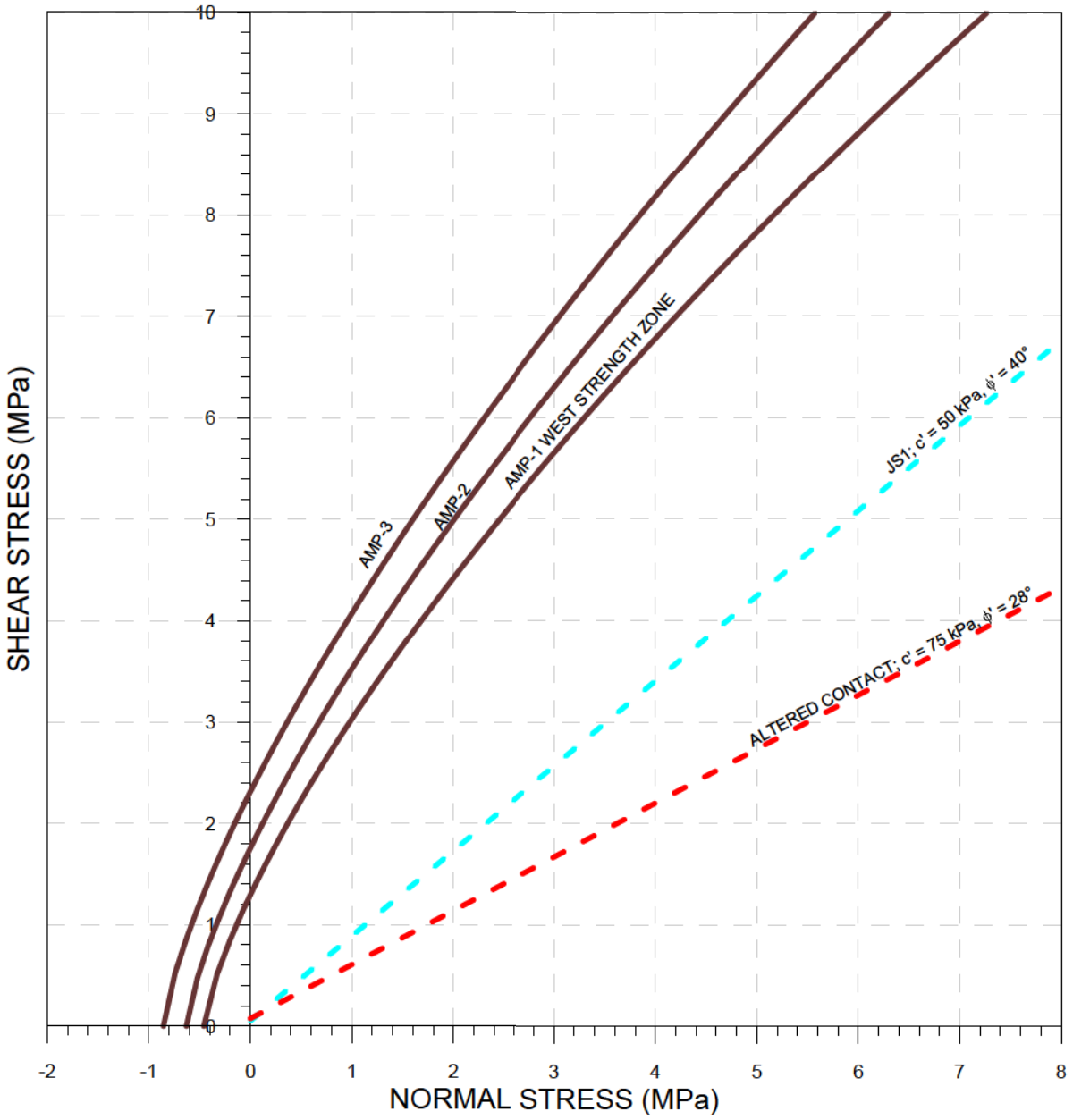
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ROCK MASS AND DISCONTINUITY SHEAR STRENGTH ENVELOPE FOR QUARTZITE (QR)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	7

H:\Project\1846\2015-08 P1 Offload review\Geomech\rock mas strength curves\AMP rock strength curves.grf

AMPHIBOLITE (AMP)



NOTES:
1. Based on the 35th percentile and assuming a disturbance D value of 0.85.
2. Figure originally published in Piteau, 2010.

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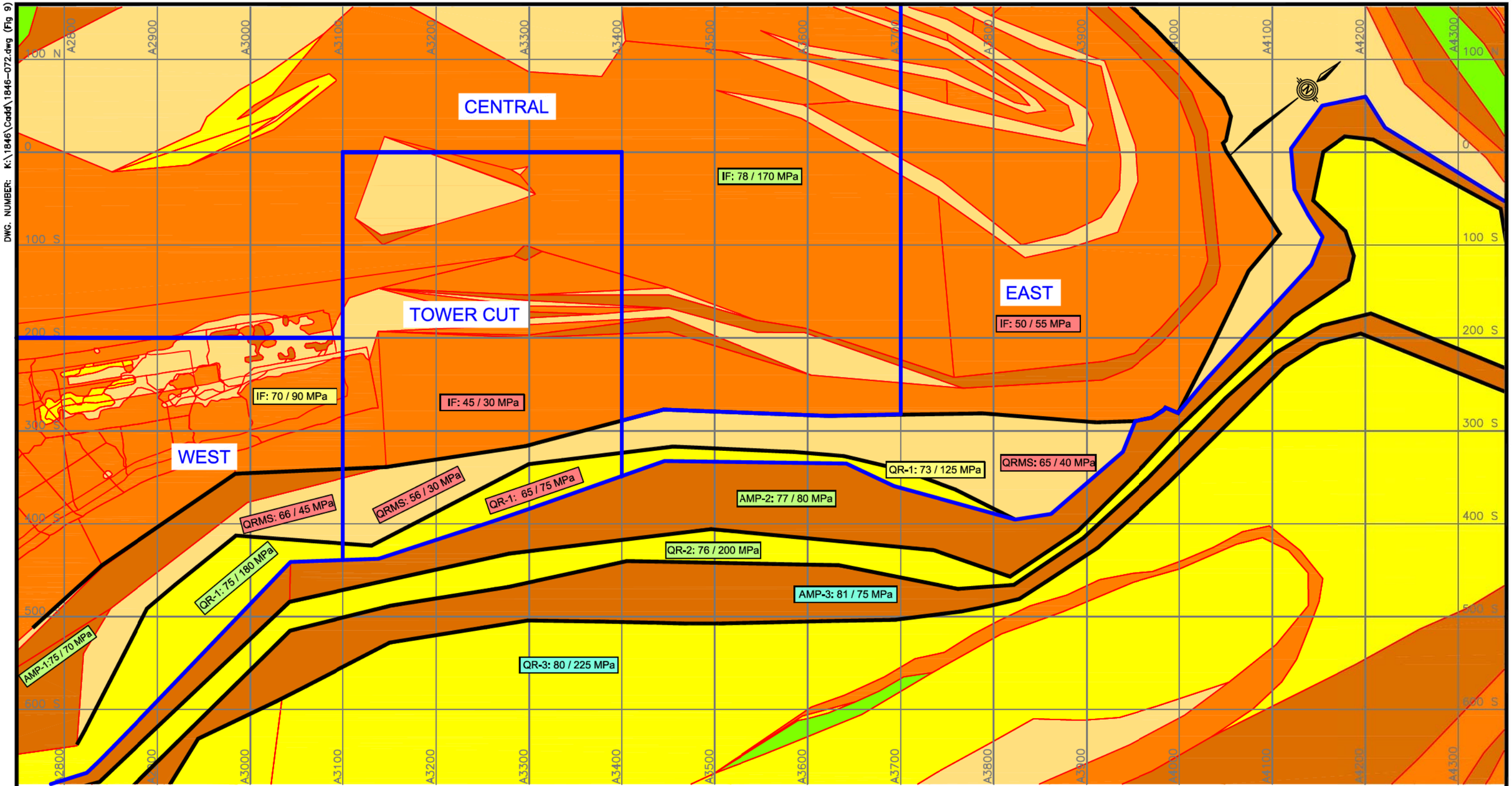
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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ROCK MASS AND DISCONTINUITY SHEAR STRENGTH ENVELOPE FOR AMPHIBOLITE (AMP)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	8

DWG. NUMBER: K:\1846\Cadd\1846-072.dwg (Fig 9)



LEGEND

- IF
- QRMS
- QR
- AMP
- GN

EAST — ROCK MASS STRENGTH ZONE AND BOUNDARY

ROCK MASS UNIT

QR-3: 85 / 250 MPa

RMR / UCS

- <= 69 RMR
- 70-74 RMR
- 75-79 RMR
- >= 80 RMR

NOTES:

1. LITHOLOGIC LEVEL PLAN SHOWN FOR THE 483m ELEVATION FROM ARCELORMITTAL'S SURPAC MODEL.
2. RMR AND UCS VALUES SHOWN ARE SELECTED DESIGN VALUES AS SUMMARIZED IN TABLE II.
3. 483m ELEVATION PLAN (mi_banc_utm_483.dxf) PROVIDED BY ARCELORMITTAL ON NOV 3, 2015.

0 40 80 120 160 200m

SCALE 1:4000

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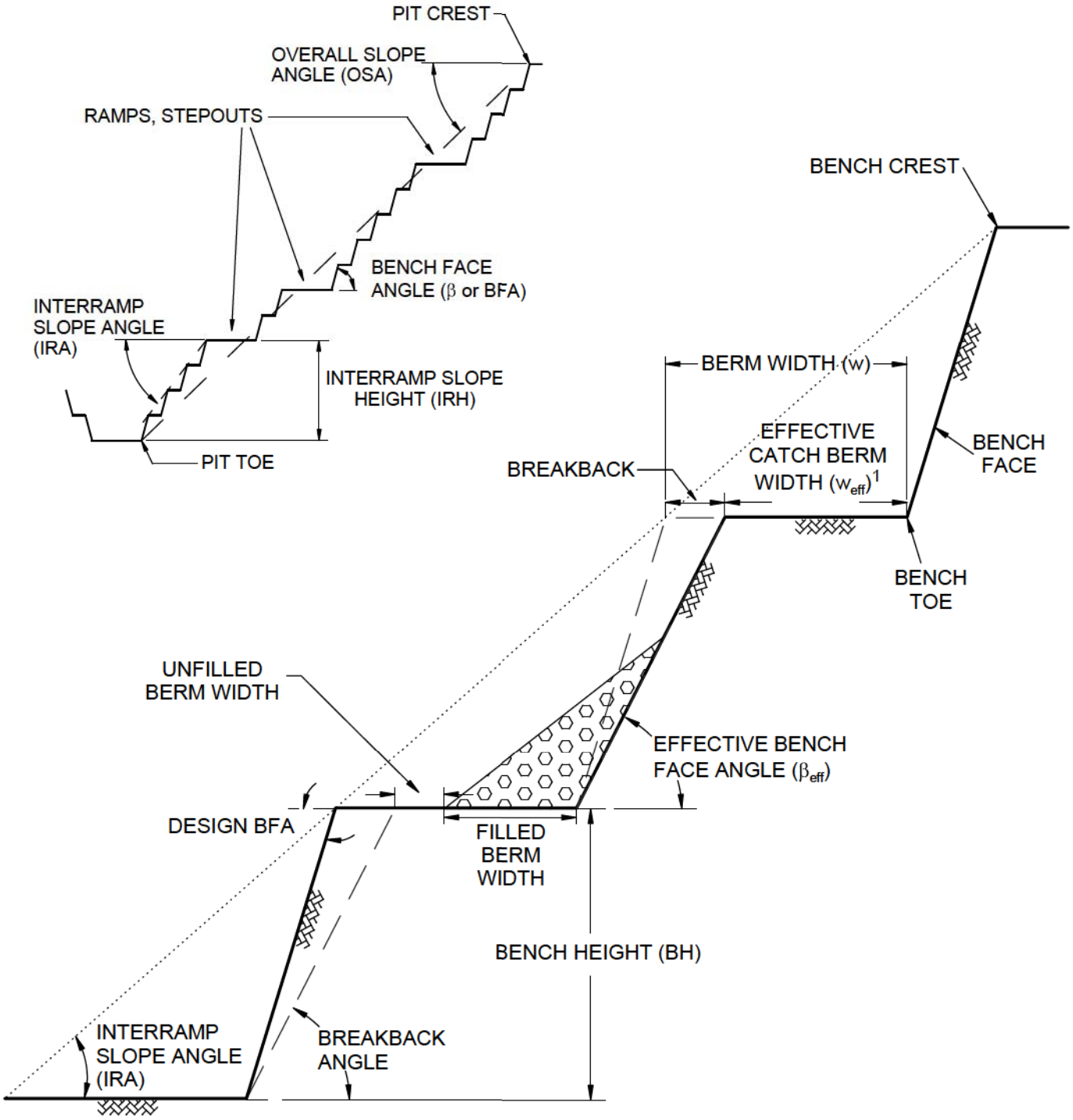
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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ROCK MASS STRENGTH ZONES PROJECTED ON THE 483m LITHOLOGIC LEVEL PLAN

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	9

H:\Project\11846\2015-08 P1 Offload review\Grapher\BasicSlopeGeom.grf



Notes: 1. Minimum effective catch berm widths of 12 and 13m are assumed for BFAs flatter and steeper than 42°, respectively.
2. Refer to Section 3.2 for description of basic slope geometry parameters.

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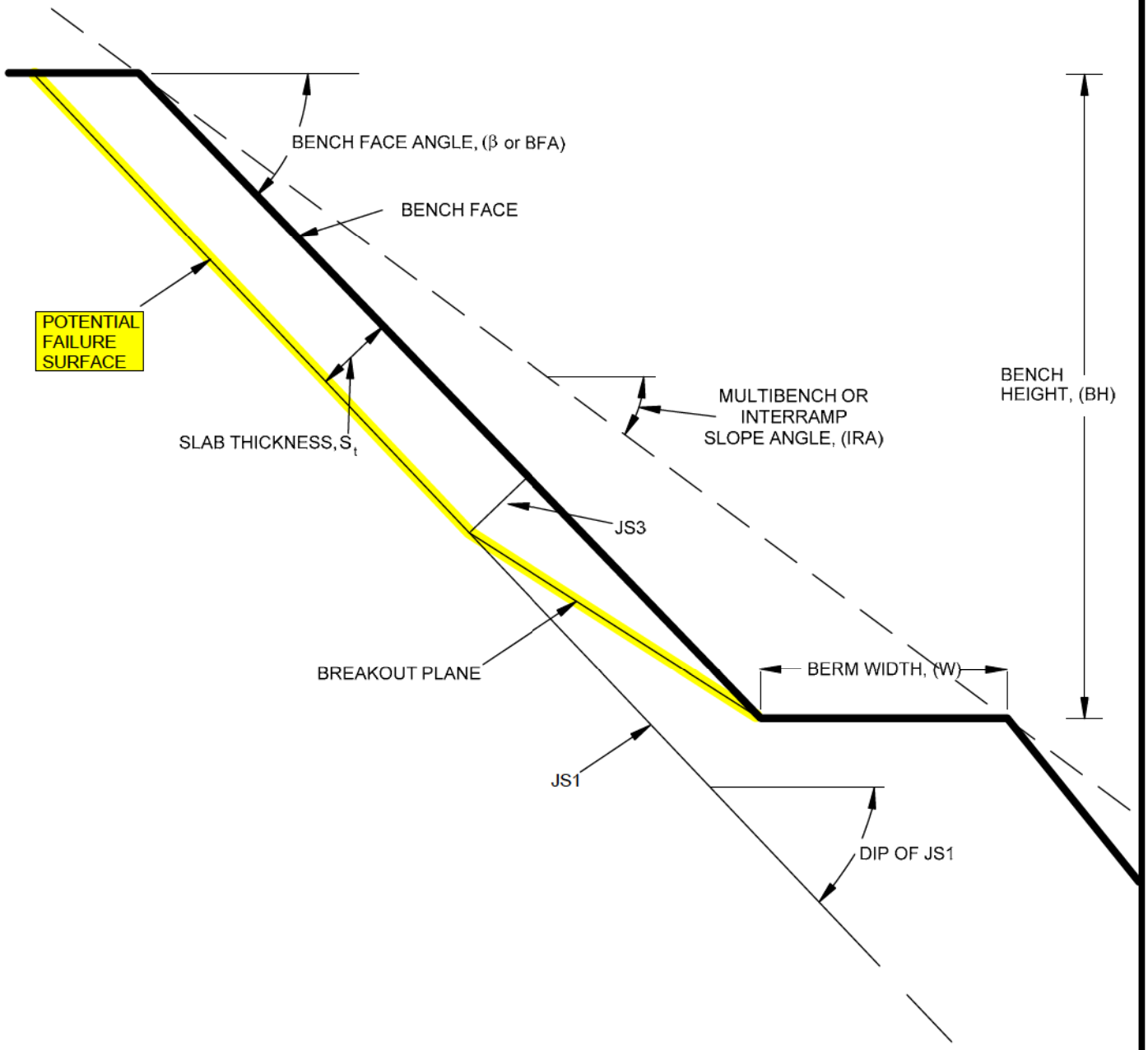
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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BASIC SLOPE GEOMETRY PARAMETERS

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	10

H:\Project\1846\2015-08 P1 Offload review\Grapher\fig-bilinear_slab_geometry.grf



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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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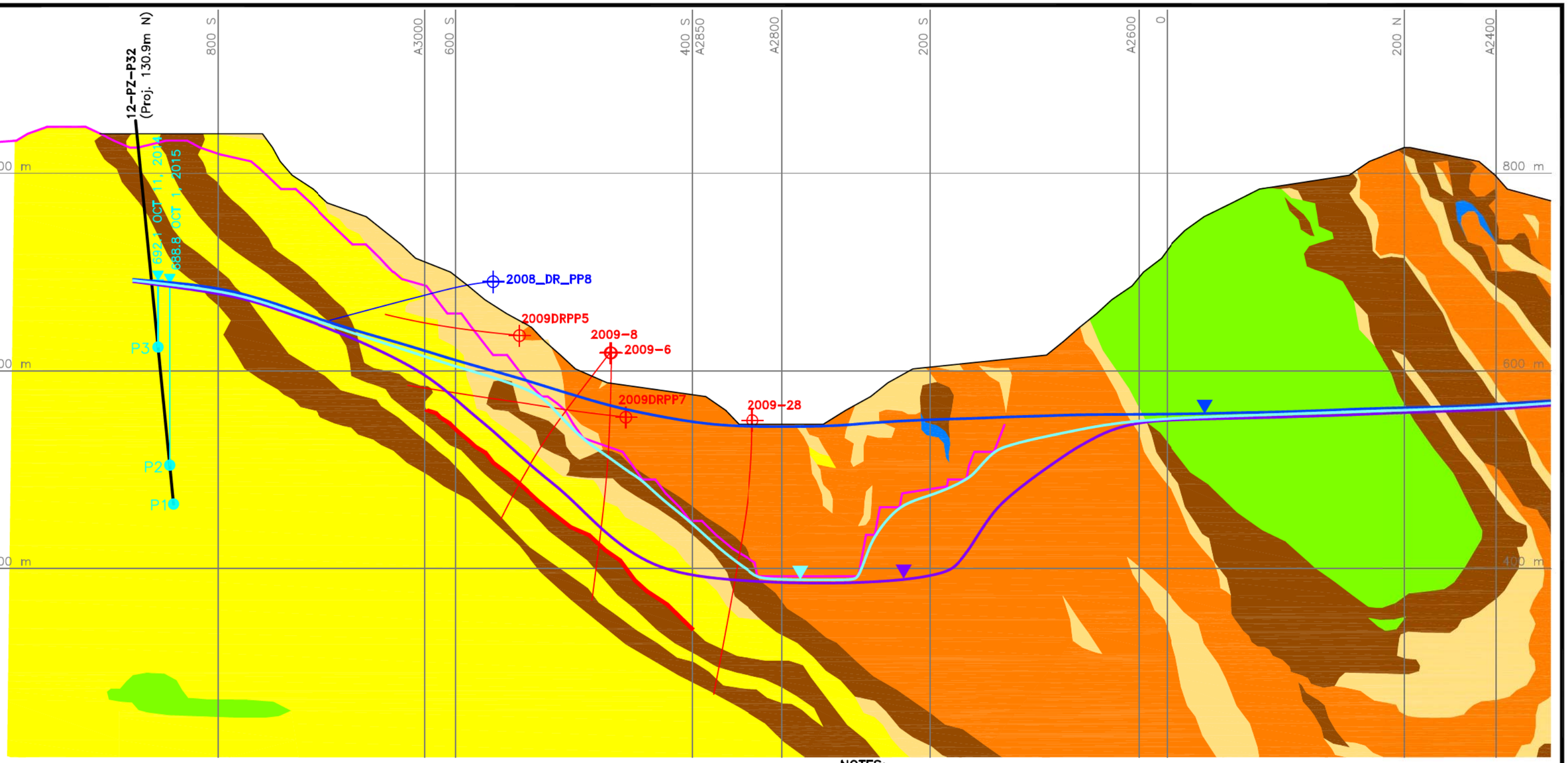
BILINEAR SLAB GEOMETRY

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	11

APPENDIX A

2015 GEOLOGIC SECTIONS

DWG. NUMBER: K:\1846\Cadd\1846-073.dwg (Fig A1)



LEGEND

- AMPHIBOLITE
- IRON FORMATION
- QUARTZ ROCK
- QUARTZ ROCK MICA SCHIST
- GNEISS
- CONTAMINATED IRON FORMATION Al-Ti
- AMPHIBOLITE IRON FORMATION
- QUARTZ ROCK IRON FORMATION
- IRON FORMATION (NON ECONOMIC)
- UNKNOWN

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 200m LONG HORIZONTAL DRAINHOLES
- 12-PZ-P32 1419.1 P1 — PIEZOMETER WITH RECENT HEAD POSTED PIEZOMETER DRILLHOLE TRACE PROJECTED AS STRAIGHT LINE
- DRILLHOLE FROM 2009 DRILLING PROGRAM
- DRILLHOLE FROM PREVIOUS DRILLING PROGRAMS IN 2007, 2008, OR EARLY 2009

- 2009-13 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION

- MARCH 10, 2010 TOPOGRAPHY
- 2015 SOUTH WALL MINE PLAN
- WEAK OR ALTERED CONTACT ZONE

0 40 80 120 160 200m

SCALE 1:4000

NOTES:

1. 2010 PIT TOPOGRAPHY (pp100310.dxf) PROVIDED BY ARCELORMITTAL ON MARCH 19, 2010.
2. 2015 SOUTH WALL MINE PLAN (MurSud_Final_PP_courbe7m.dxf) PROVIDED BY ARCELORMITTAL ON AUGUST 17, 2015.
3. GEOLOGIC SECTION PROVIDED BY ARCELORMITTAL ON OCTOBER 14, 2015.
4. SEE FIGURE 1 FOR PLAN LOCATION OF SECTION.
5. LOCATION OF THE PREDICTED POST MINING WATER TABLE IS RELATIVE TO THE MINE PLAN BEING USED.
6. MINE GRID SHOWN.

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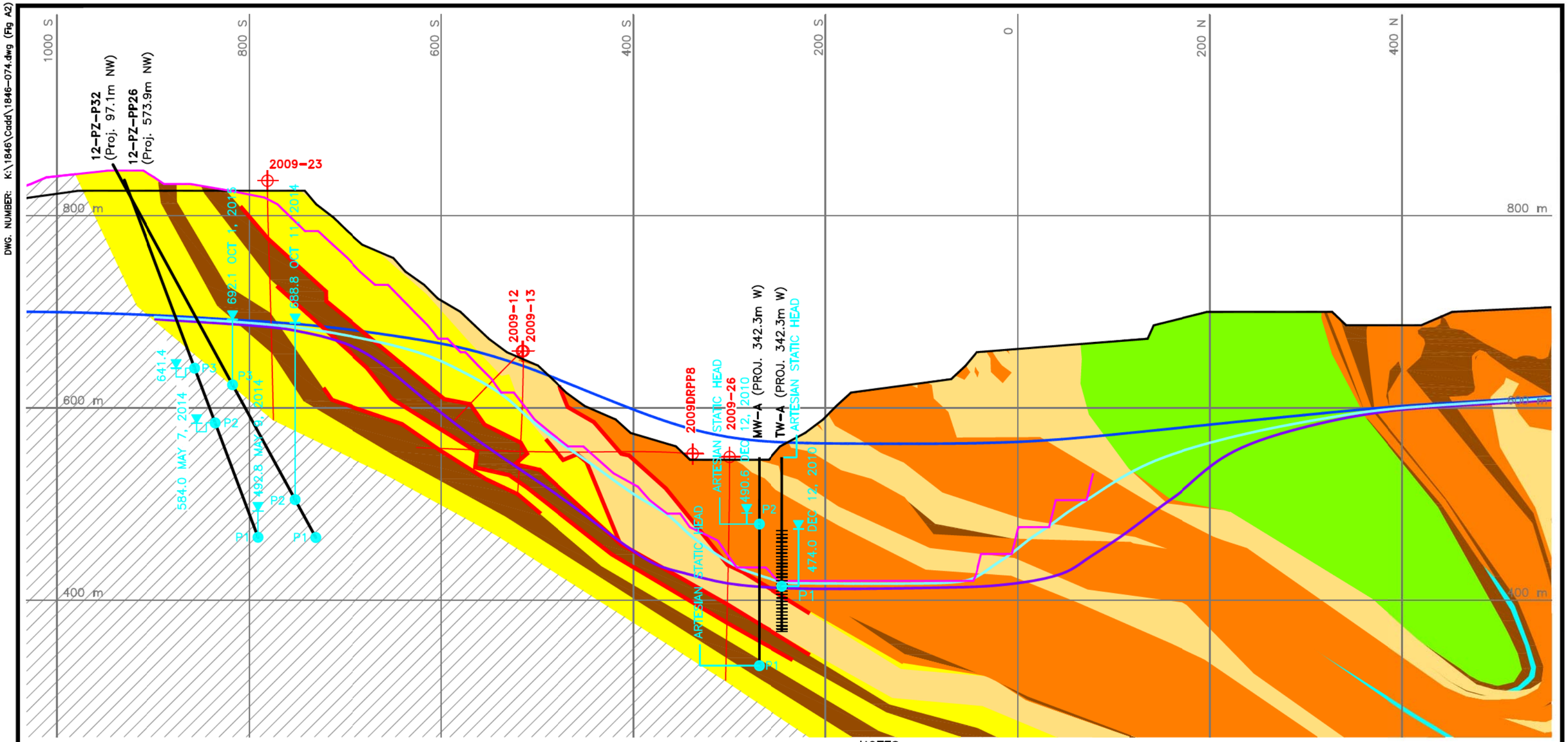
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

PITEAU ASSOCIATES
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GEOLOGIC SECTION 1

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	A1

DWG. NUMBER: K:\1846\Cadd\1846-074.dwg (Fig A2)



LEGEND

- AMPHIBOLITE
- IRON FORMATION
- QUARTZ ROCK
- QUARTZ ROCK MICA SCHIST
- GNEISS
- CONTAMINATED IRON FORMATION Al-Ti
- AMPHIBOLITE IRON FORMATION
- QUARTZ ROCK IRON FORMATION
- IRON FORMATION (NON ECONOMIC)
- UNKNOWN

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 200m LONG HORIZONTAL DRAINHOLES
- 12-PZ-P32 1419.1 P1 — PIEZOMETER WITH RECENT HEAD POSTED; PIEZOMETER DRILLHOLE TRACE PROJECTED AS STRAIGHT LINE
- DRILLHOLE FROM 2009 DRILLING PROGRAM
- DRILLHOLE FROM PREVIOUS DRILLING PROGRAMS IN 2007, 2008, OR EARLY 2009
- 2009-13 — COLLAR LOCATION; SURVEYED ORIENTATION PROJECTED ONTO SECTION
- MARCH 10, 2010 TOPOGRAPHY
- 2015 SOUTH WALL MINE PLAN
- WEAK OR ALTERED CONTACT ZONE

0 40 80 120 160 200m

SCALE 1:4000

NOTES:

1. 2010 PIT TOPOGRAPHY (pp100310.dxf) PROVIDED BY ARCELORMITTAL ON MARCH 19, 2010.
2. 2015 SOUTH WALL MINE PLAN (MurSud_Final_PP_courbe7m.dxf) PROVIDED BY ARCELORMITTAL ON AUGUST 17, 2015.
3. GEOLOGIC SECTION PROVIDED BY ARCELORMITTAL ON OCTOBER 9, 2015.
4. SEE FIGURE 1 FOR PLAN LOCATION OF SECTION.
5. LOCATION OF THE PREDICTED POST MINING WATER TABLE IS RELATIVE TO THE MINE PLAN BEING USED.
6. MINE GRID SHOWN.

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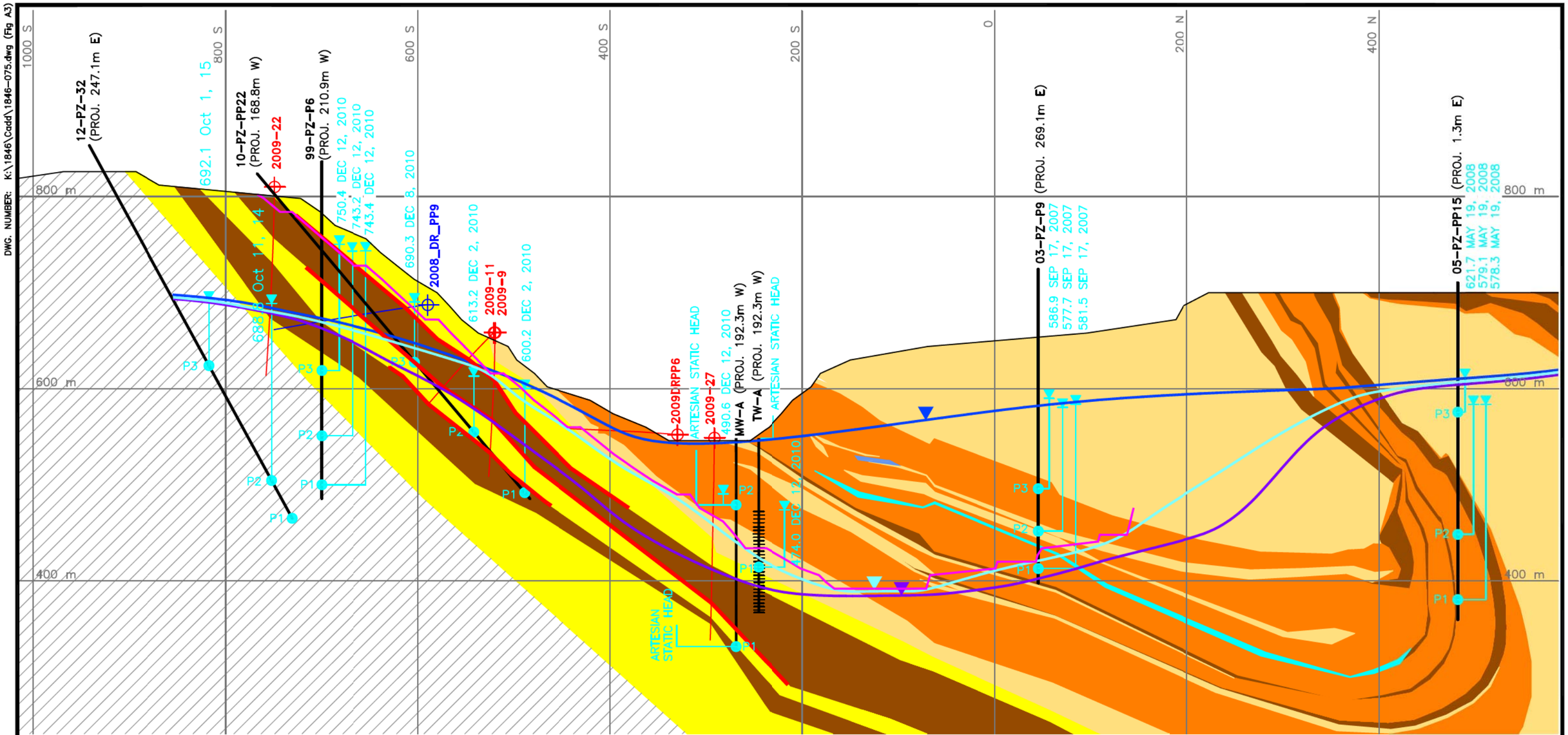
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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GEOLOGIC SECTION A3150

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	A2

DWG. NUMBER: K:\1846\Cadd\1846-075.dwg (Fig A3)



LEGEND

- AMPHIBOLITE
- IRON FORMATION
- QUARTZ ROCK
- QUARTZ ROCK MICA SCHIST
- GNEISS
- CONTAMINATED IRON FORMATION Al-Ti
- AMPHIBOLITE IRON FORMATION
- QUARTZ ROCK IRON FORMATION
- IRON FORMATION (NON ECONOMIC)
- UNKNOWN

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 200m LONG HORIZONTAL DRAINHOLES
- 12-PZ-P32 / 1419.1 / P1 — PIEZOMETER WITH RECENT HEAD POSTED; PIEZOMETER DRILLHOLE TRACE PROJECTED AS STRAIGHT LINE
- DRILLHOLE FROM 2009 DRILLING PROGRAM
- DRILLHOLE FROM PREVIOUS DRILLING PROGRAMS IN 2007, 2008, OR EARLY 2009
- 2009-13 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- MARCH 10, 2010 TOPOGRAPHY
- 2015 SOUTH WALL MINE PLAN
- WEAK OR ALTERED CONTACT ZONE

0 40 80 120 160 200m

SCALE 1:4000

NOTES:

1. 2010 PIT TOPOGRAPHY (pp100310.dxf) PROVIDED BY ARCELORMITTAL ON MARCH 19, 2010.
2. 2015 SOUTH WALL MINE PLAN (MurSud_Final_PP_courbe7m.dxf) PROVIDED BY ARCELORMITTAL ON AUGUST 17, 2015.
3. GEOLOGIC SECTION PROVIDED BY ARCELORMITTAL ON OCTOBER 14, 2015.
4. SEE FIGURE 1 FOR PLAN LOCATION OF SECTION.
5. LOCATION OF THE PREDICTED POST MINING WATER TABLE IS RELATIVE TO THE MINE PLAN BEING USED.
6. MINE GRID SHOWN.

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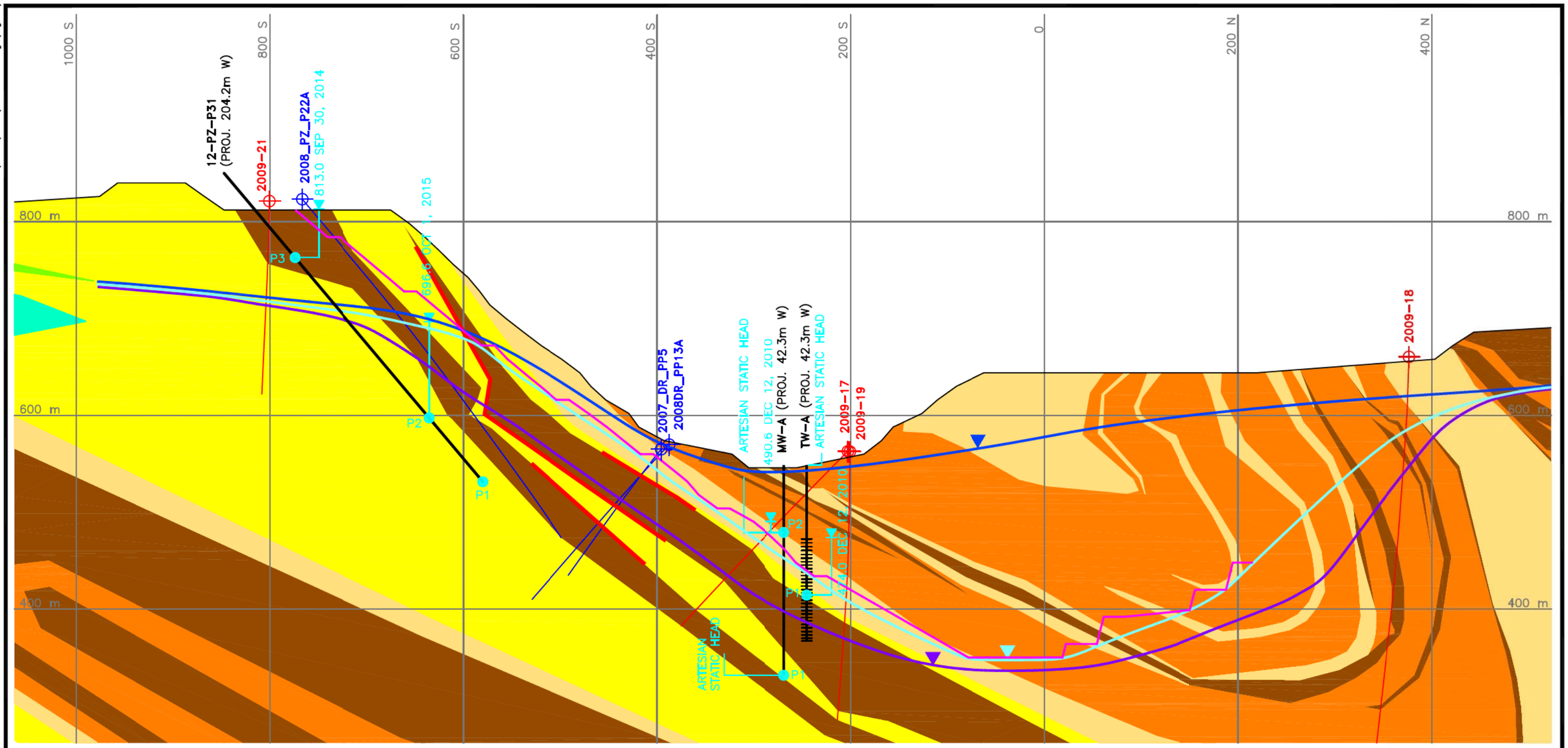
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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GEOLOGIC SECTION A3300

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	A3

DWG. NUMBER: K:\1846\Cadd\1846-076.dwg (Fig A4)



LEGEND

- AMPHIBOLITE
- IRON FORMATION
- QUARTZ ROCK
- QUARTZ ROCK MICA SCHIST
- GNEISS
- CONTAMINATED IRON FORMATION Al-Ti
- AMPHIBOLITE IRON FORMATION
- QUARTZ ROCK IRON FORMATION
- IRON FORMATION (NON ECONOMIC)
- UNKNOWN

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 200m LONG HORIZONTAL DRAINHOLES
- 12-PZ-P32 / 1419.1 / P1 — PIEZOMETER WITH RECENT HEAD POSTED; PIEZOMETER DRILLHOLE TRACE PROJECTED AS STRAIGHT LINE
- DRILLHOLE FROM 2009 DRILLING PROGRAM
- DRILLHOLE FROM PREVIOUS DRILLING PROGRAMS IN 2007, 2008, OR EARLY 2009
- 2009-13 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- MARCH 10, 2010 TOPOGRAPHY
- 2015 SOUTH WALL MINE PLAN
- WEAK OR ALTERED CONTACT ZONE

0 40 80 120 160 200m

SCALE 1:4000

NOTES:

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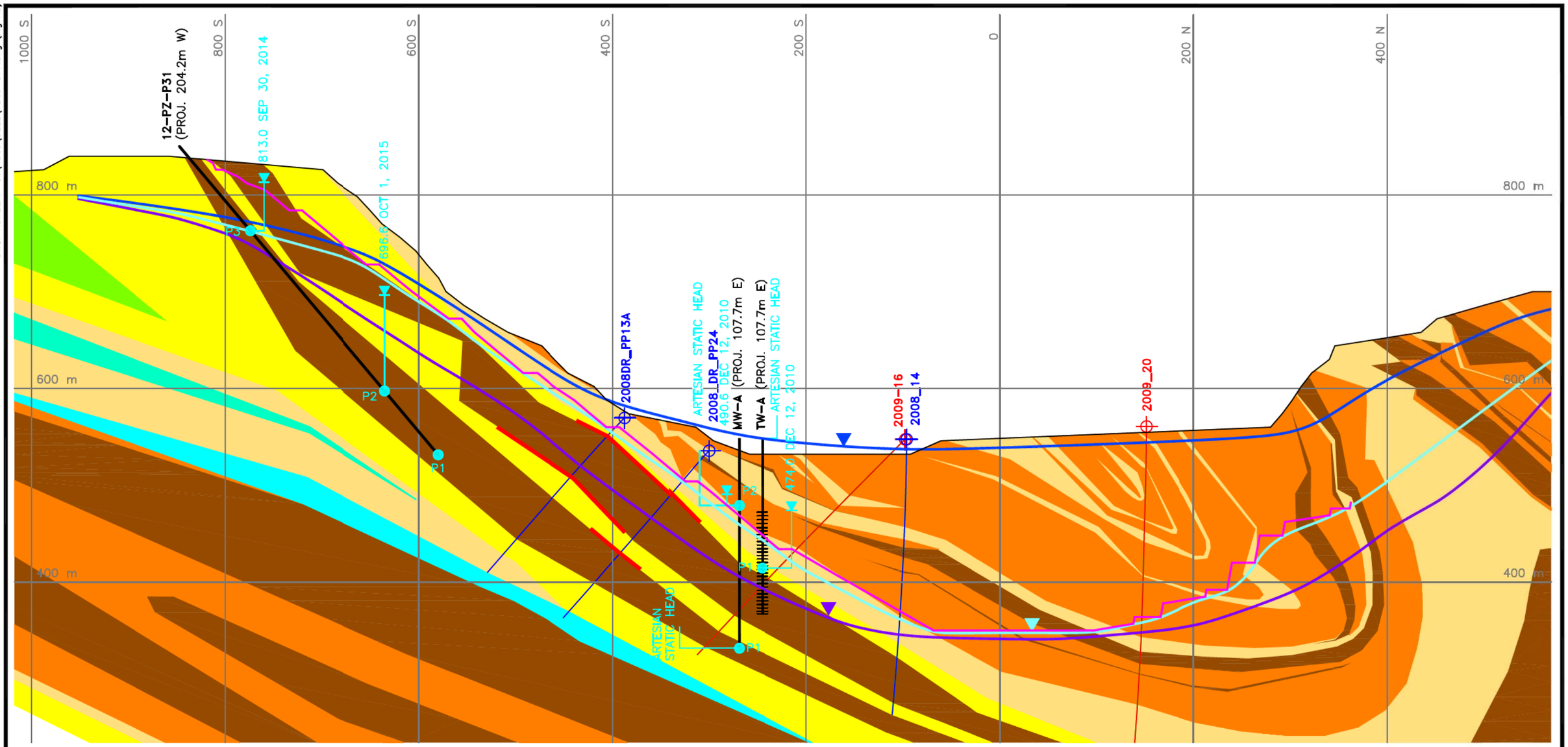
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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GEOLOGIC SECTION A3450

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	A4

DWG. NUMBER: K:\1846\Cadd\1846-077.dwg (Fig A5)



LEGEND

- AMPHIBOLITE
- IRON FORMATION
- QUARTZ ROCK
- QUARTZ ROCK MICA SCHIST
- GNEISS
- CONTAMINATED IRON FORMATION Al-Ti
- AMPHIBOLITE IRON FORMATION
- QUARTZ ROCK IRON FORMATION
- IRON FORMATION (NON ECONOMIC)
- UNKNOWN

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 200m LONG HORIZONTAL DRAINHOLES
- 12-PZ-P32 / 1419.1 / P1 — PIEZOMETER WITH RECENT HEAD POSTED; PIEZOMETER DRILLHOLE TRACE PROJECTED AS STRAIGHT LINE
- DRILLHOLE FROM 2009 DRILLING PROGRAM
- DRILLHOLE FROM PREVIOUS DRILLING PROGRAMS IN 2007, 2008, OR EARLY 2009

- 2009-13 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- MARCH 10, 2010 TOPOGRAPHY
- 2015 SOUTH WALL MINE PLAN
- WEAK OR ALTERED CONTACT ZONE

0 40 80 120 160 200m

SCALE 1:4000

NOTES:

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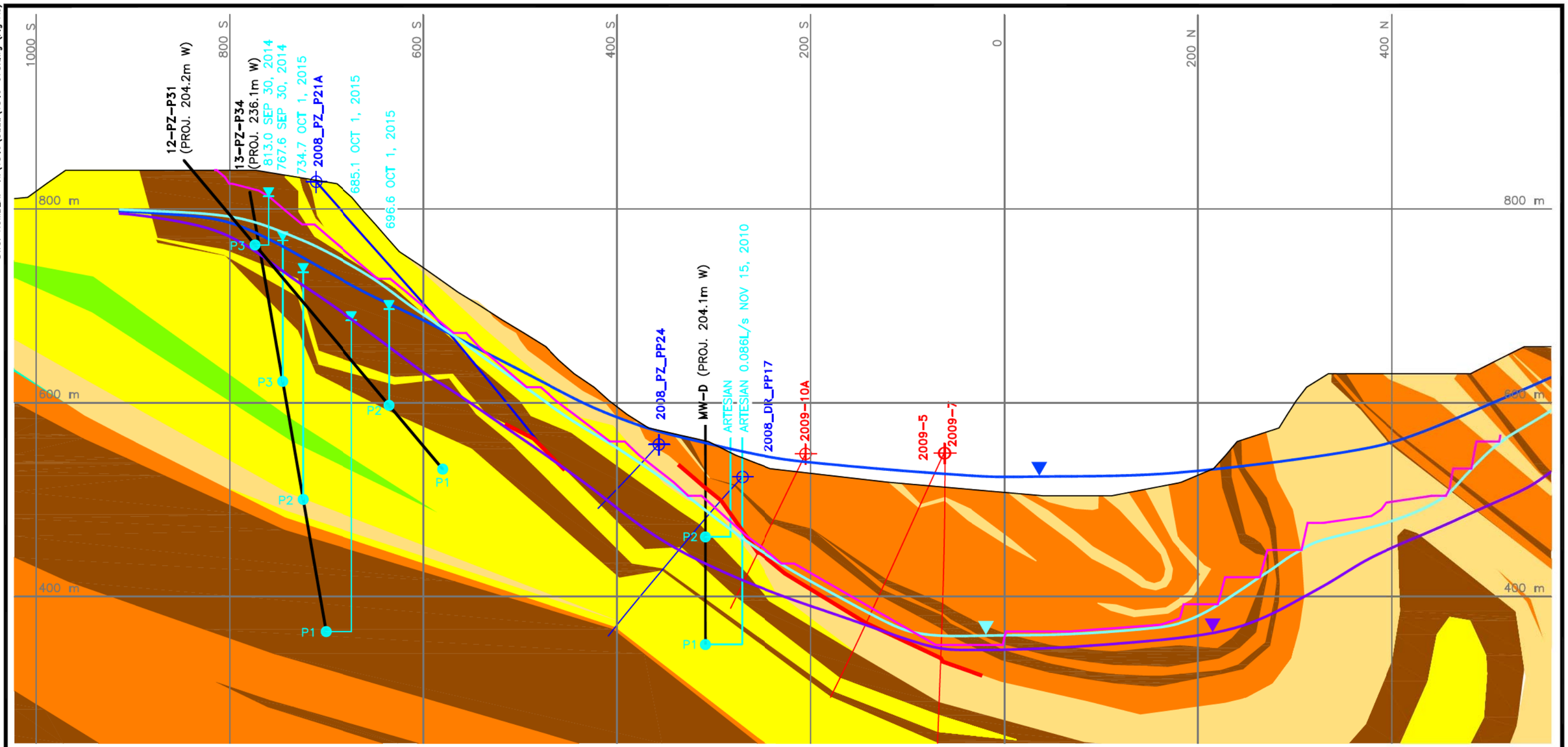
ARCELORMITTAL MINES CANADA
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GEOLOGIC SECTION A3600

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	A5

DWG. NUMBER: K:\1846\Cadd\1846-078.dwg (Fig A6)



LEGEND

- AMPHIBOLITE
- IRON FORMATION
- QUARTZ ROCK
- QUARTZ ROCK MICA SCHIST
- GNEISS
- CONTAMINATED IRON FORMATION Al-Ti
- AMPHIBOLITE IRON FORMATION
- QUARTZ ROCK IRON FORMATION
- IRON FORMATION (NON ECONOMIC)
- UNKNOWN

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 200m LONG HORIZONTAL DRAINHOLES
- 12-PZ-P32 / N1419.1 / P1 — PIEZOMETER WITH RECENT HEAD POSTED PIEZOMETER DRILLHOLE TRACE PROJECTED AS STRAIGHT LINE
- DRILLHOLE FROM 2009 DRILLING PROGRAM
- DRILLHOLE FROM PREVIOUS DRILLING PROGRAMS IN 2007, 2008, OR EARLY 2009

- 2009-13 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION

- MARCH 10, 2010 TOPOGRAPHY
- 2015 SOUTH WALL MINE PLAN
- WEAK OR ALTERED CONTACT ZONE

0 40 80 120 160 200m

SCALE 1:4000

NOTES:

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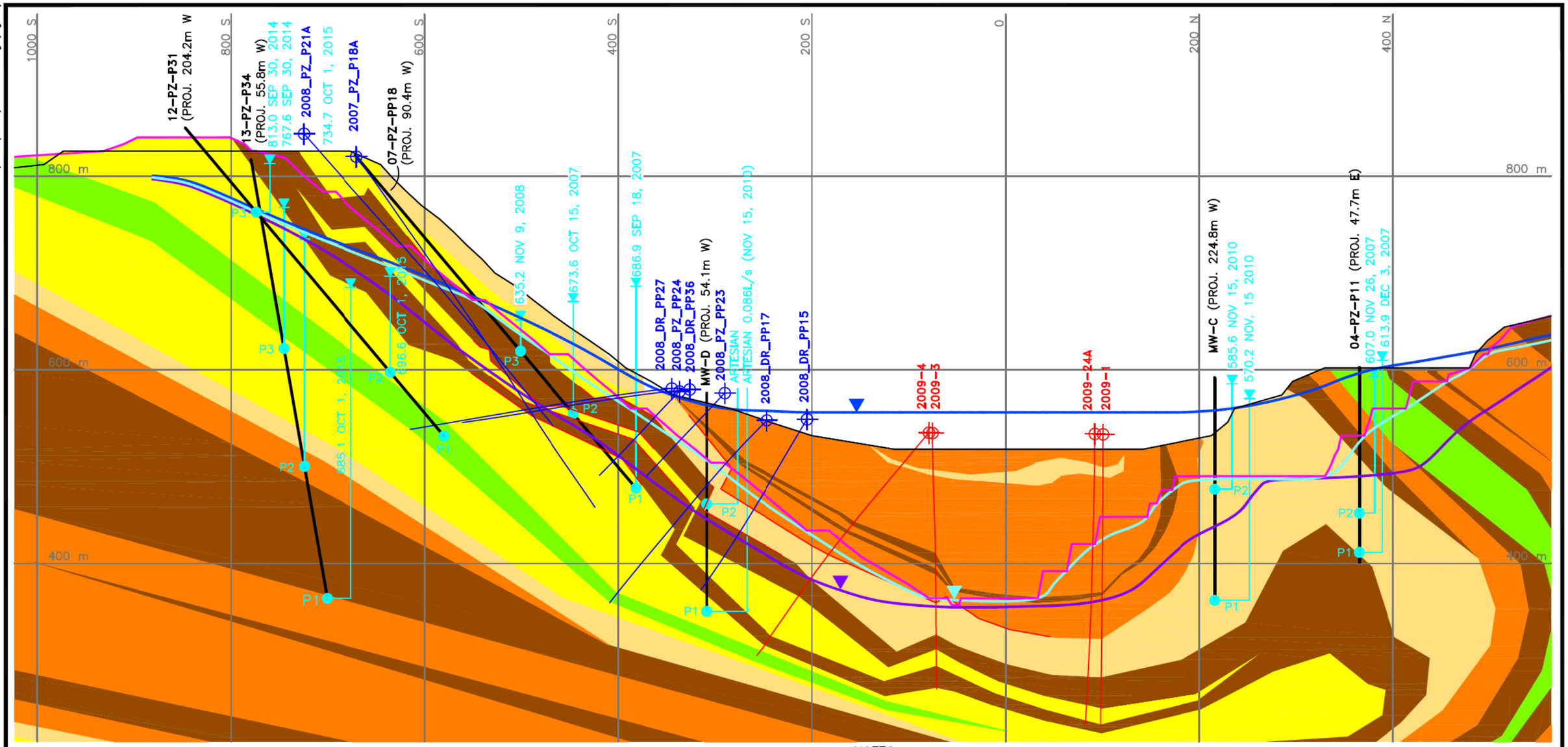
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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GEOLOGIC SECTION A3750

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	A6

DWG. NUMBER: K:\1846\Cadd\1846-079.dwg (Fig A7)



LEGEND

- AMPHIBOLITE
- IRON FORMATION
- QUARTZ ROCK
- QUARTZ ROCK MICA SCHIST
- GNEISS
- CONTAMINATED IRON FORMATION Al-Ti
- AMPHIBOLITE IRON FORMATION
- QUARTZ ROCK IRON FORMATION
- IRON FORMATION (NON ECONOMIC)
- UNKNOWN

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 200m LONG HORIZONTAL DRAINHOLES
- 12-PZ-P32 / 1419.1 / P1 — PIEZOMETER WITH RECENT HEAD POSTED; PIEZOMETER DRILLHOLE TRACE PROJECTED AS STRAIGHT LINE
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- 2009-13 — COLLAR LOCATION
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- 2015 SOUTH WALL MINE PLAN
- WEAK OR ALTERED CONTACT ZONE

0 40 80 120 160 200m

SCALE 1:4000

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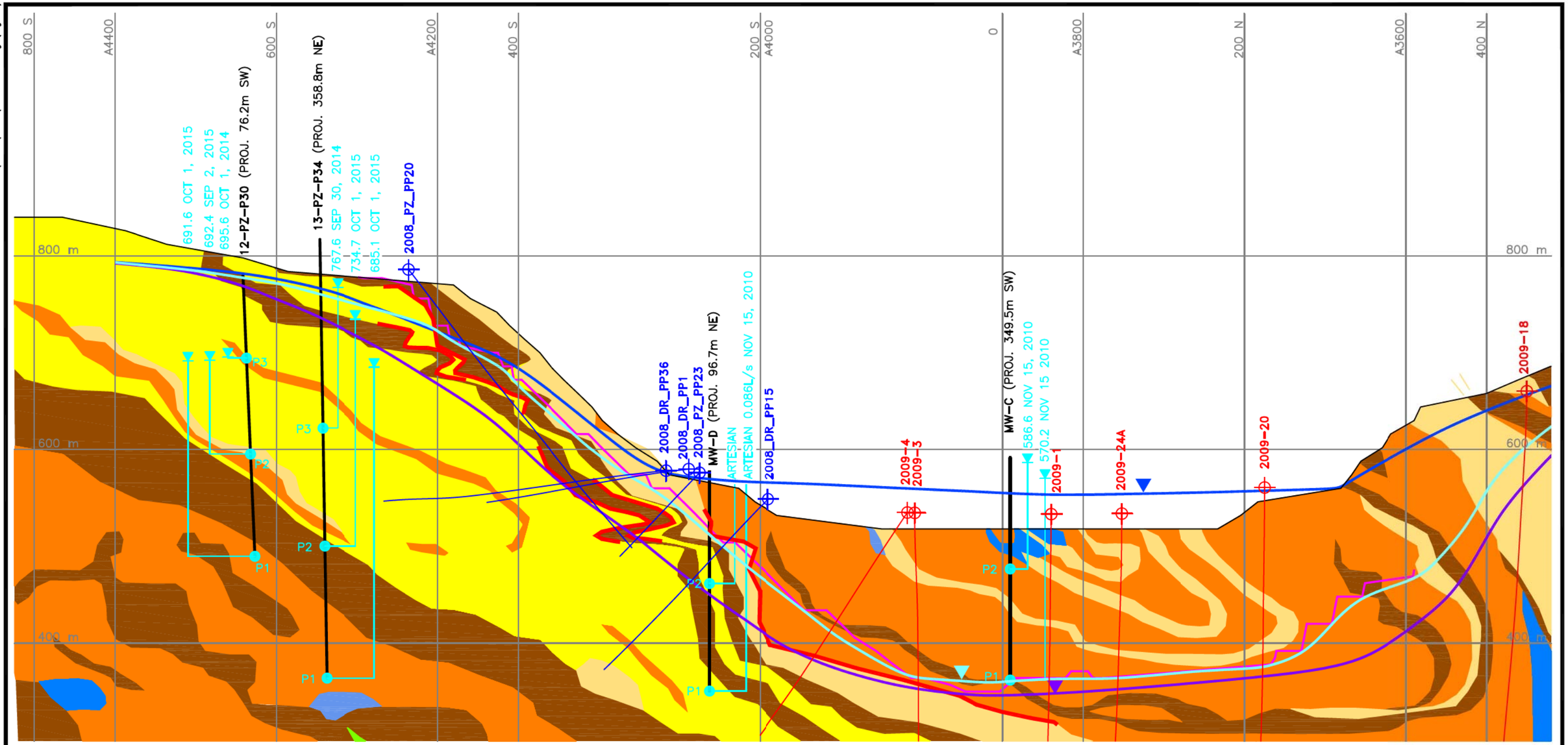
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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GEOLOGIC SECTION A3900

BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	A7

DWG. NUMBER: K:\1846\Cadd\1846-080.dwg (Fig A8)



LEGEND

- AMPHIBOLITE
- IRON FORMATION
- QUARTZ ROCK
- QUARTZ ROCK MICA SCHIST
- GNEISS
- CONTAMINATED IRON FORMATION Al-Ti
- AMPHIBOLITE IRON FORMATION
- QUARTZ ROCK IRON FORMATION
- IRON FORMATION (NON ECONOMIC)
- UNKNOWN

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 200m LONG HORIZONTAL DRAINHOLES
- 1419.1 / 12-PZ-P32 / P1 — PIEZOMETER WITH RECENT HEAD POSTED PIEZOMETER DRILLHOLE TRACE PROJECTED AS STRAIGHT LINE
- DRILLHOLE FROM 2009 DRILLING PROGRAM
- DRILLHOLE FROM PREVIOUS DRILLING PROGRAMS IN 2007, 2008, OR EARLY 2009

- 2009-13 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION

- MARCH 10, 2010 TOPOGRAPHY
- 2015 SOUTH WALL MINE PLAN
- WEAK OR ALTERED CONTACT ZONE

0 40 80 120 160 200m

SCALE 1:4000

NOTES:

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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GEOLOGIC SECTION 7

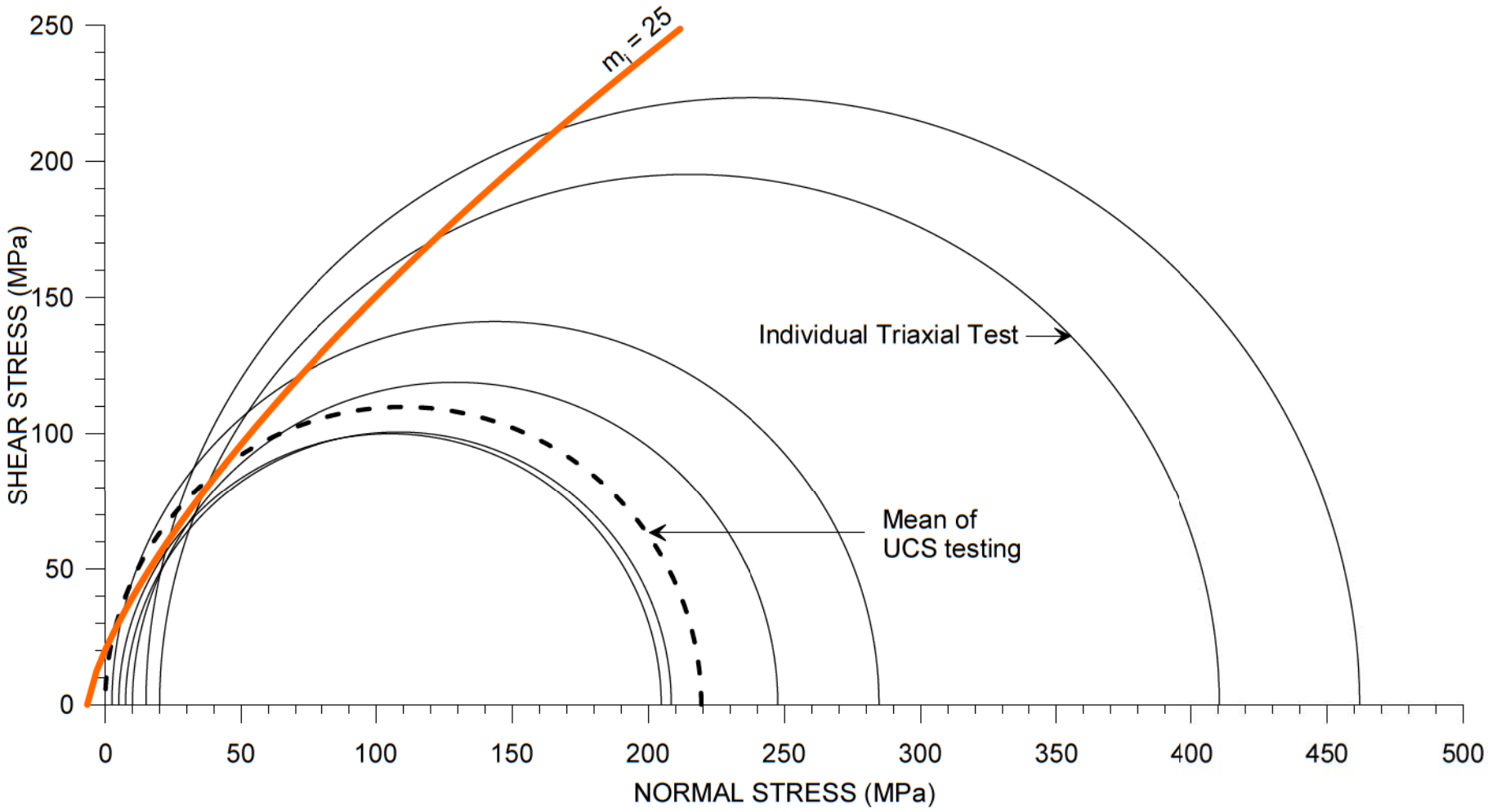
BY:	DATE:
RS/sl	DEC 15
APPROVED:	FIG:
GG	A8

APPENDIX B

LABORATORY ROCK STRENGTH TESTING RESULTS

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IRON FORMATION (IF)



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NOTES:
1. Value of m_i calculated with RocLab® (v.1.031), using triaxial data and mean of UCS testing; best fit curve is shown.
2. Figure orginally published in Piteau, 2010.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

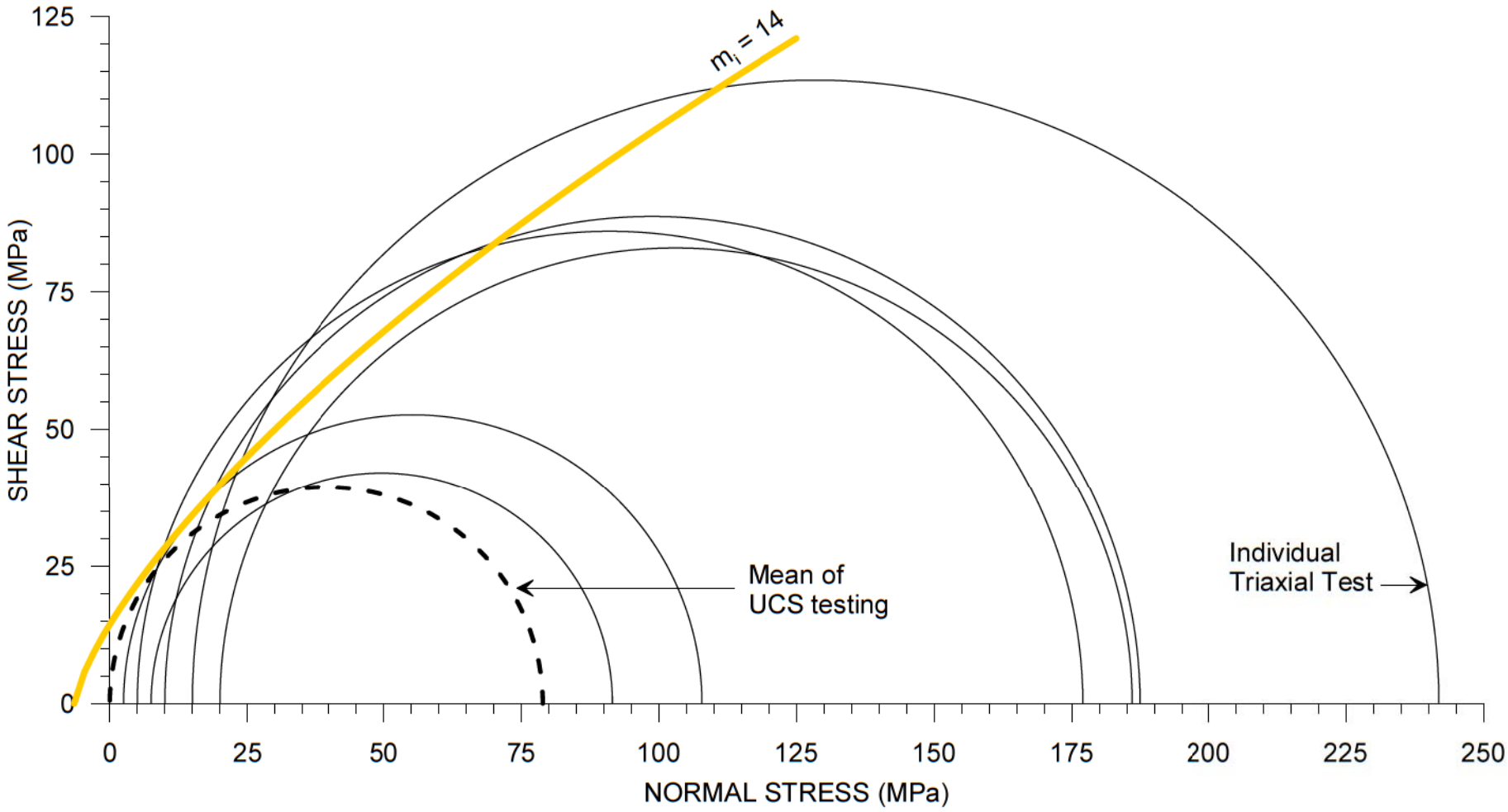
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SUMMARY OF TRIAXIAL AND UCS LABORATORY TESTING RESULTS FOR IRON FORMATION (IF)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	B1

H:\Project\1846\2015-08 P1 Offload review\Testing\Rocklab+Mohr Circles\QRMS-logo.grf

QUARTZ ROCK MICA SCHIST (QRMS)



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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

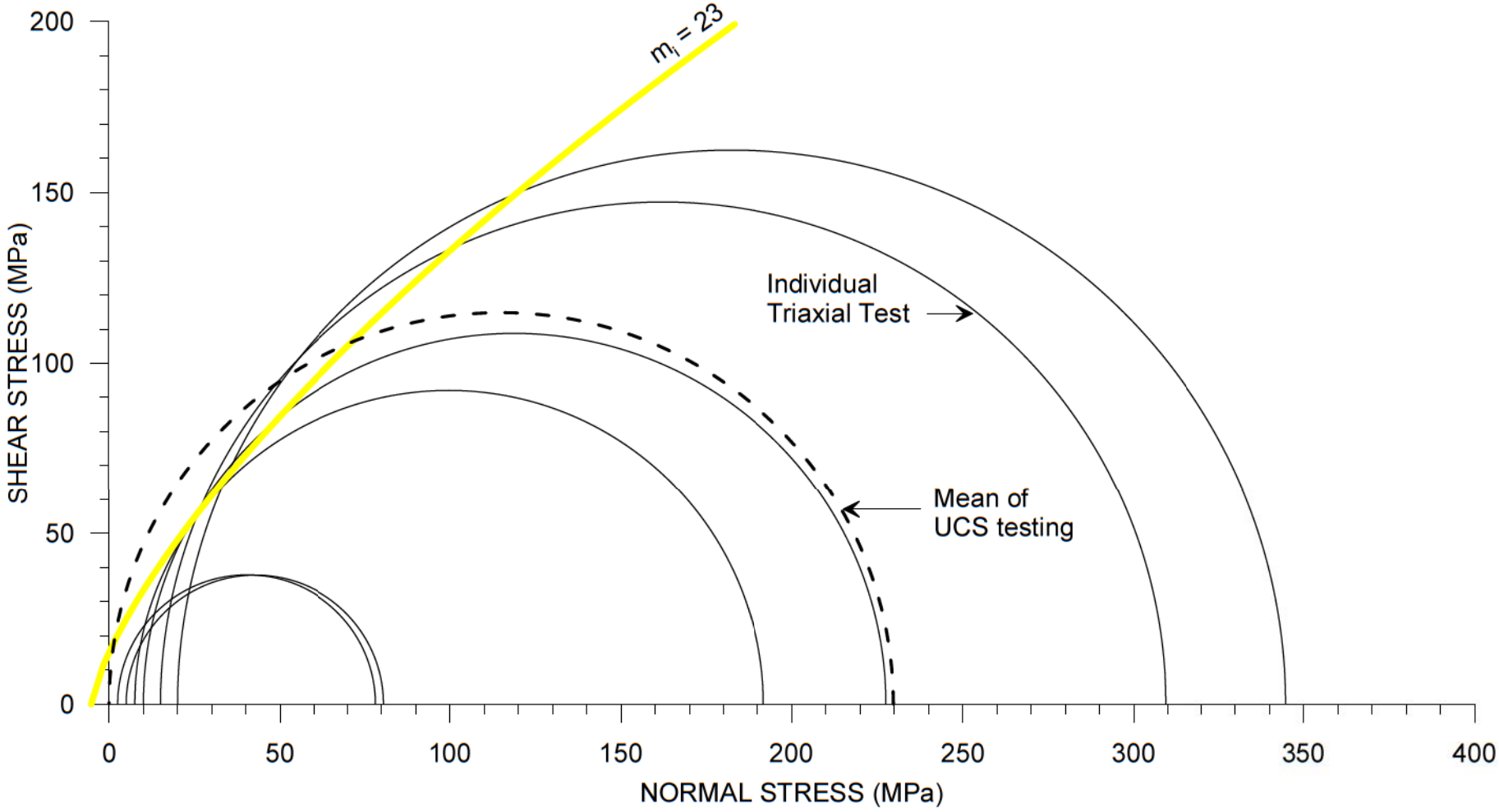
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SUMMARY OF TRIAXIAL AND UCS LABORATORY TESTING RESULTS FOR QUARTZ ROCK MICA SCHIST (QRMS)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	B2

H:\Project\18462\2015-08 P1 Offload review\Testing\Rocklab+Mohr_Circles\QR-logo.grf

QUARTZITE (QR)



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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

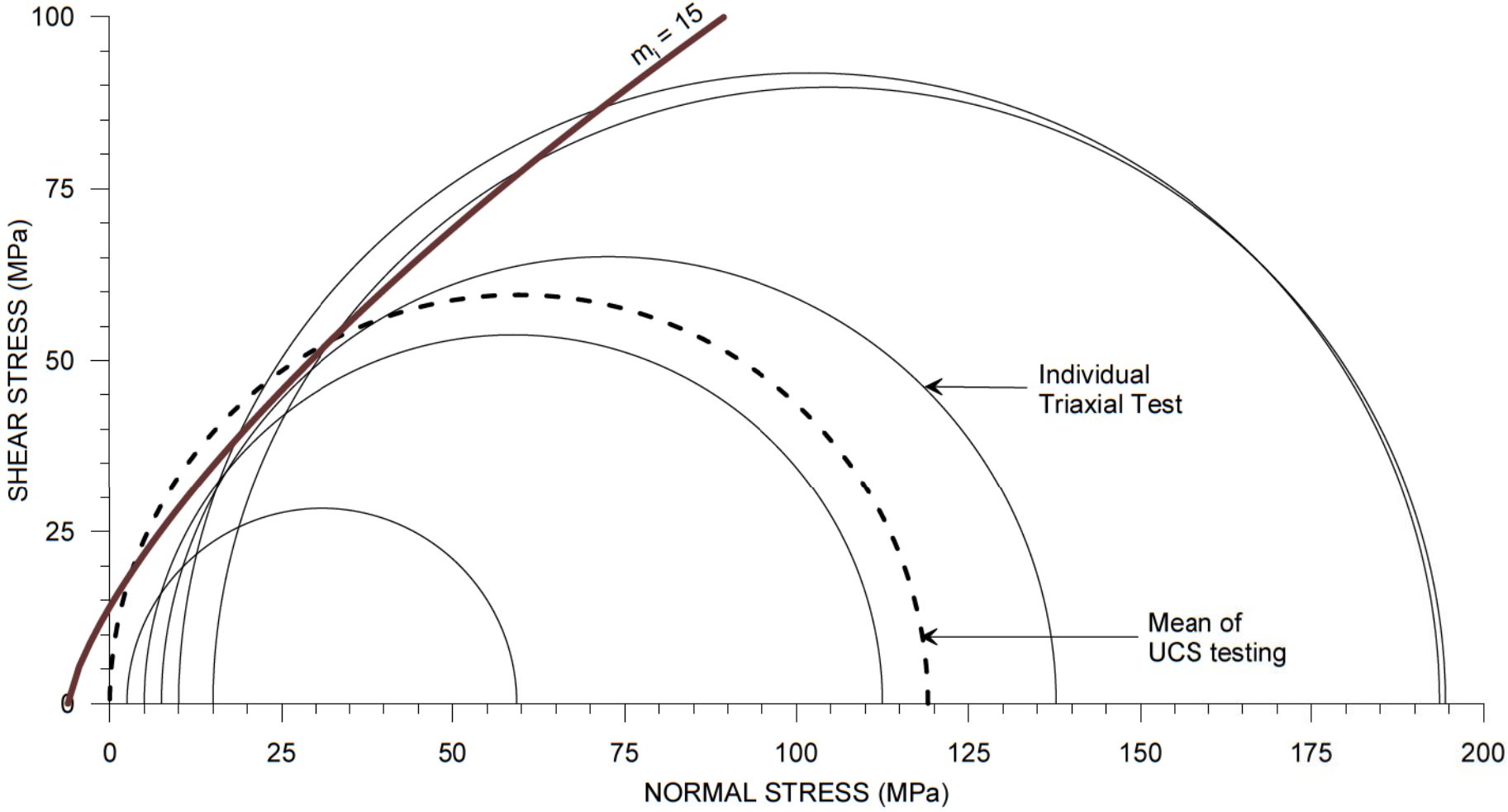
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SUMMARY OF TRIAXIAL AND UCS LABORATORY TESTING RESULTS FOR QUARTZITE (QR)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	B3

H:\Project\1846\2015-08 P1 Offload review\Testing\Roclab+Mohr_CirclesAMP-logo.grf

AMPHIBOLITE (AMP)



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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

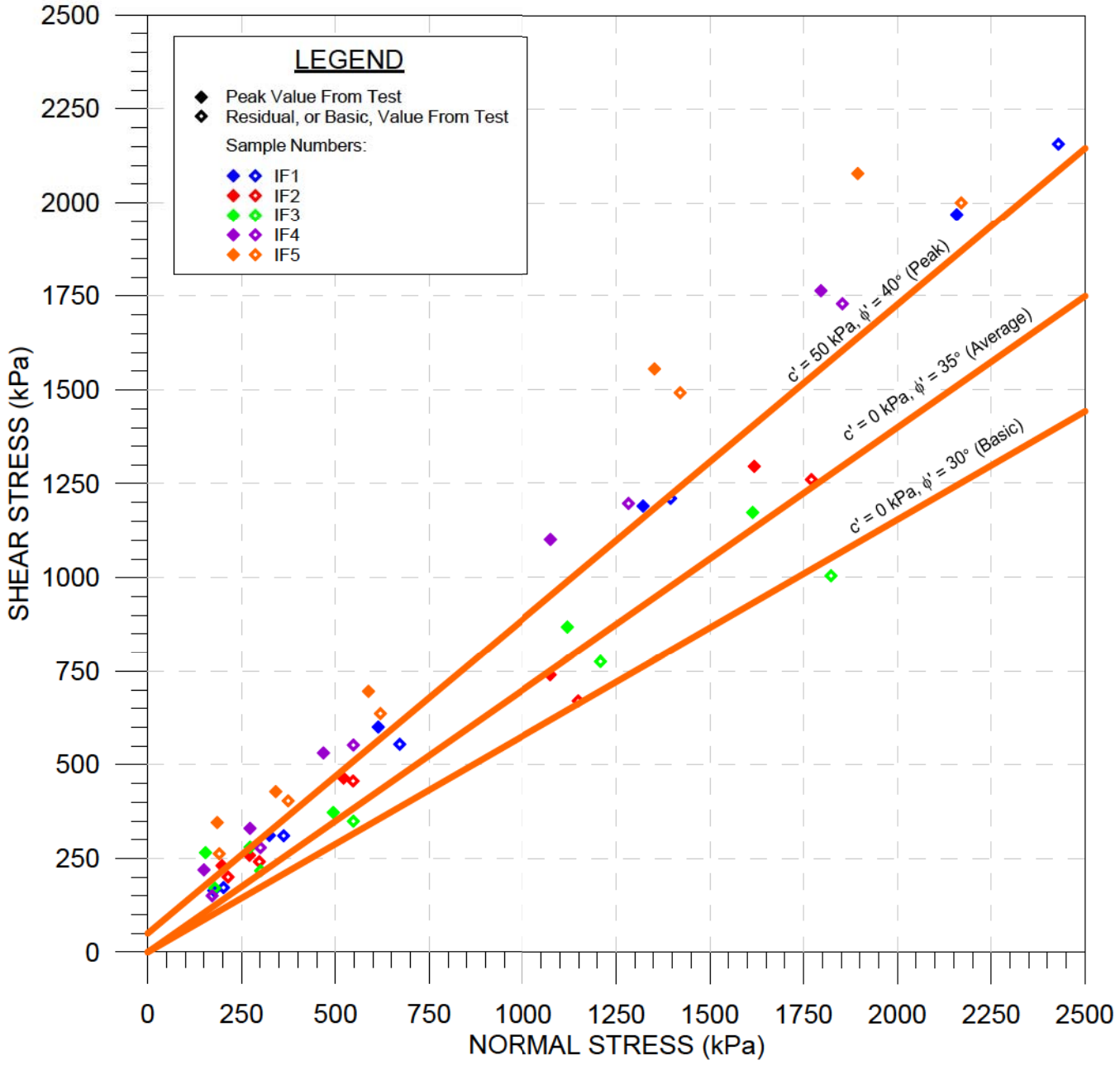
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SUMARY OF TRAXIAL AND UCS LABORATORY TESTING RESULTS FOR AMPHIBOLITE (AMP)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	B4

H:\Project\1846\2015-08 P1 Offload review\Testing\Direct Shear-corrected calcs\Fig_Direct_Shear_IF.grf

IRON FORMATION (IF)



NOTE: Figure orginally published in Piteau, 2010.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

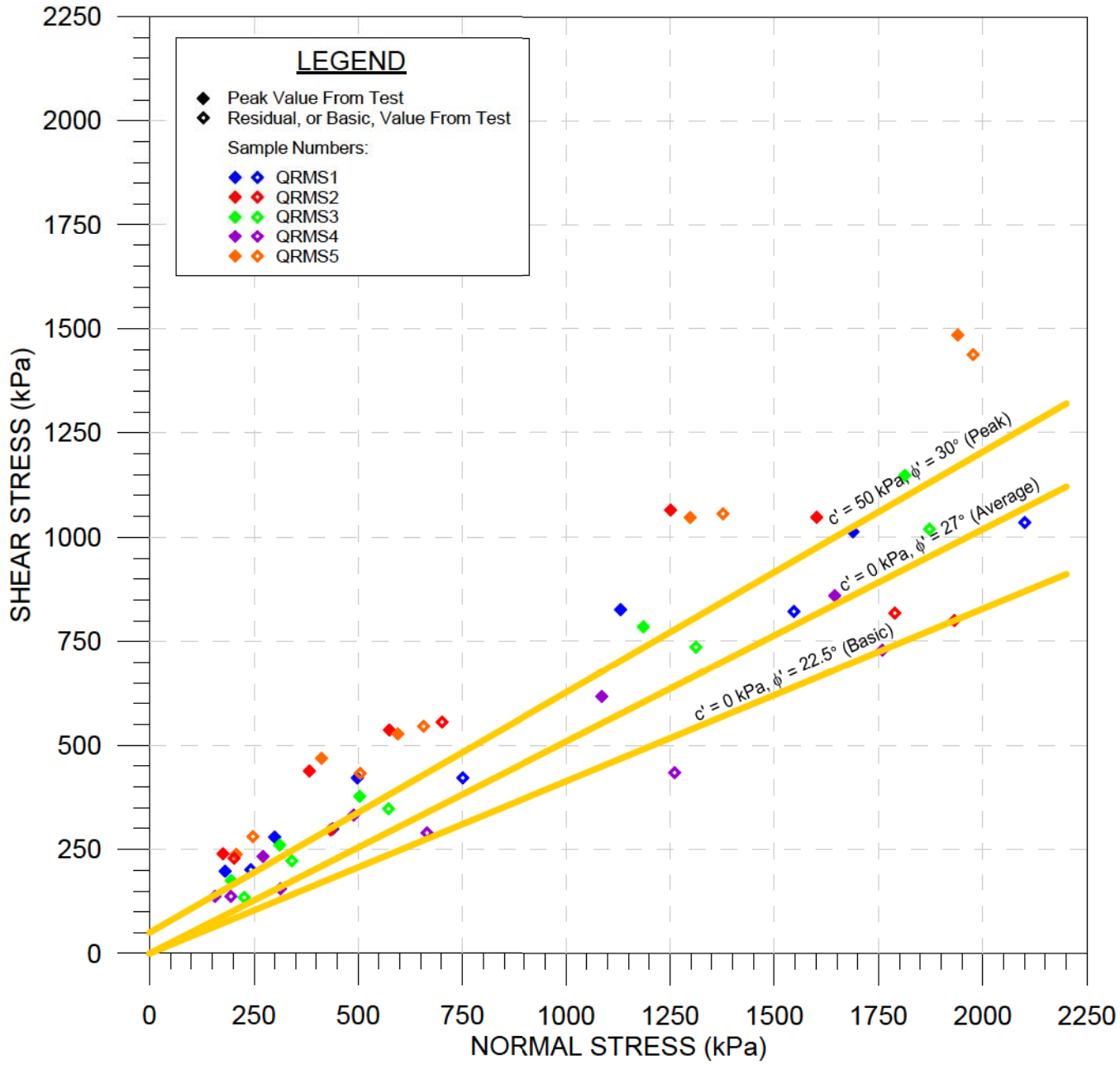
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SUMMARY OF DIRECT SHEAR LABORATORY TESTING RESULTS FOR IRON FORMATION (IF)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	B5

H:\Project\18460\2015-08 P1 Offload review\Testing\Direct Shear-corrected calcs\Fig_Direct_Shear_QRMS.grf

QUARTZ ROCK MICA SCHIST (QRMS)



NOTE: Figure orginally published in Piteau, 2010.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

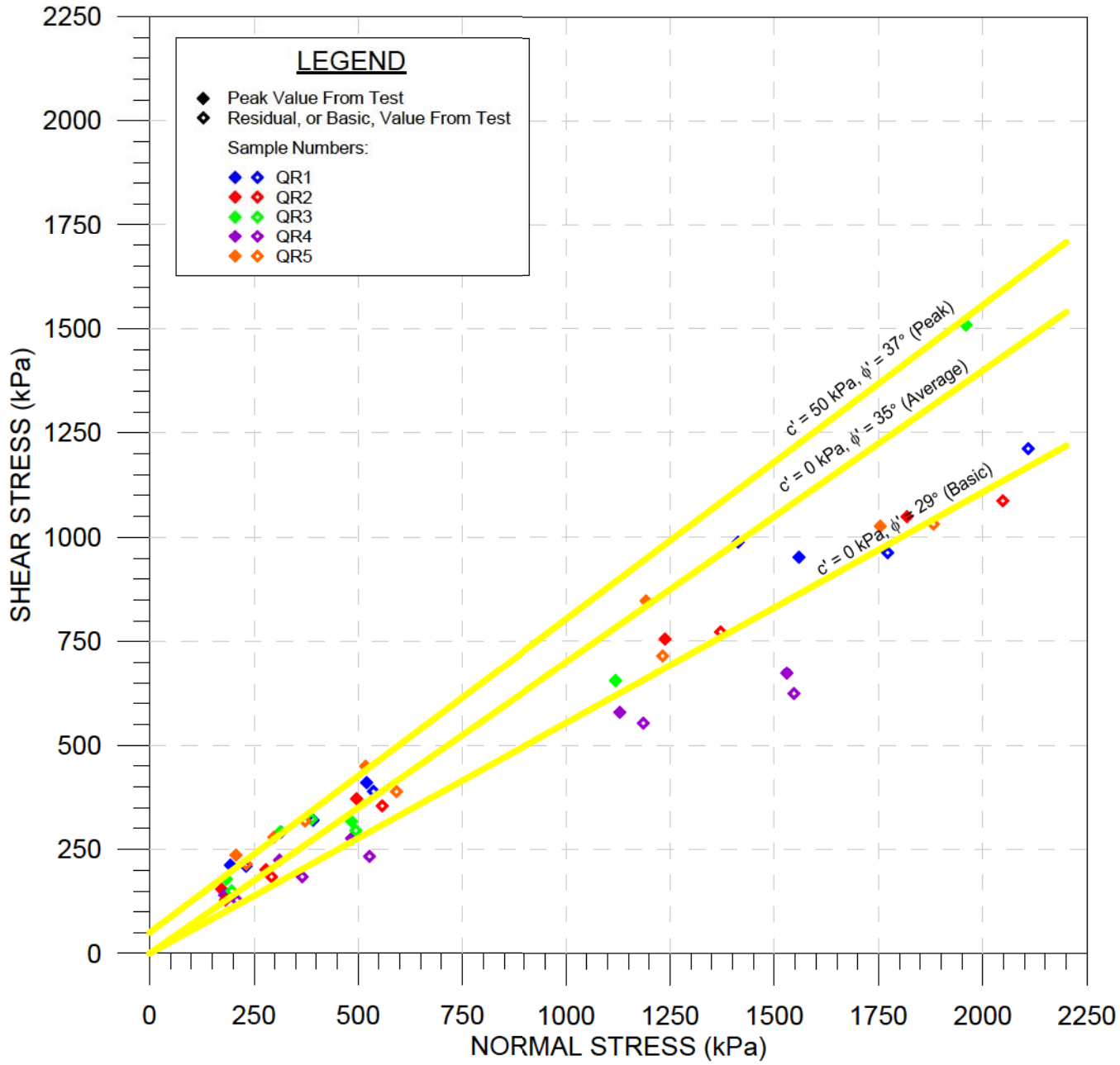
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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

SUMMARY OF DIRECT SHEAR LABORATORY TESTING RESULTS FOR QUARTZ ROCK MICA SCHIST (QRMS)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	B6

H:\Project\1846\2015-08 P1 Offload review\Testing\Direct Shear-corrected calcs\Fig_Direct_Shear_QR.grf

QUARTZITE (QR)



NOTE: Figure orginally published in Piteau, 2010.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

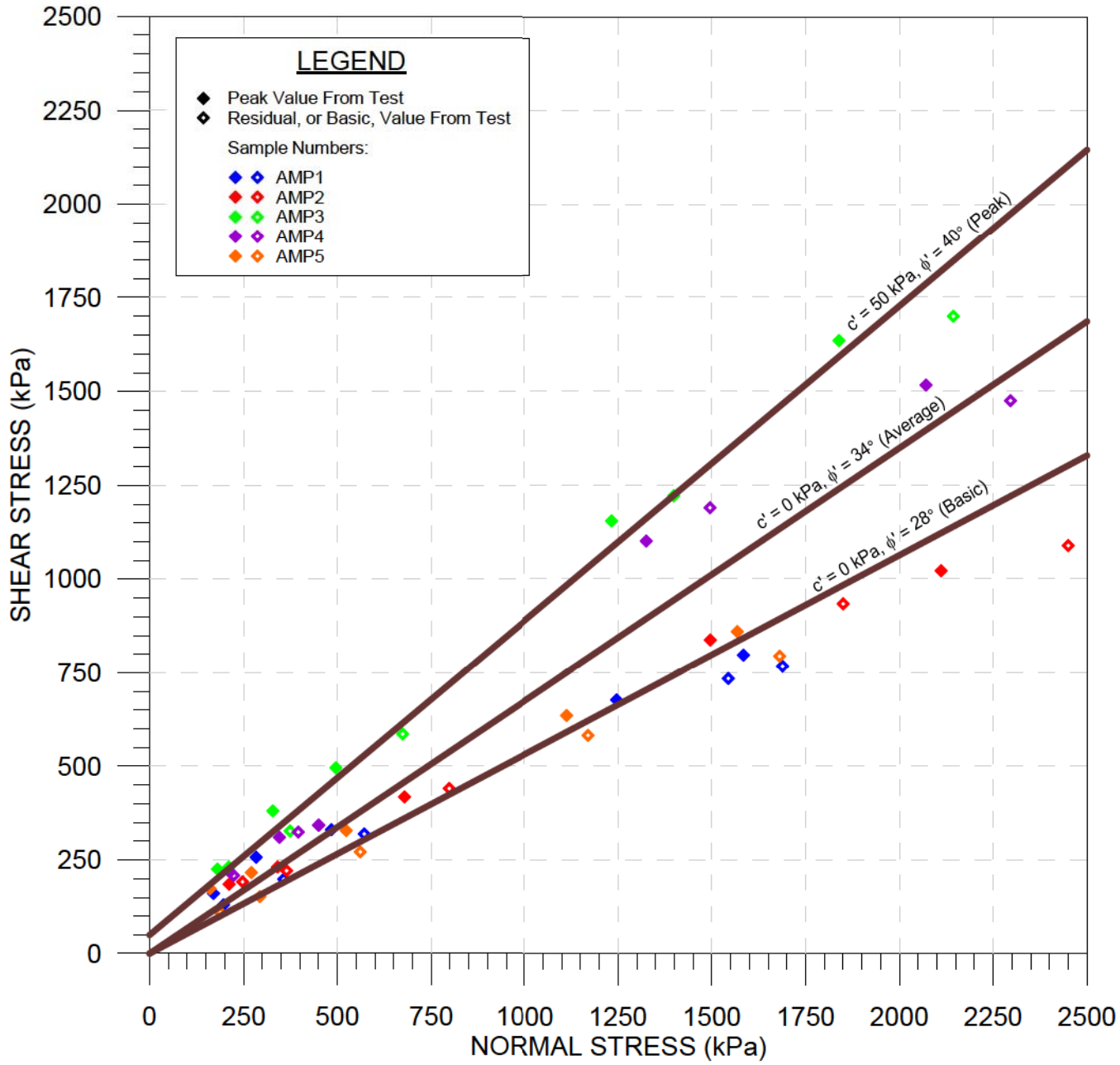
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SUMMARY OF DIRECT SHEAR LABORATORY TESTING RESULTS FOR QUARTZITE (QR)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	B7

H:\Project\1846\2015-08 P1 Offload review\Testing\Direct Shear-corrected calcs\Fig_Direct_Shear_AMP.grf

AMPHIBOLITE (AMP)



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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

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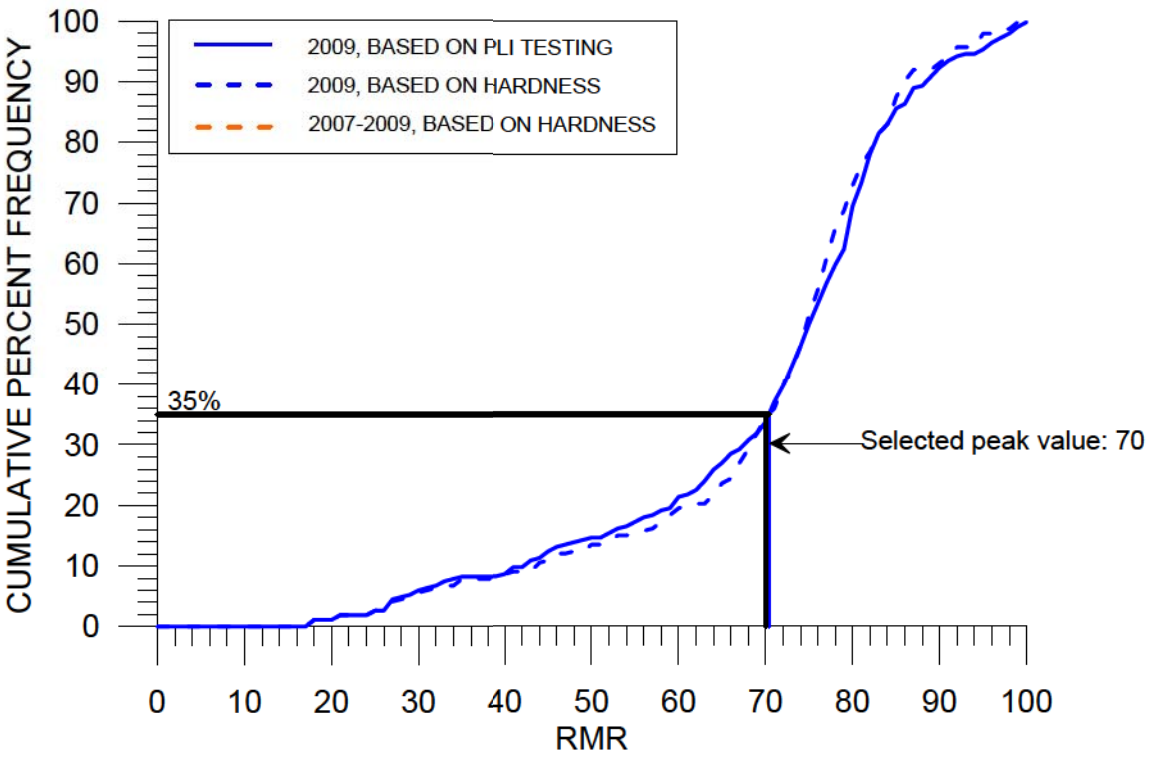
SUMMARY OF DIRECT SHEAR LABORATORY TESTING RESULTS FOR AMPHIBOLITE (AMP)

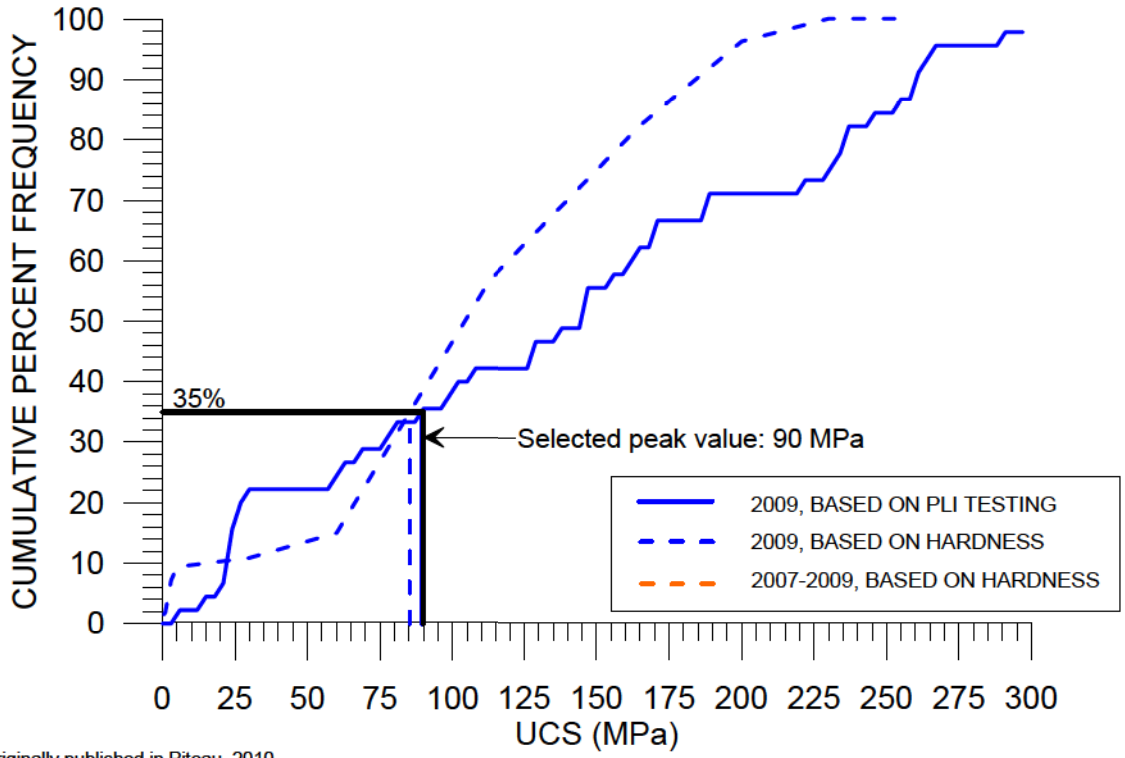
BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	B8

APPENDIX C

CUMULATIVE FREQUENCY DISTRIBUTIONS OF RMR AND UCS

H:\Project\1846\2015-08 P1 Offload review\Geomech\CFA assessments for back analysis\C01-Rock Mass CFA - IF_S1_figure.grf





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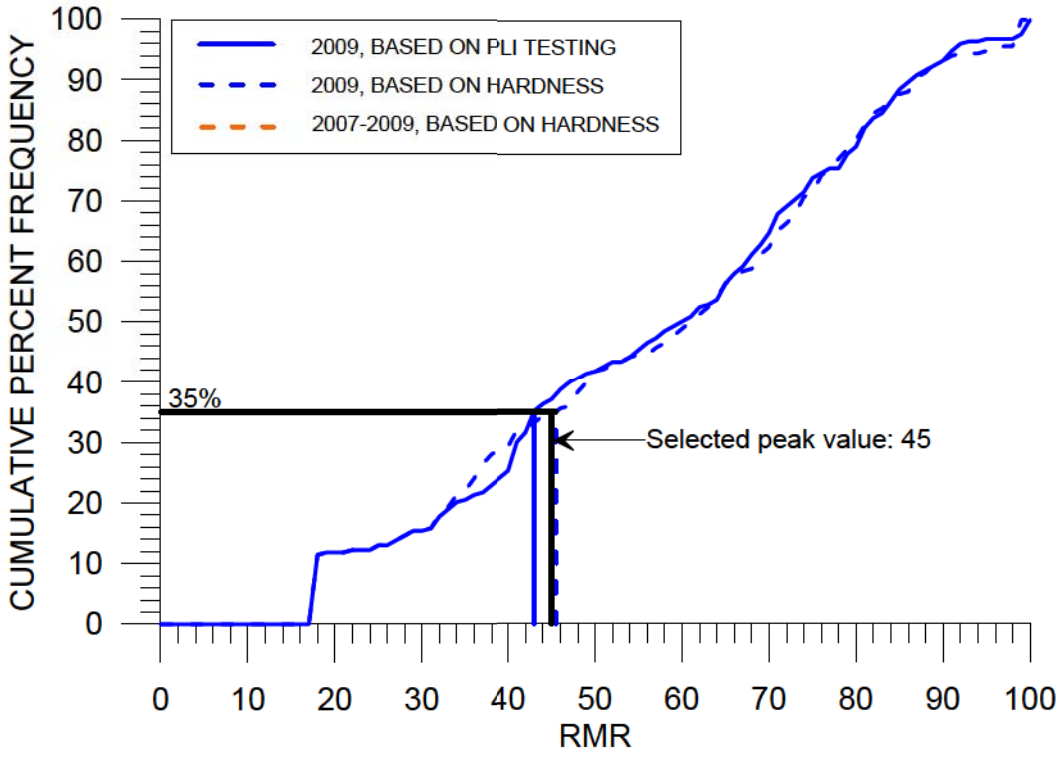
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

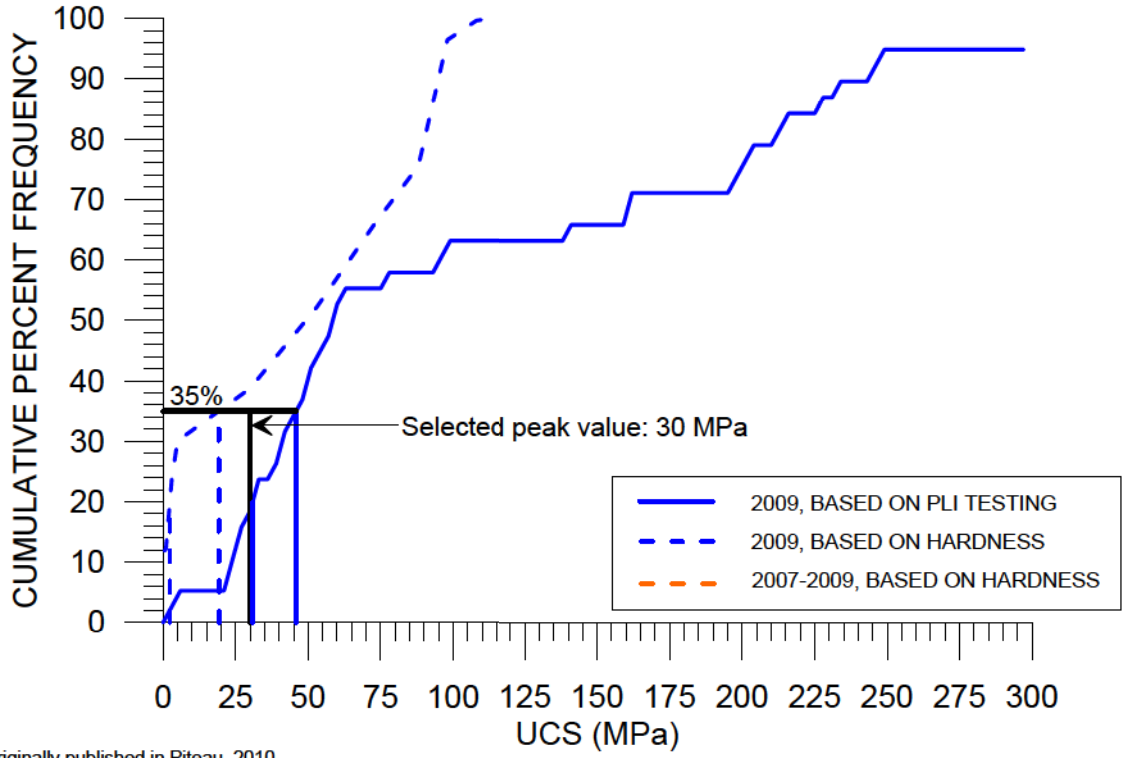
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR IRON FORMATION (IF), WEST STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C1

H:\Project\1846\2015-08 P1 Offload review\Geomech\CFA assessments for back analysis\C02-Rock Mass CFA - IF_S2_figure.grf





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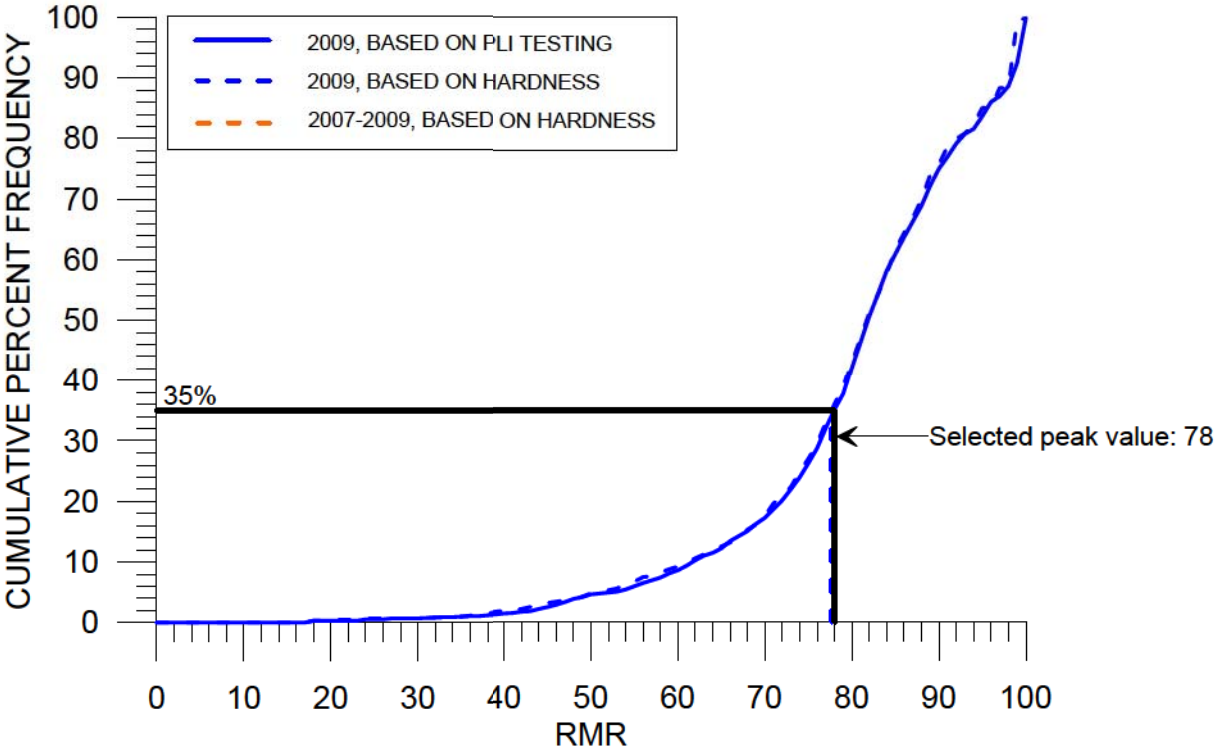
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

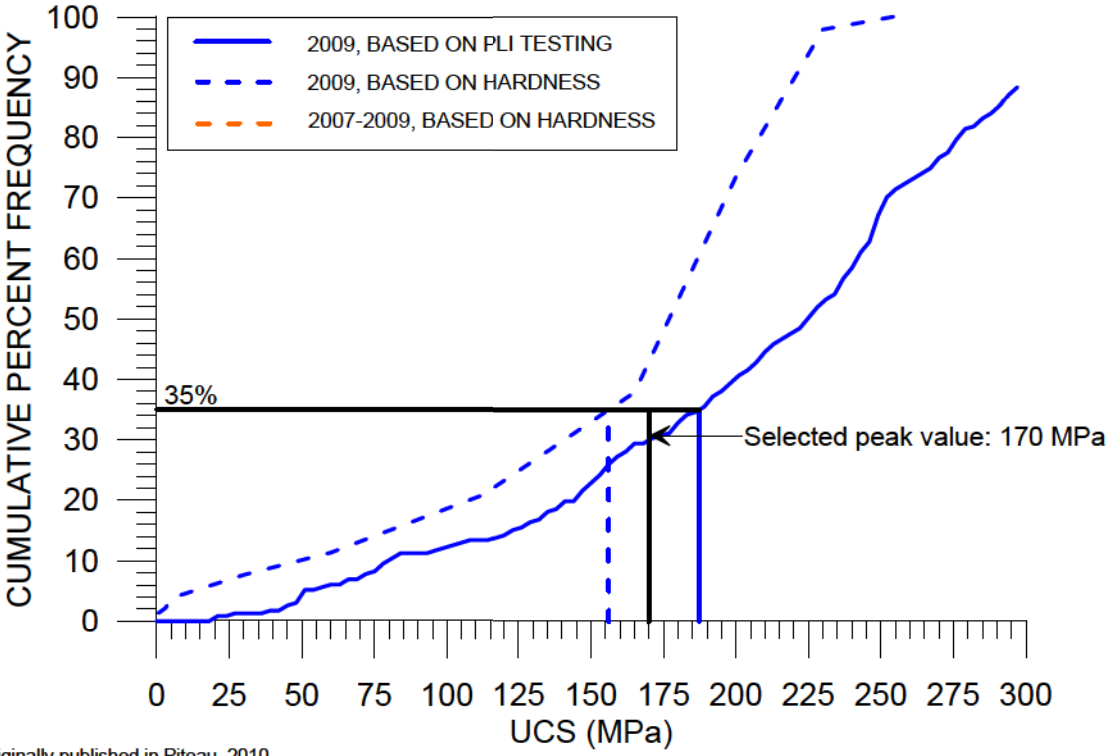
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR IRON FORMATION (IF), TOWER CUT STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C2

H:\Project\1846\2015-08 P1 Offload review\Geomech\CFA assessments for back analysis\C03-Rock Mass CFA - IF_S2_figure.grf





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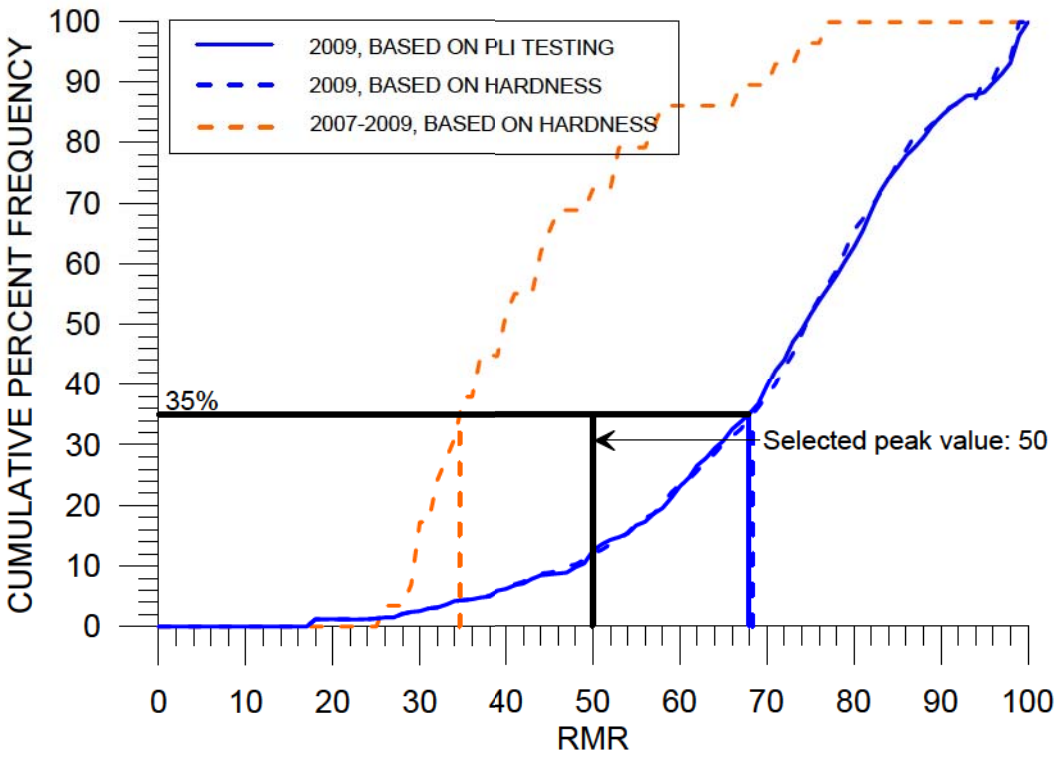
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

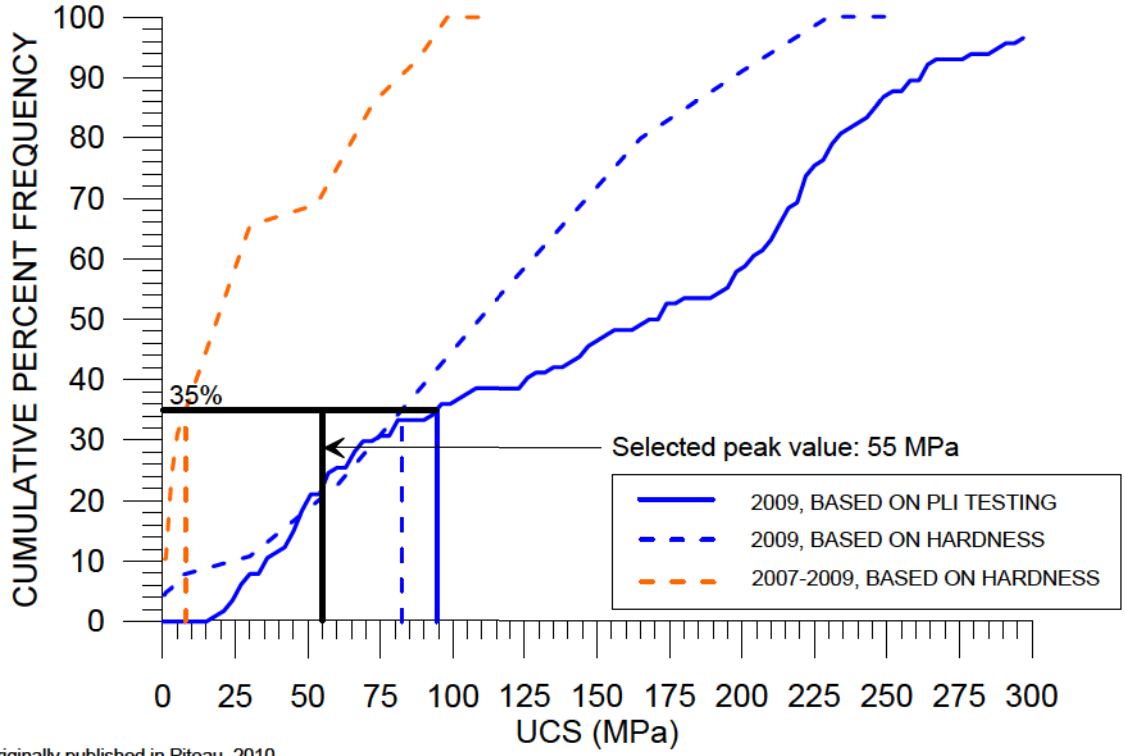
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR IRON FORMATION (IF), CENTRAL STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C3

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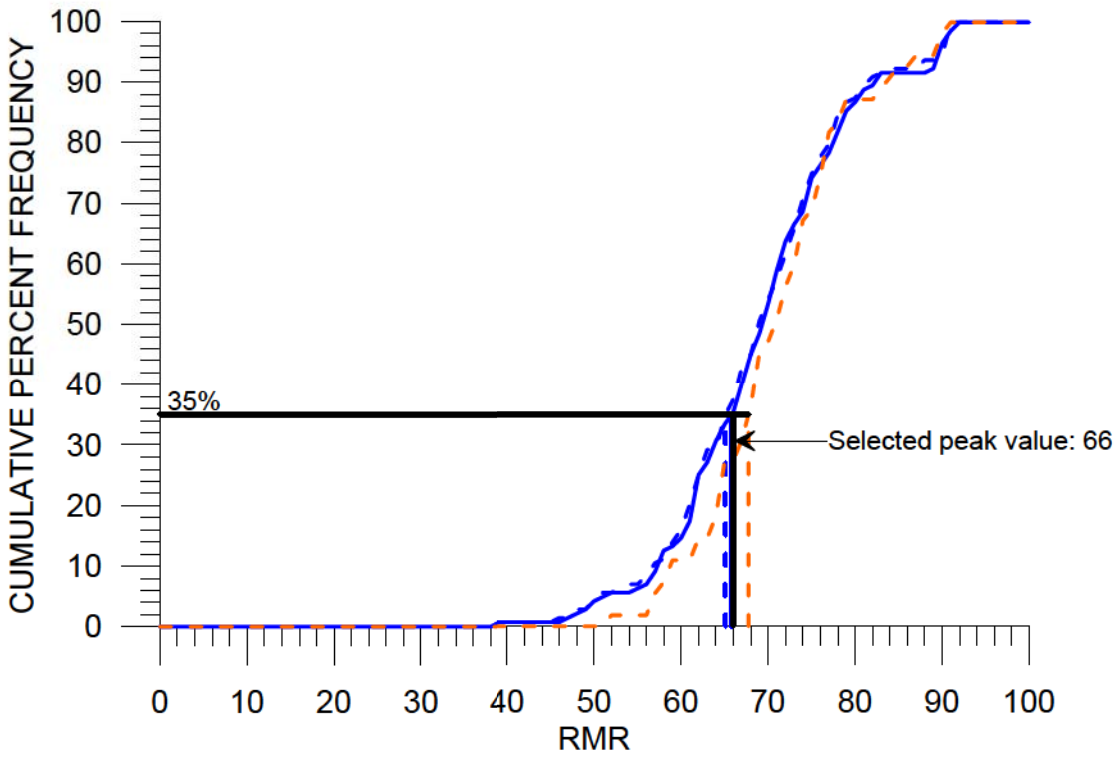
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

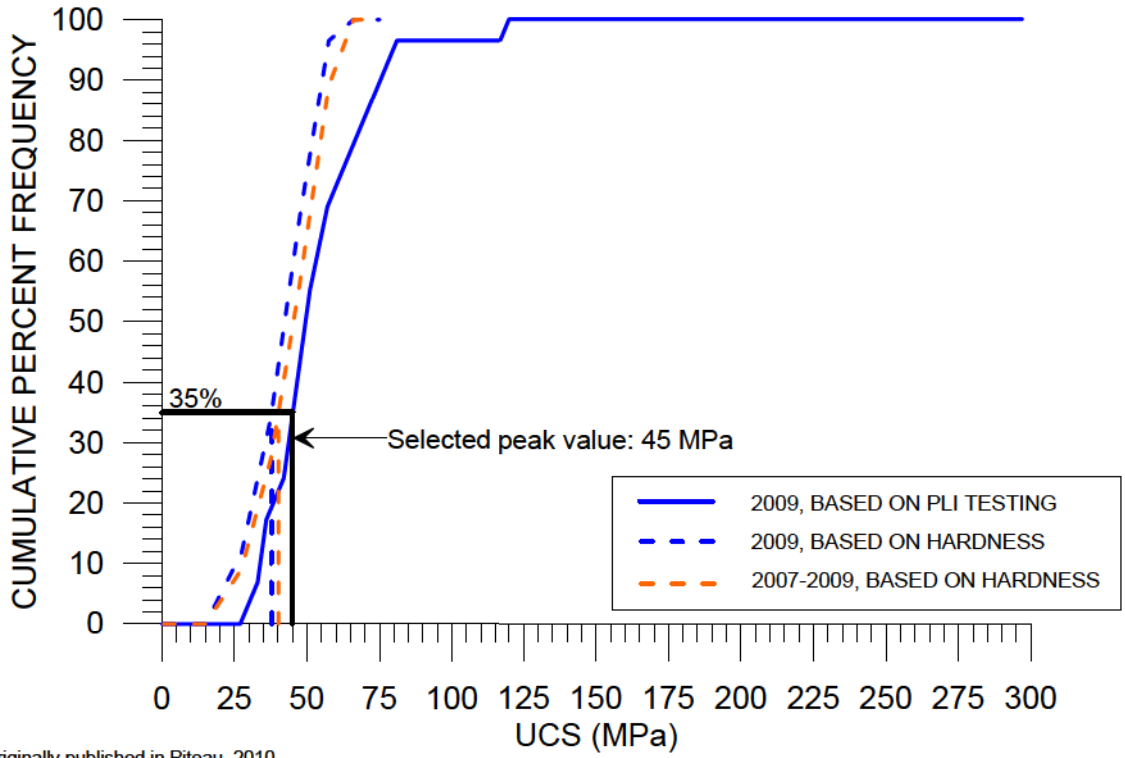
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR IRON FORMATION (IF), EAST STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C4

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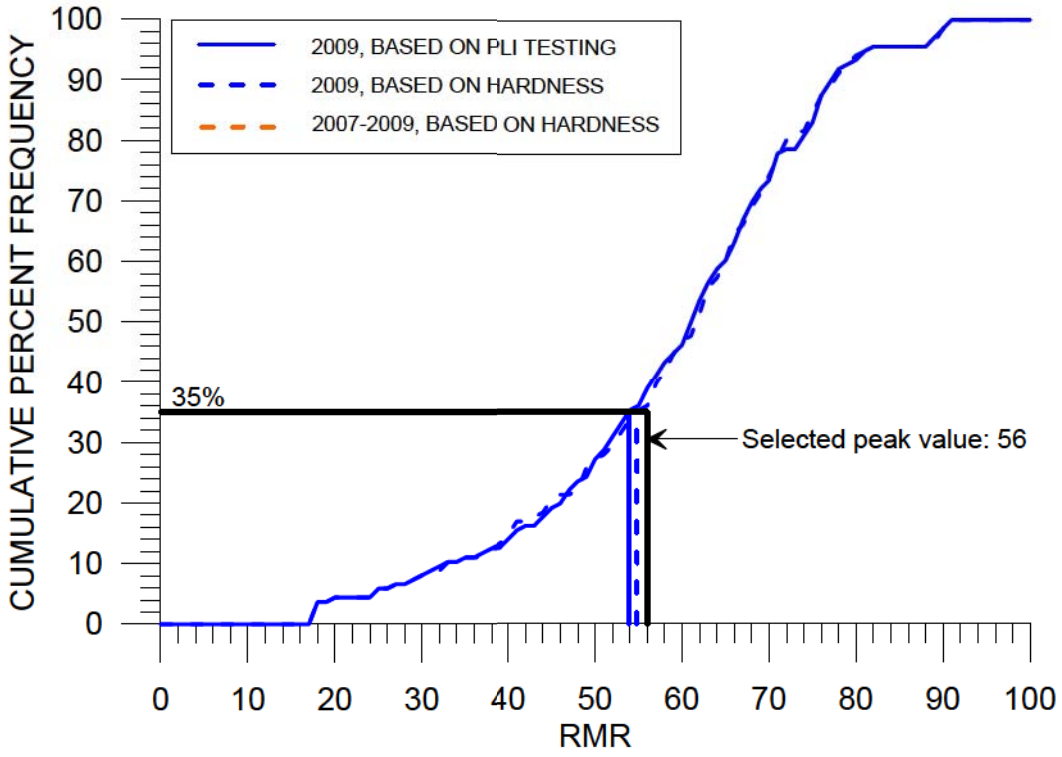
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

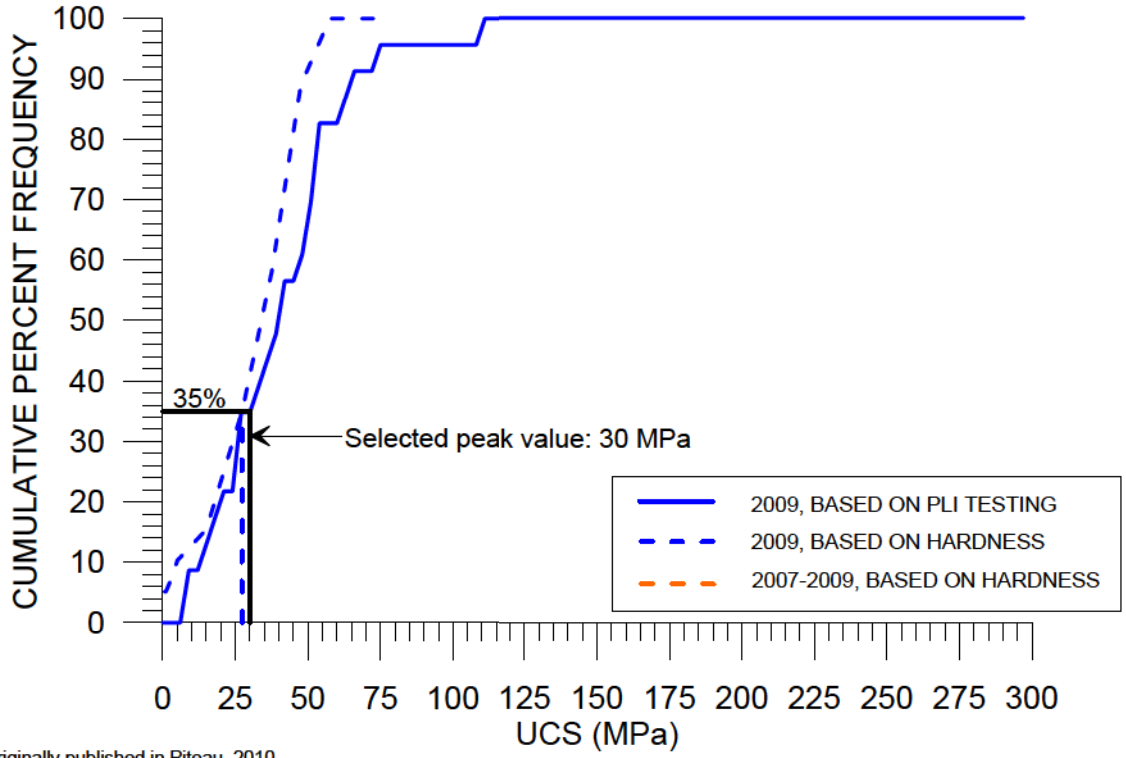
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZ ROCK MICA SCHIST (QRMS), WEST STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C5

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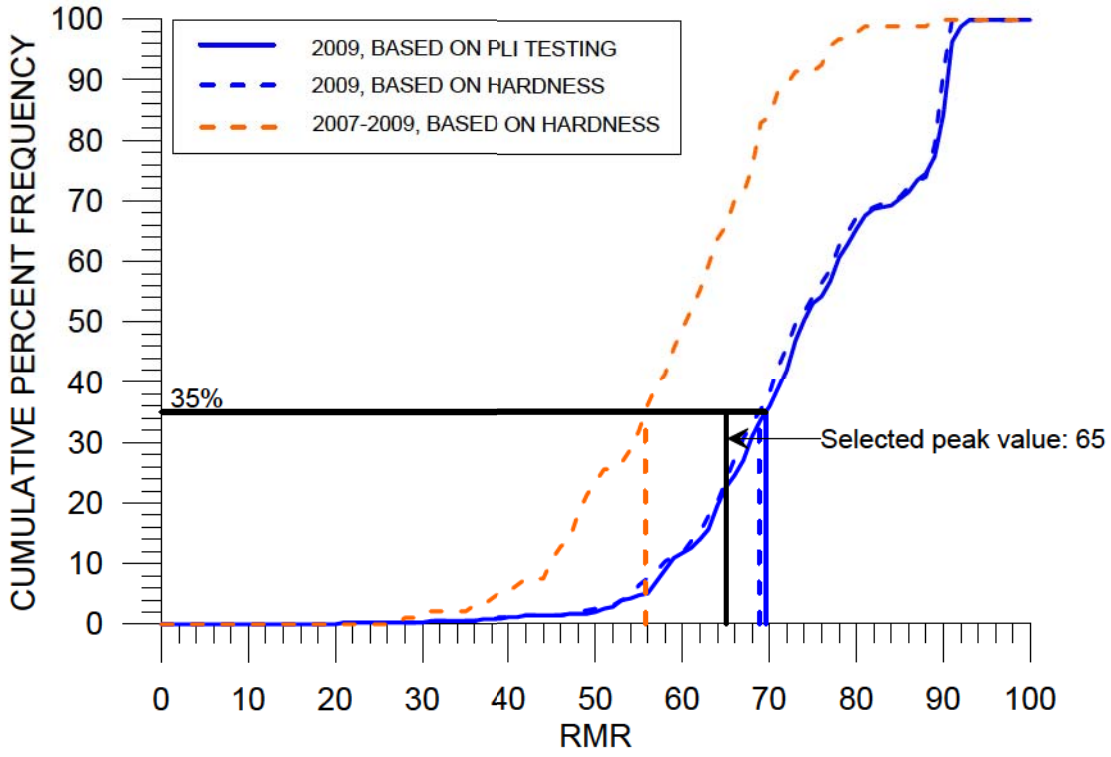
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

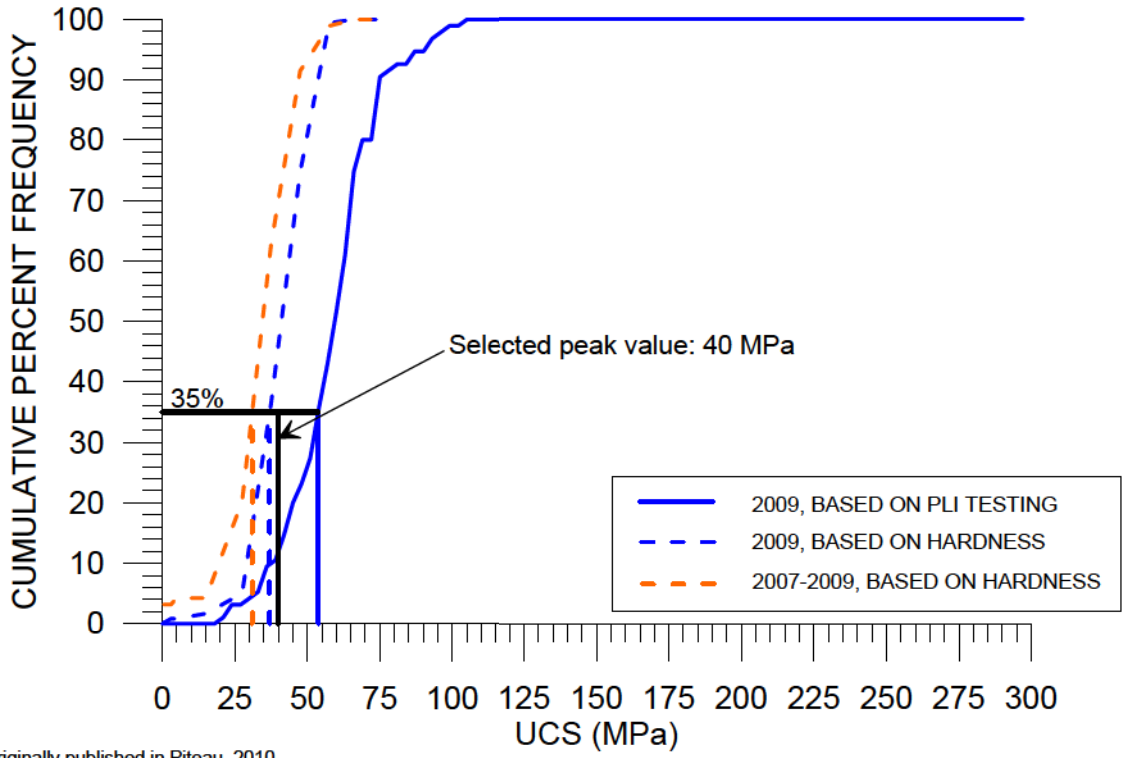
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZ ROCK MICA SCHIST (QRMS), TOWER CUT STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C6

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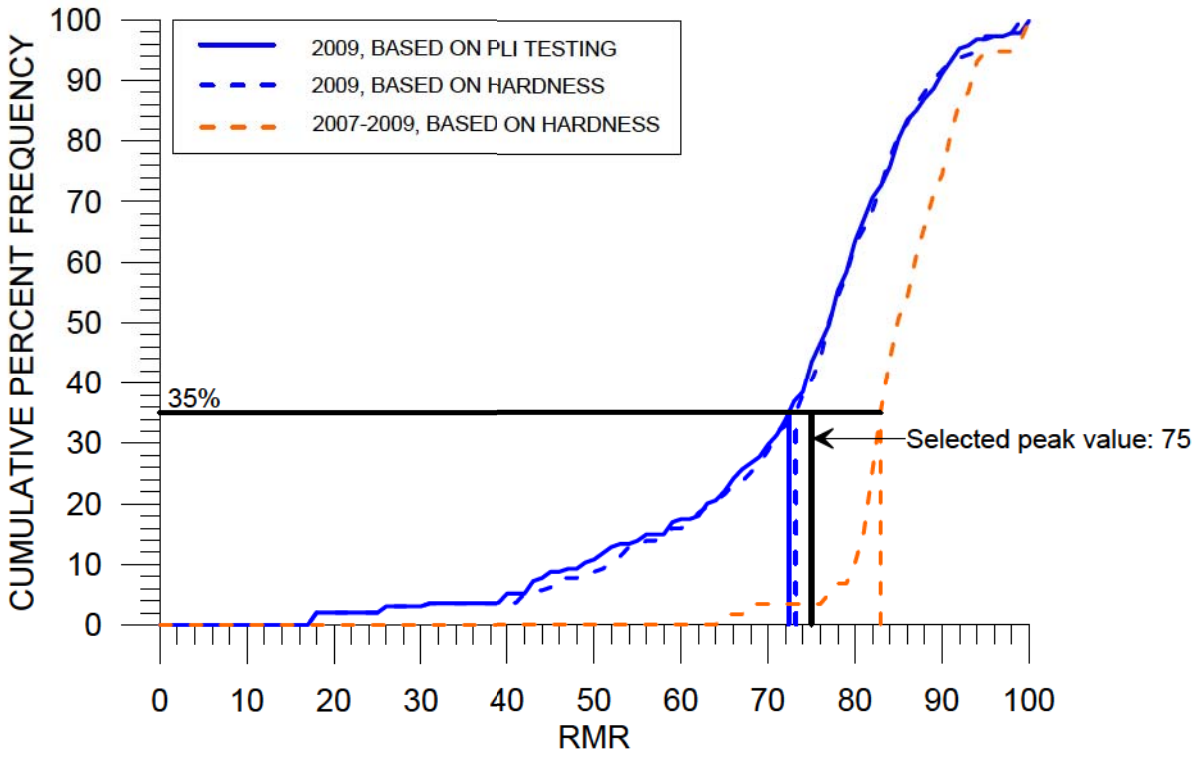
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

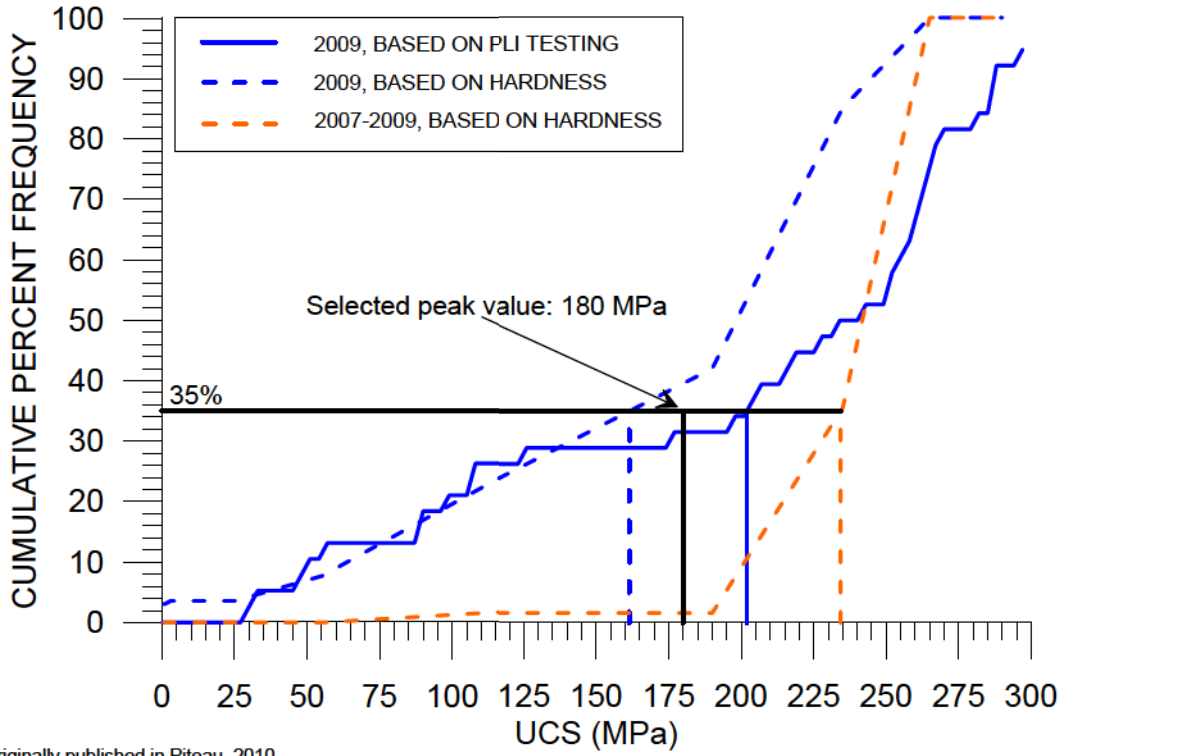
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZ ROCK MICA SCHIST (QRMS), EAST STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C7

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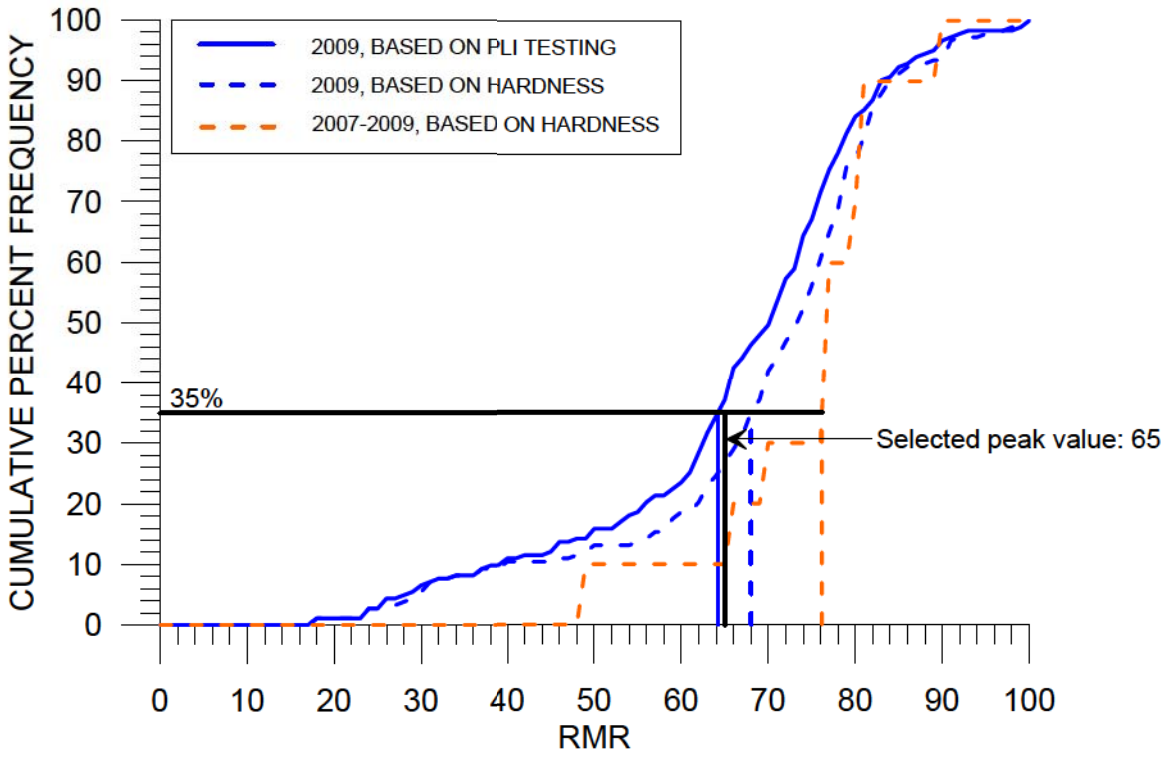
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

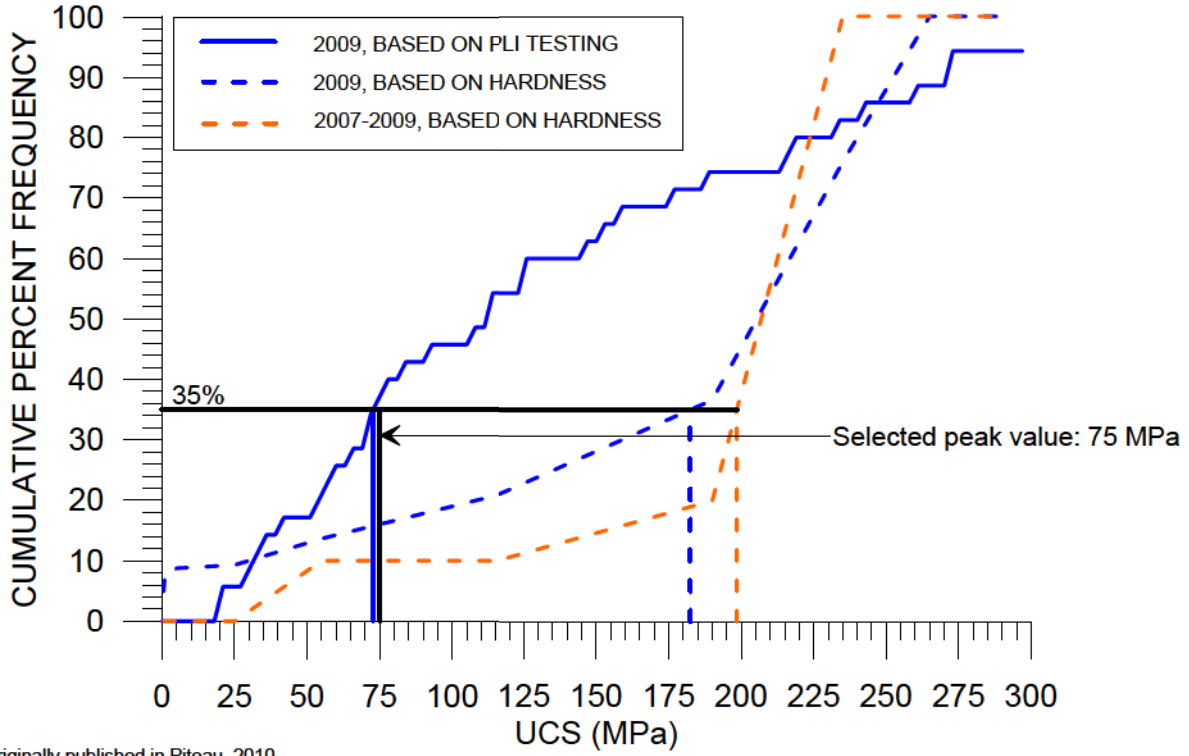
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZITE (QR-1), WEST STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C8

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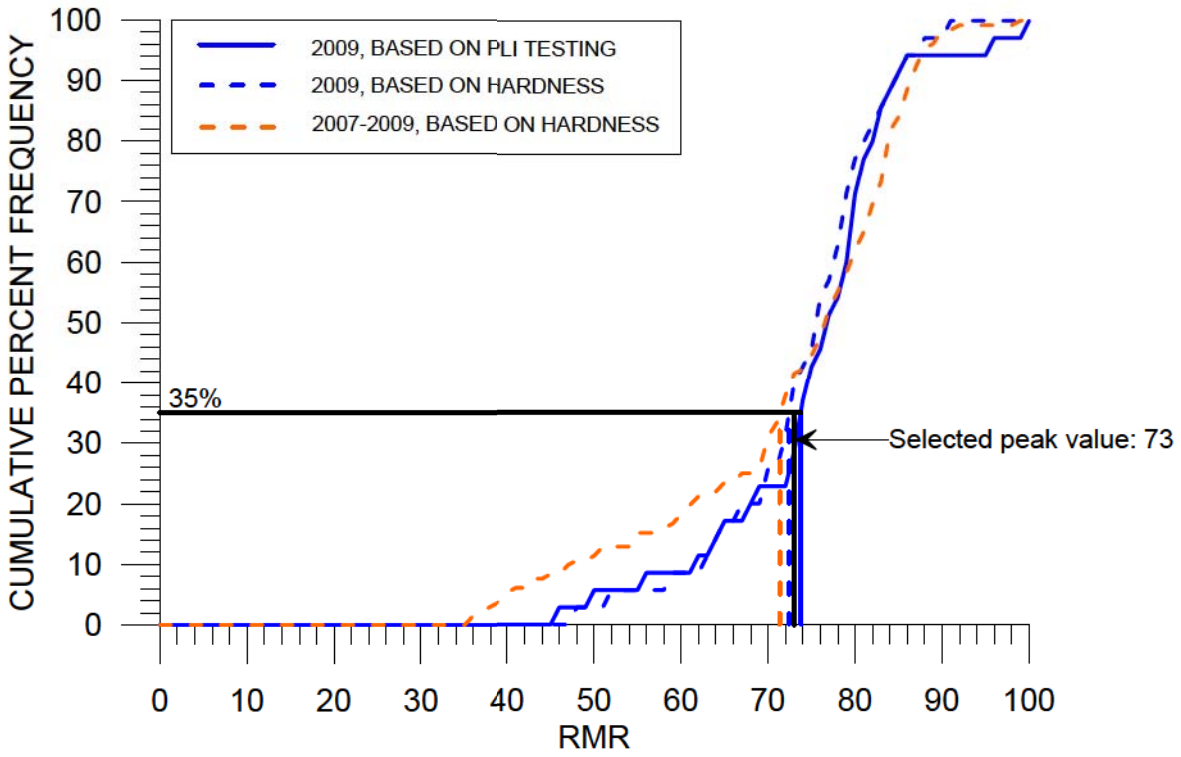
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

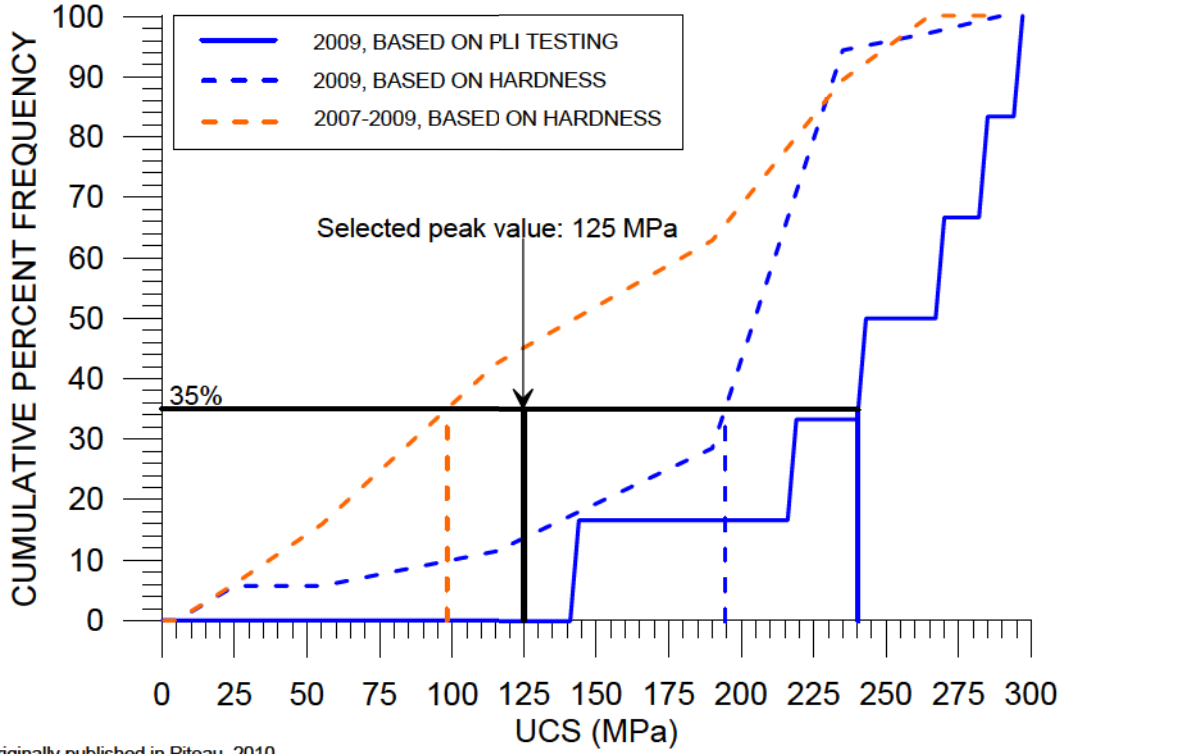
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZITE (QR-1), TOWER CUT STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C9

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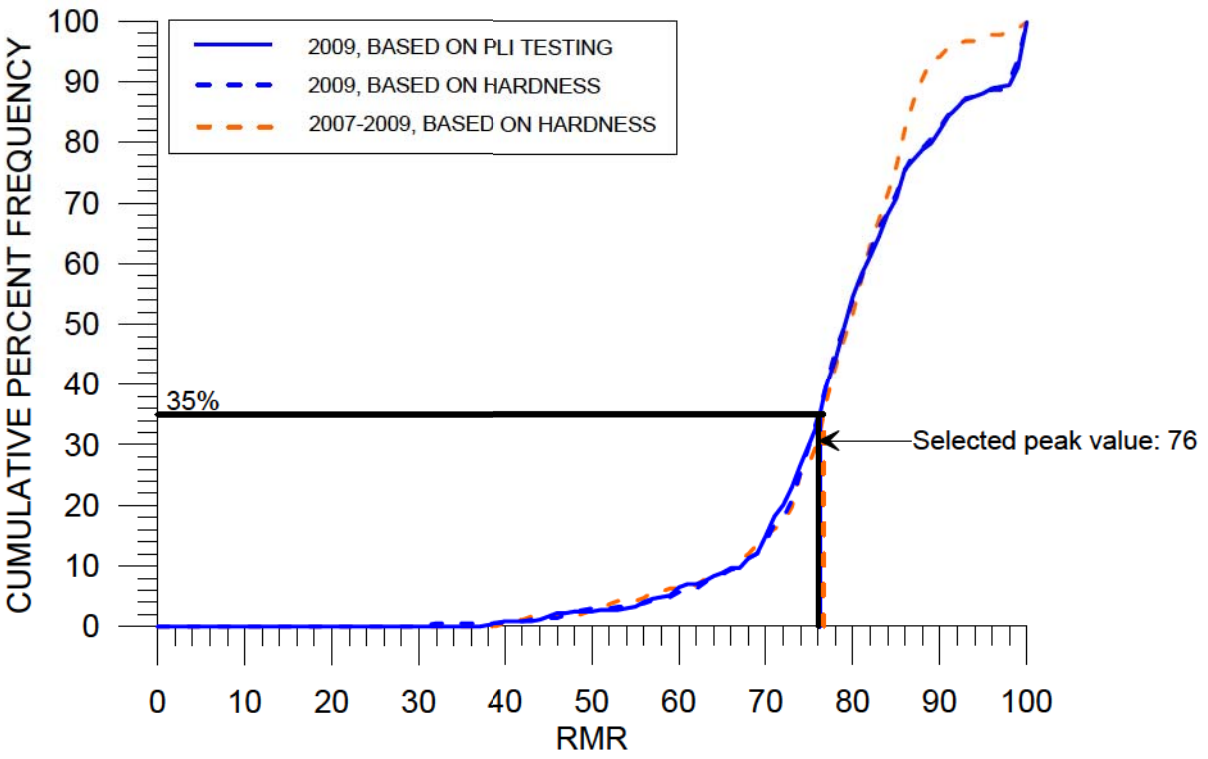
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

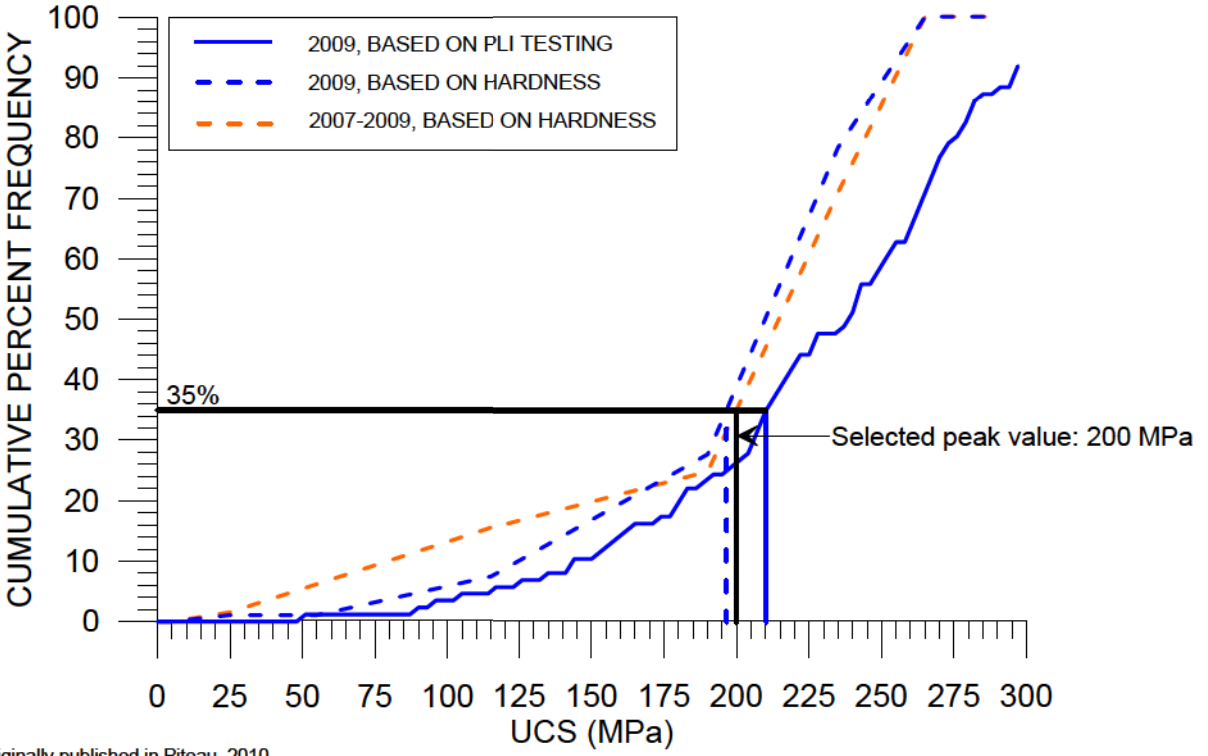
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZITE (QR-1), EAST STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C10

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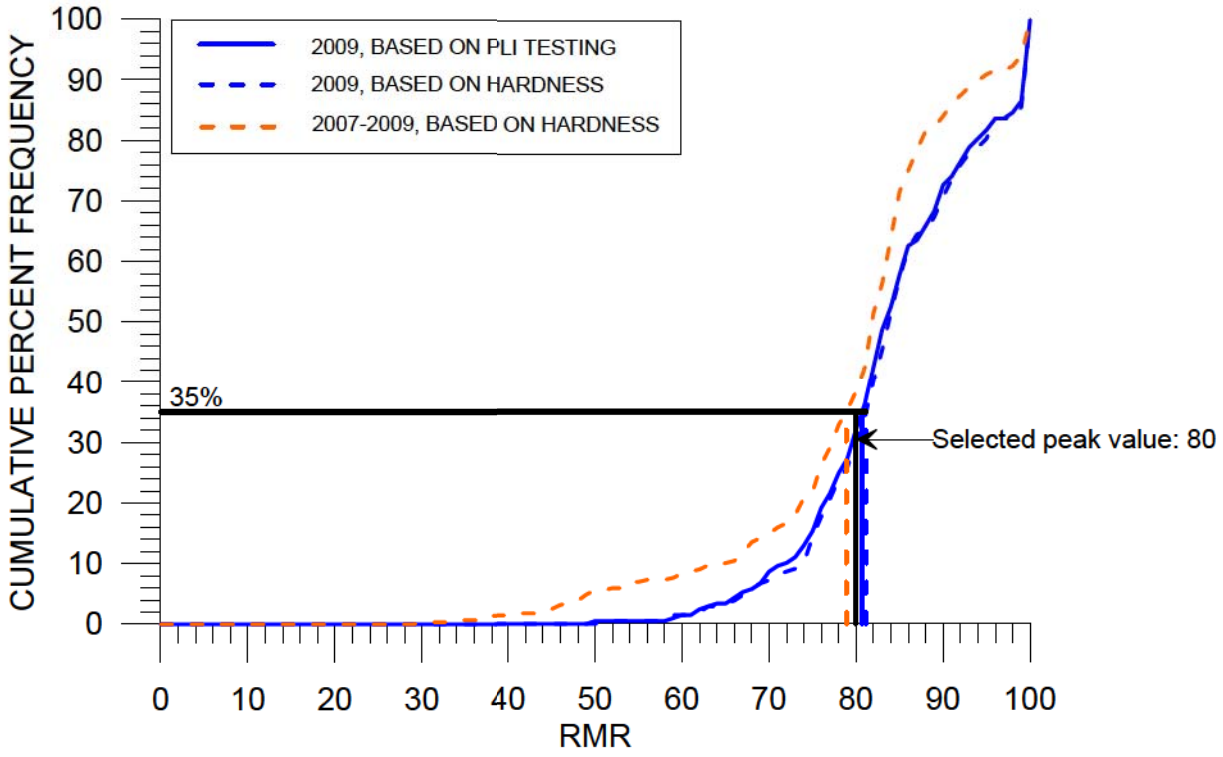
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

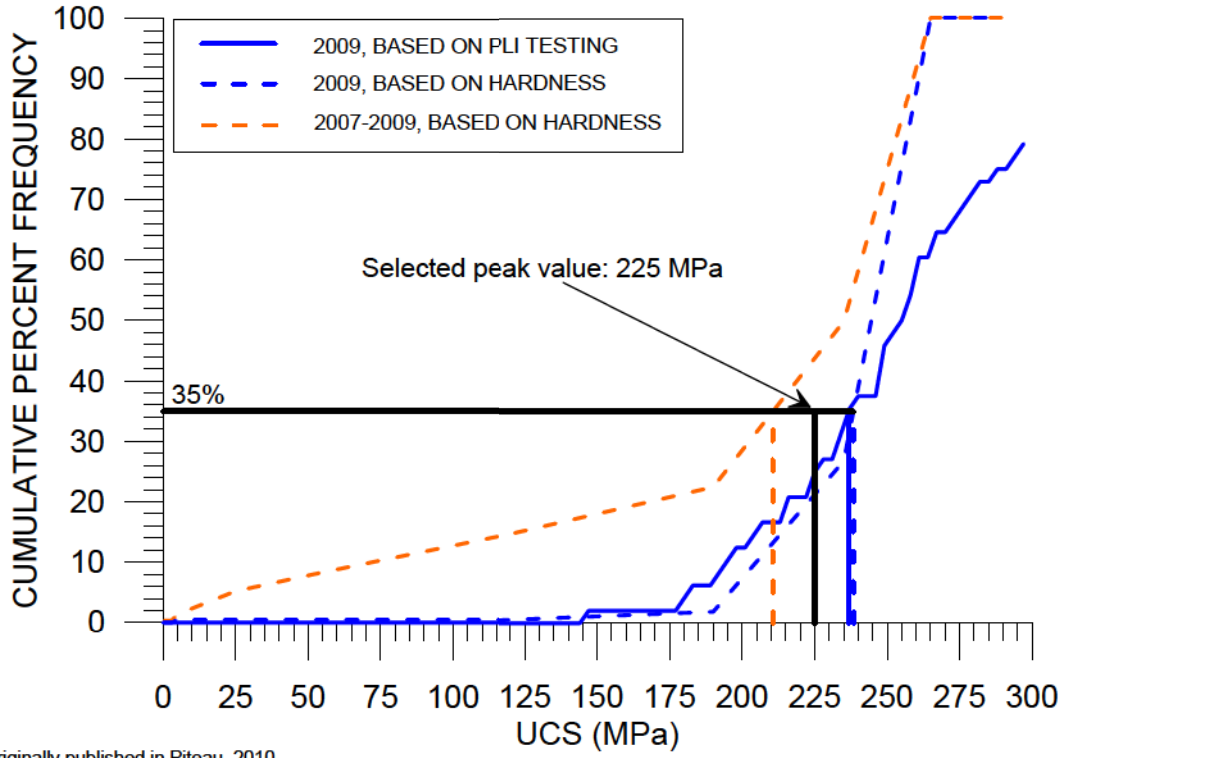
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZITE (QR-2)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C11

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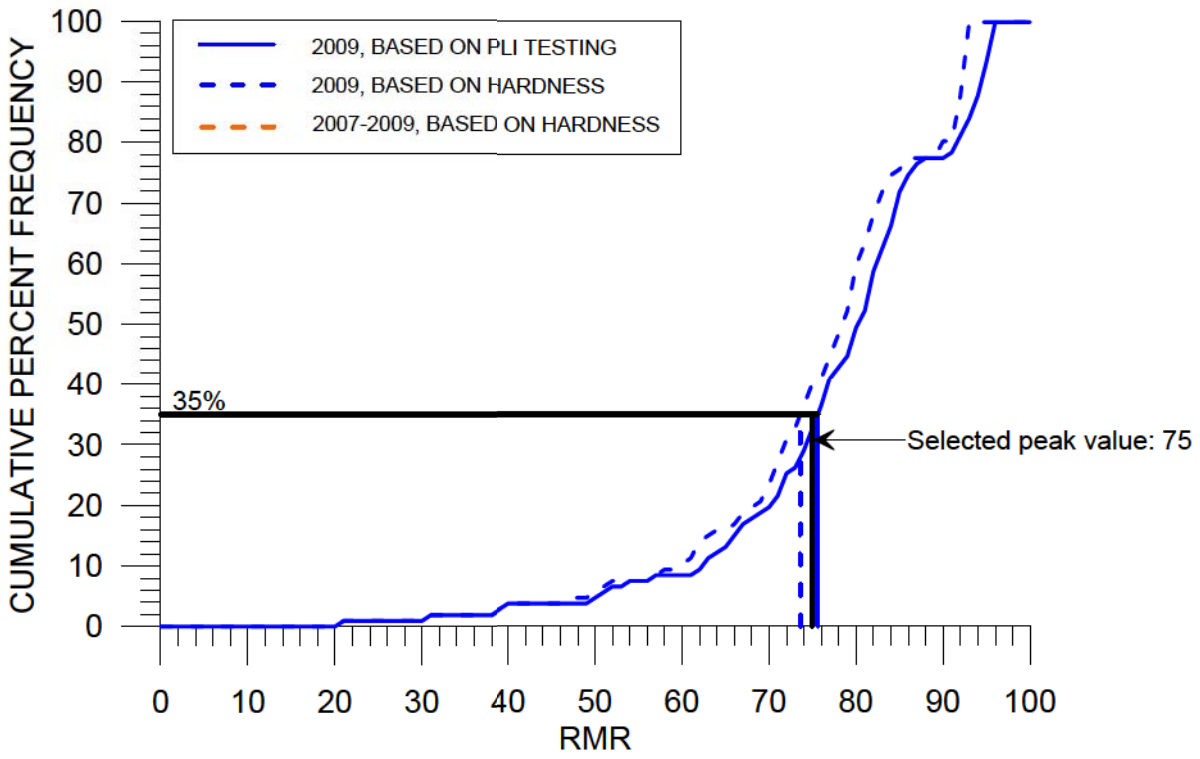
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

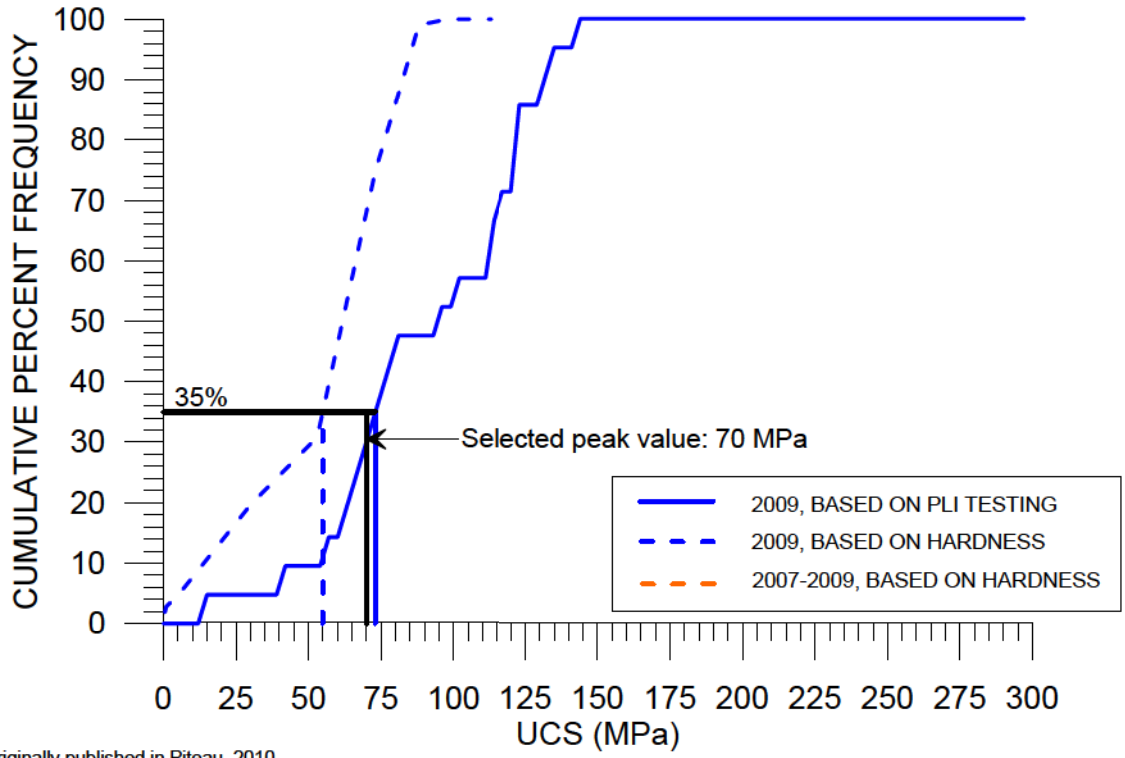
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZITE (QR-3)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C12

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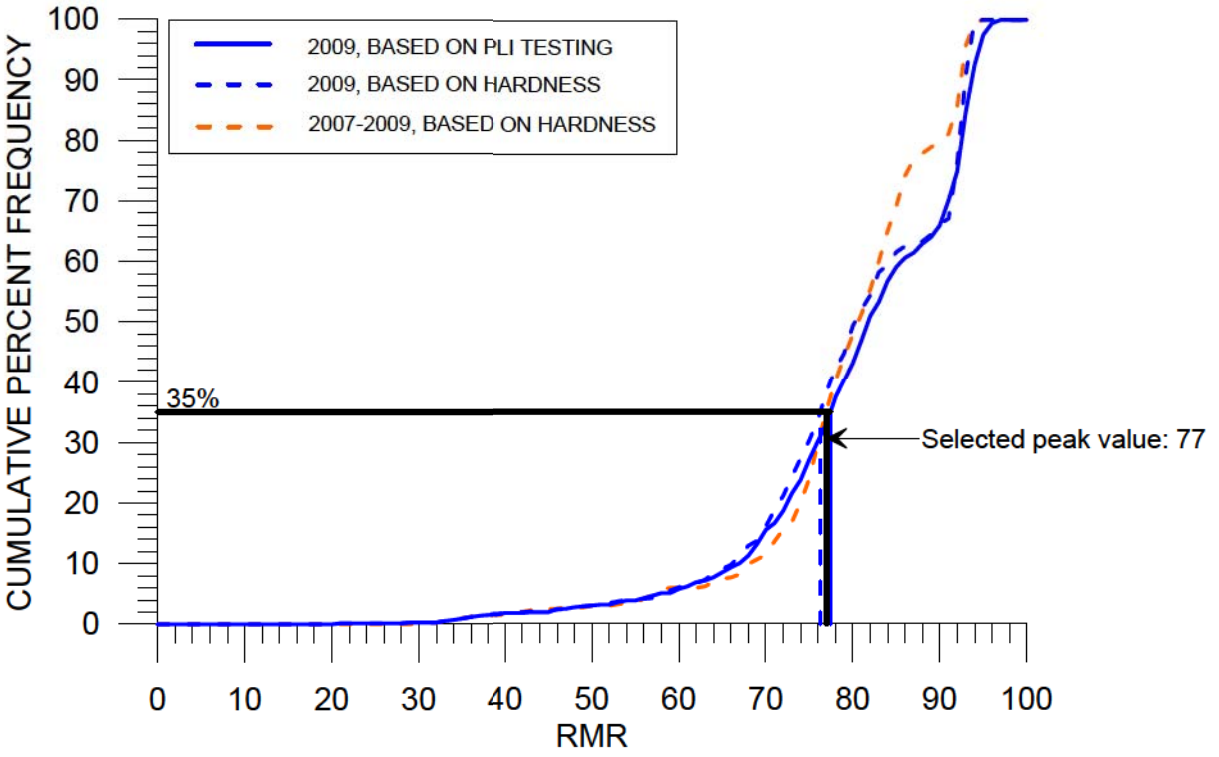
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MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

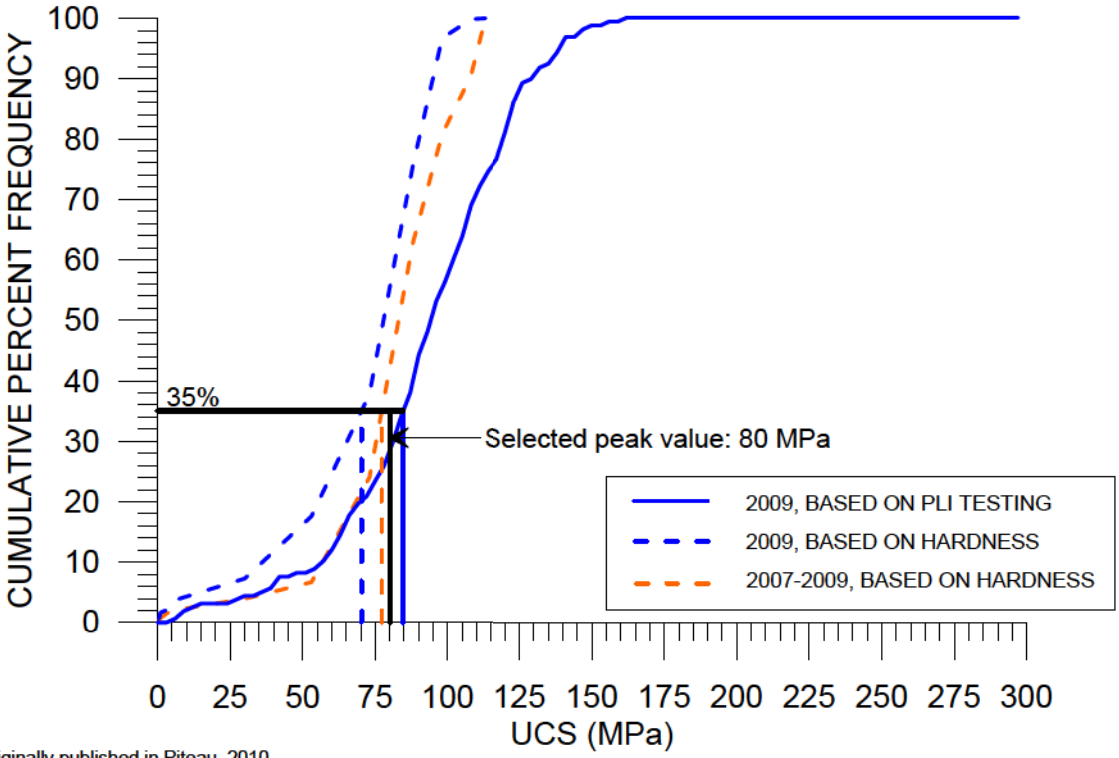
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR AMPHIBOLITE (AMP-1), WEST STRENGTH ZONE

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C13

H:\Project\1846\2015-08 P1 Offload review\Geomech\CFA assessments for back analysis\C14-Rock Mass CFA - AMP2_figure.grf





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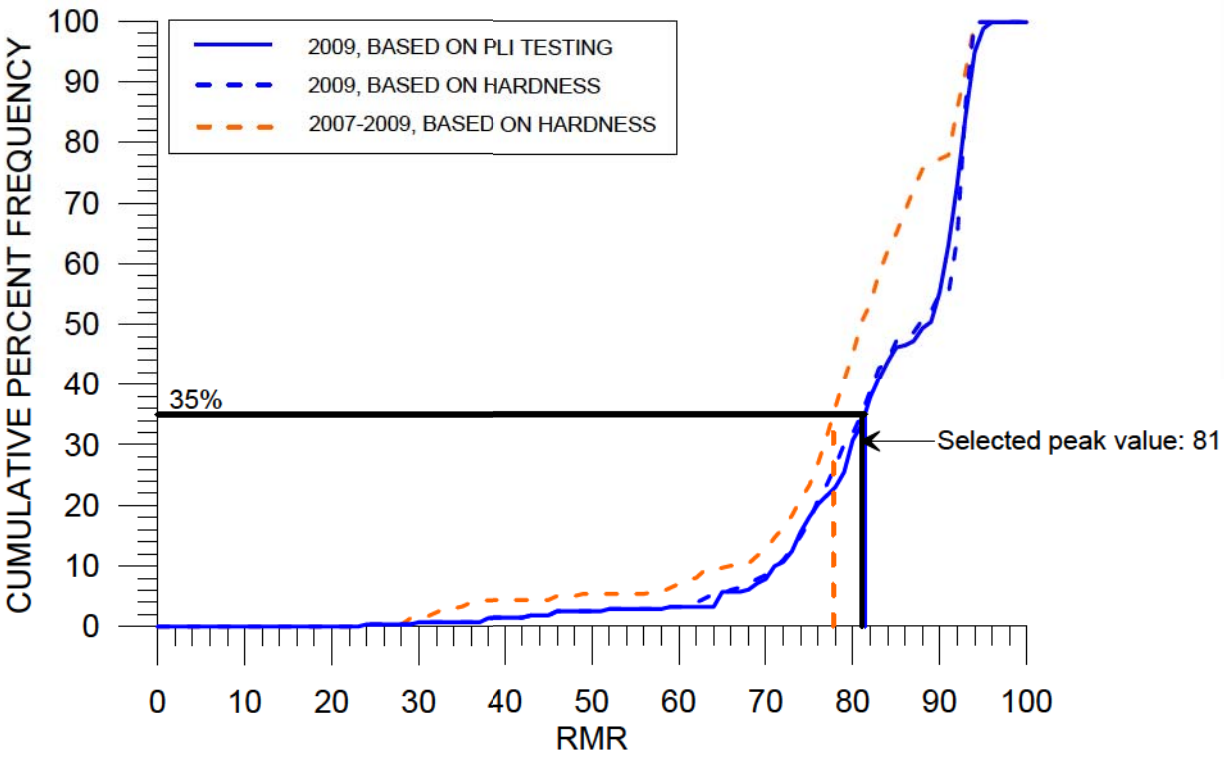
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

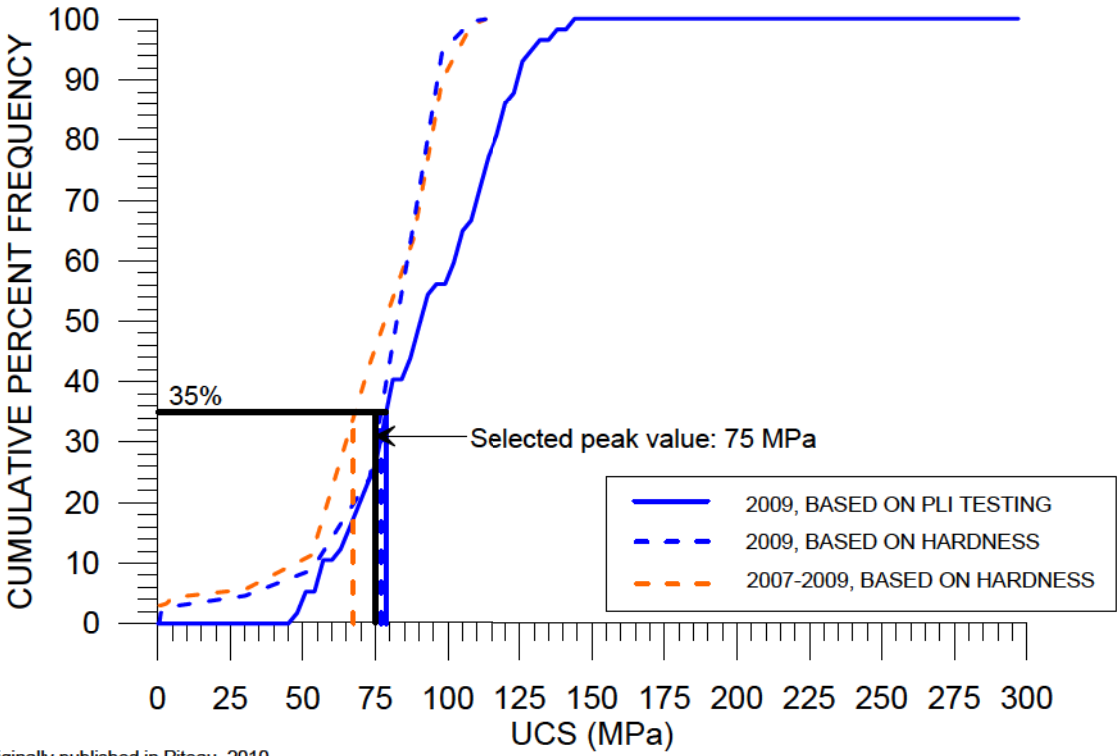
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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR AMPHIBOLITE (AMP-2)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C14

H:\Project\1846\2015-08 P1 Offload review\Geomech\CFA assessments for back analysis\C15-Rock Mass CFA - AMP3_figure.grf





NOTE: Data originally published in Piteau, 2010.

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PAUL'S PEAK PIT
2015 SOUTH WALL PIT SLOPE ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR AMPHIBOLITE (AMP-3)

BY:	DATE:
RS	NOV 15
APPROVED:	FIG:
GG	C15

APPENDIX D

LIMIT EQUILIBRIUM STABILITY ANALYSIS RESULTS

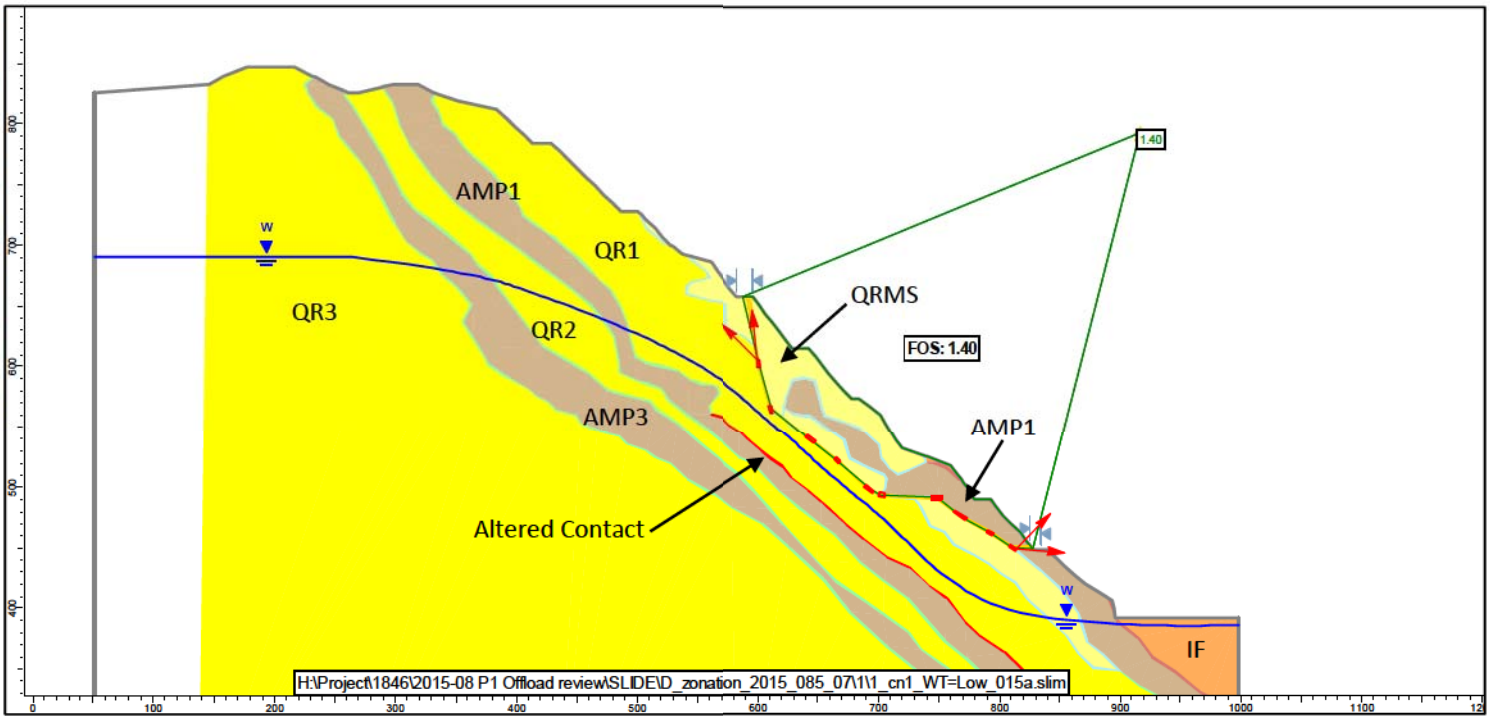


Fig. D1: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.40 between the 448 and 658m levels.

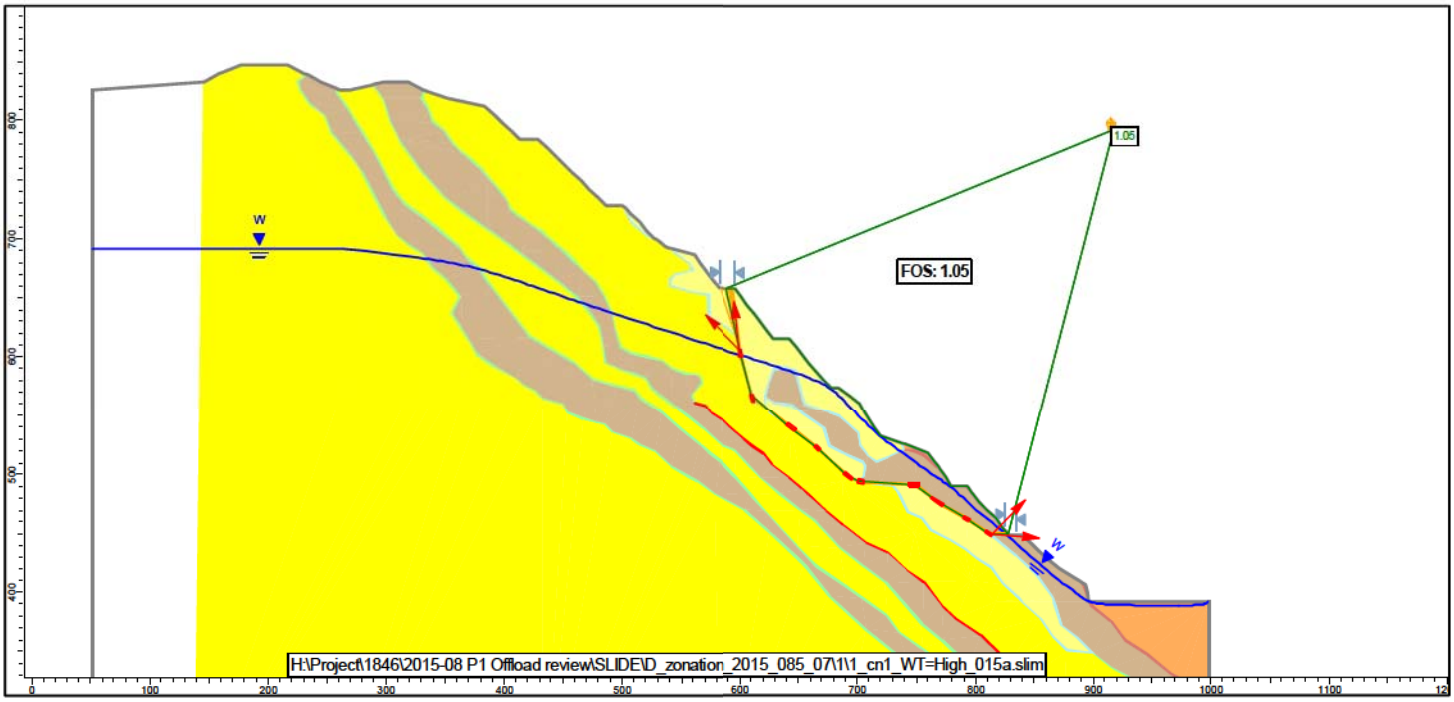


Fig. D2: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.05 between the 448 and 658m levels.

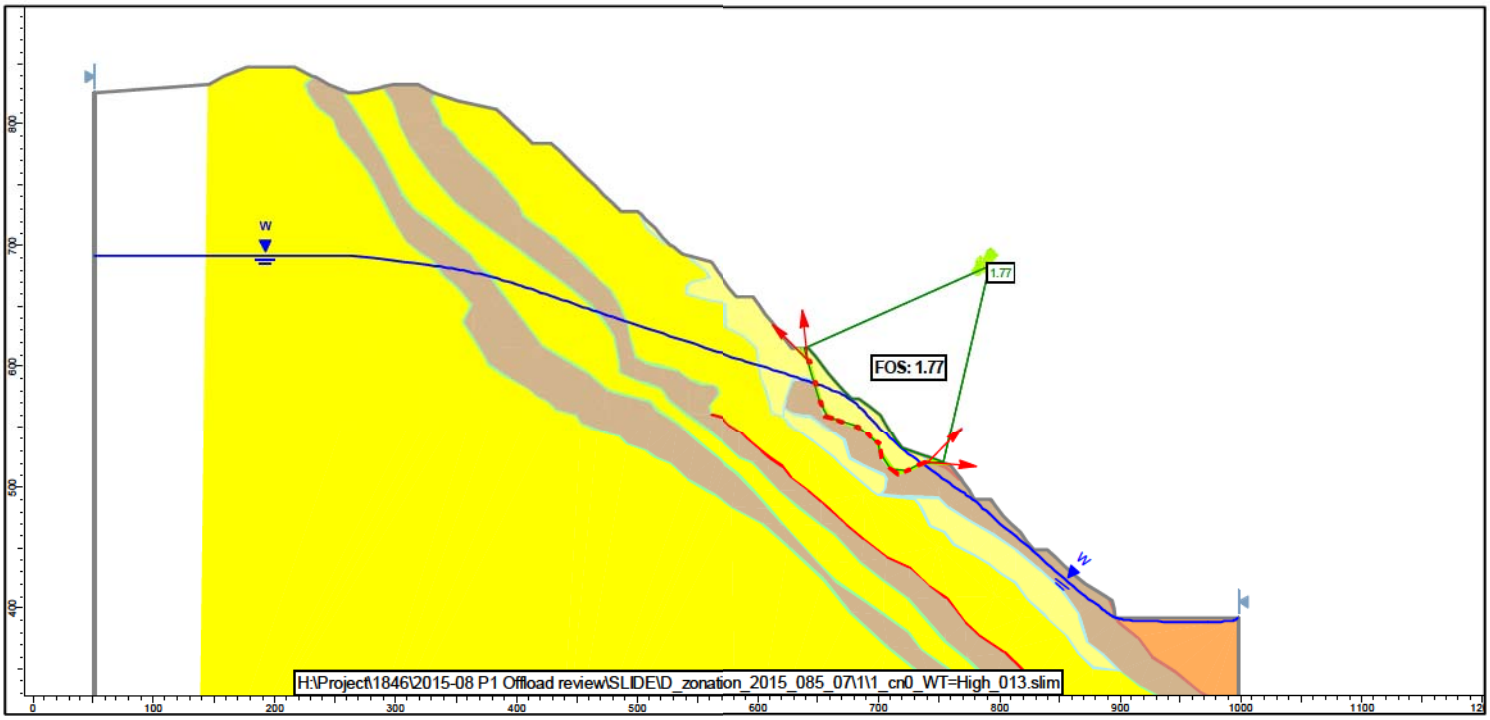


Fig. D3: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.77 between the 518 and 616m levels.

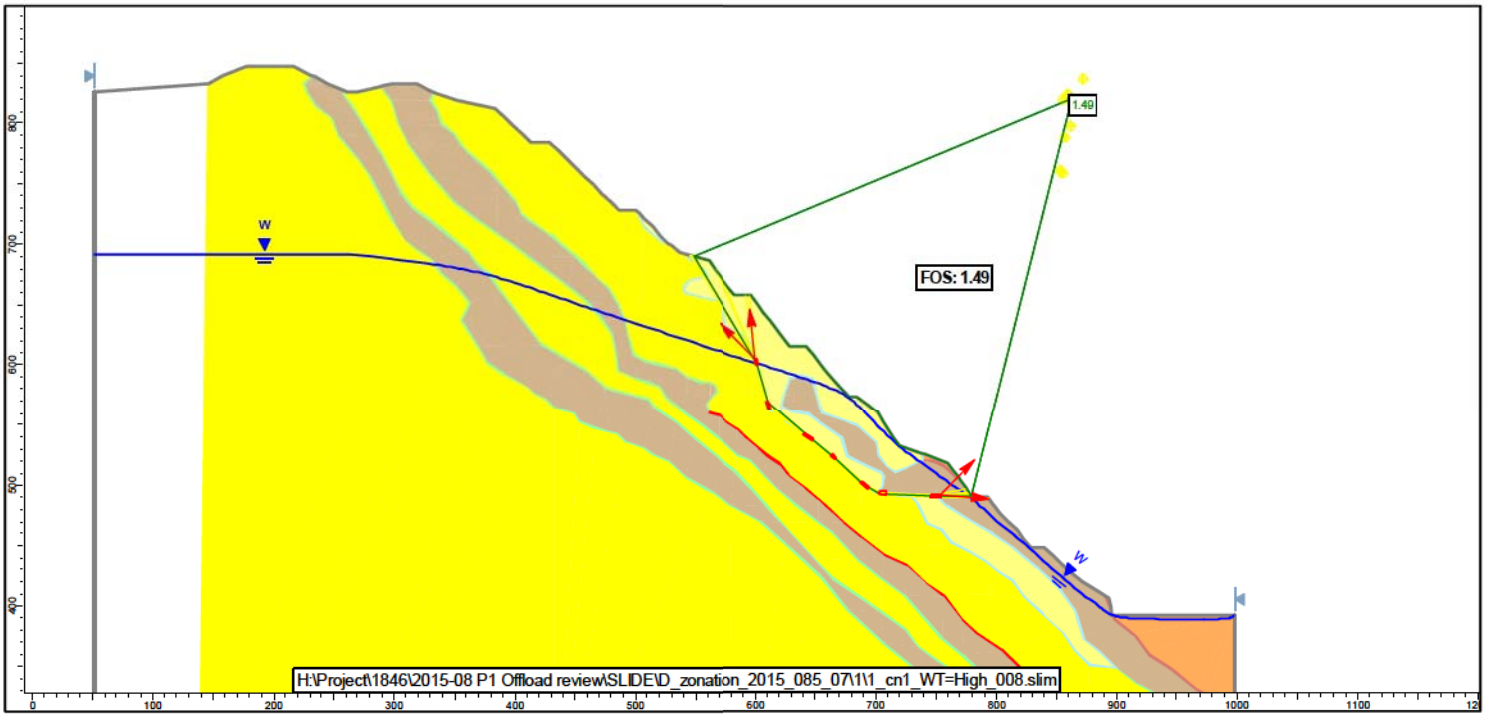


Fig. D4: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.49 between the 490 and 686m levels.

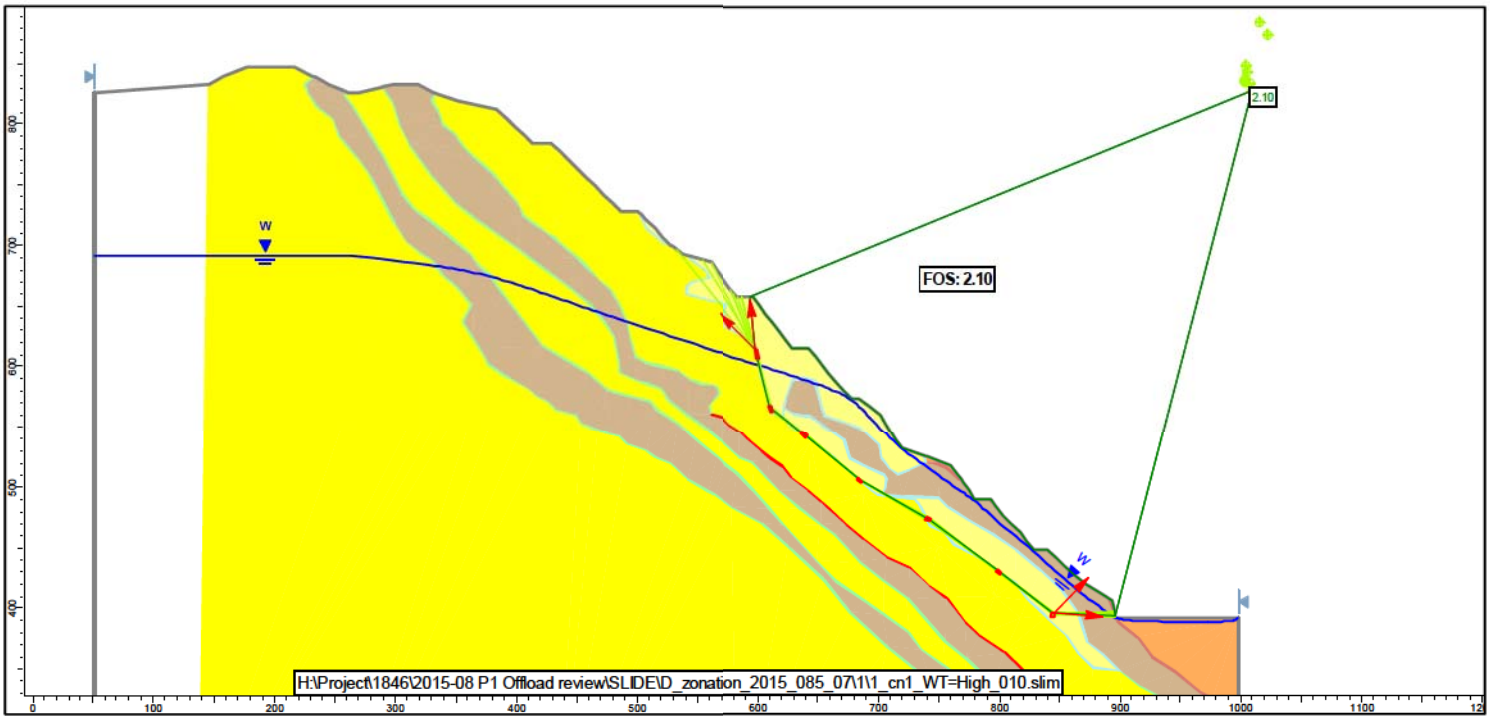


Fig. D5: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.10 between the 392 and 658m levels.

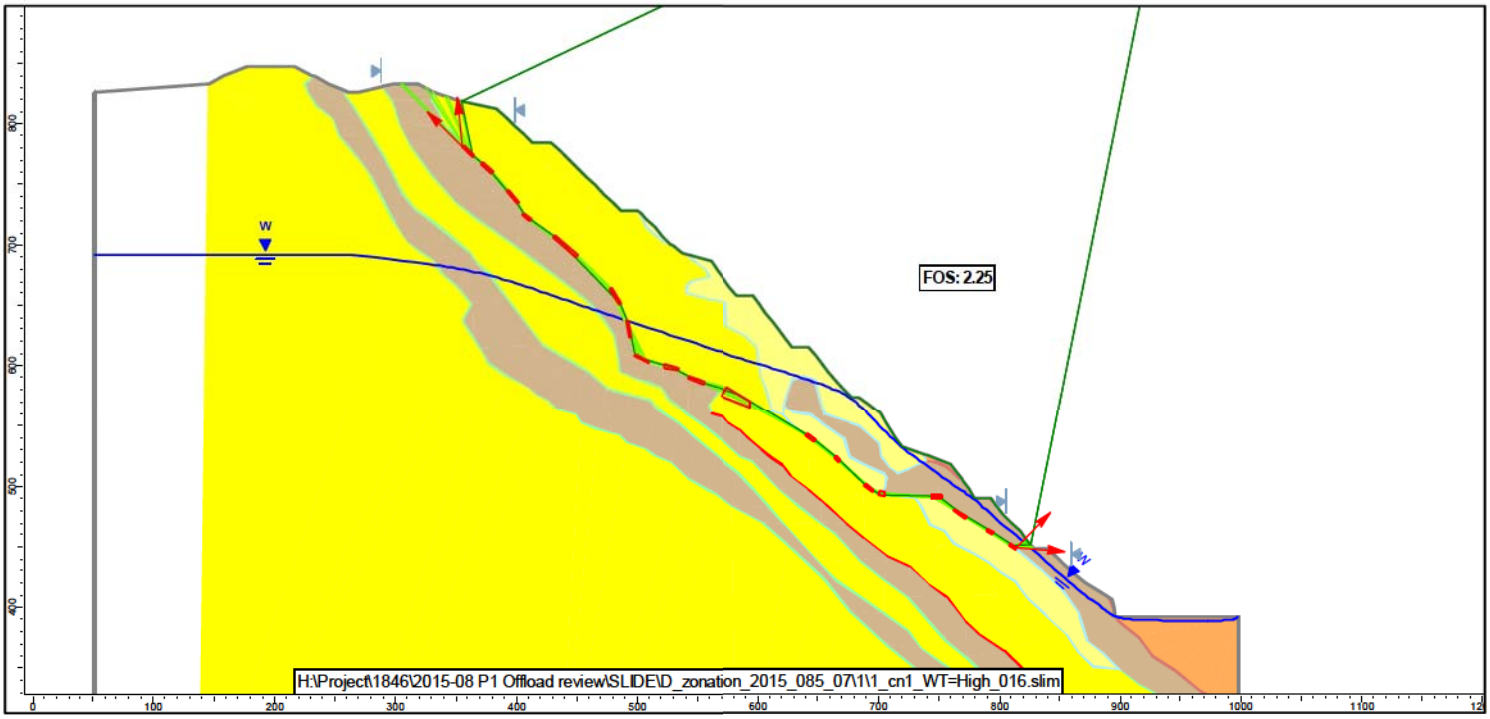


Fig. D6: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.25 between the 448 and 819m levels.

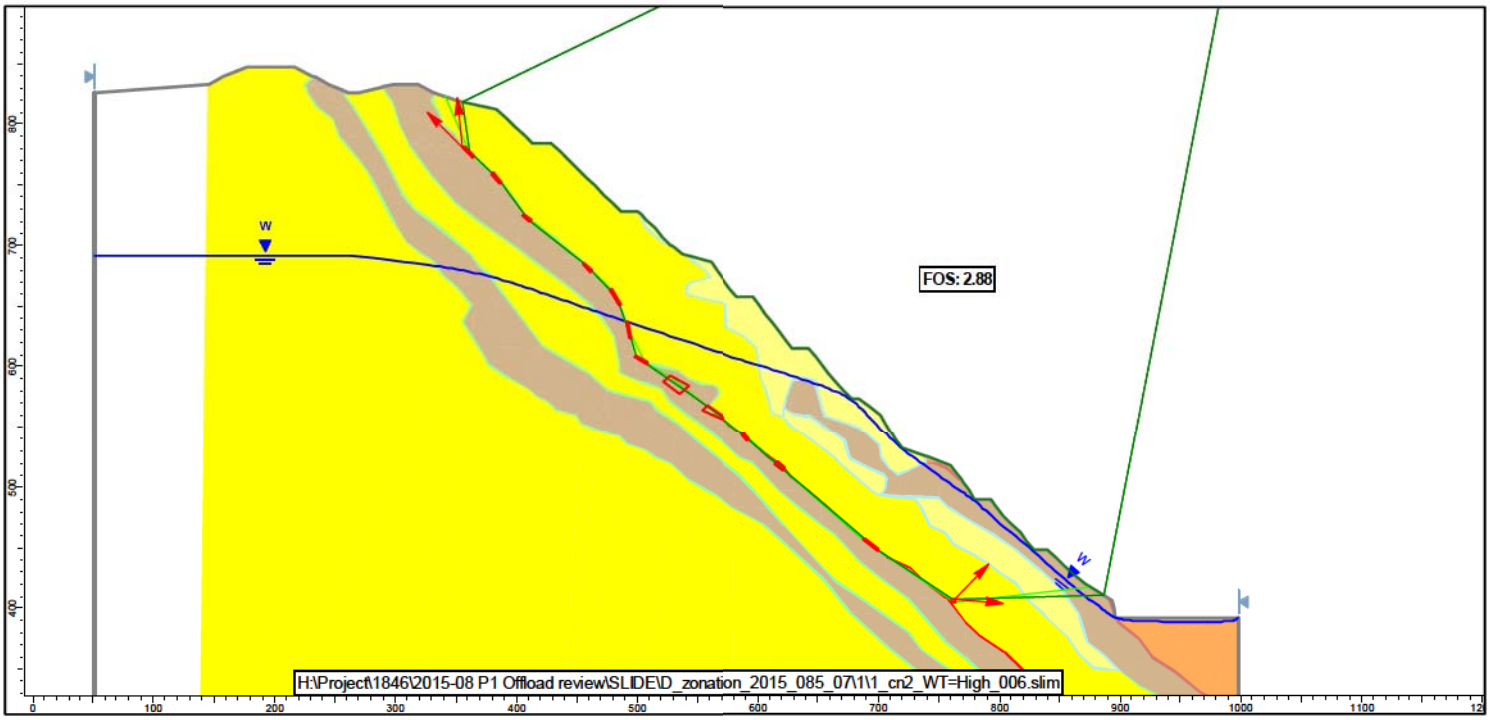


Fig. D7: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.88 between the 406 and 819m levels.

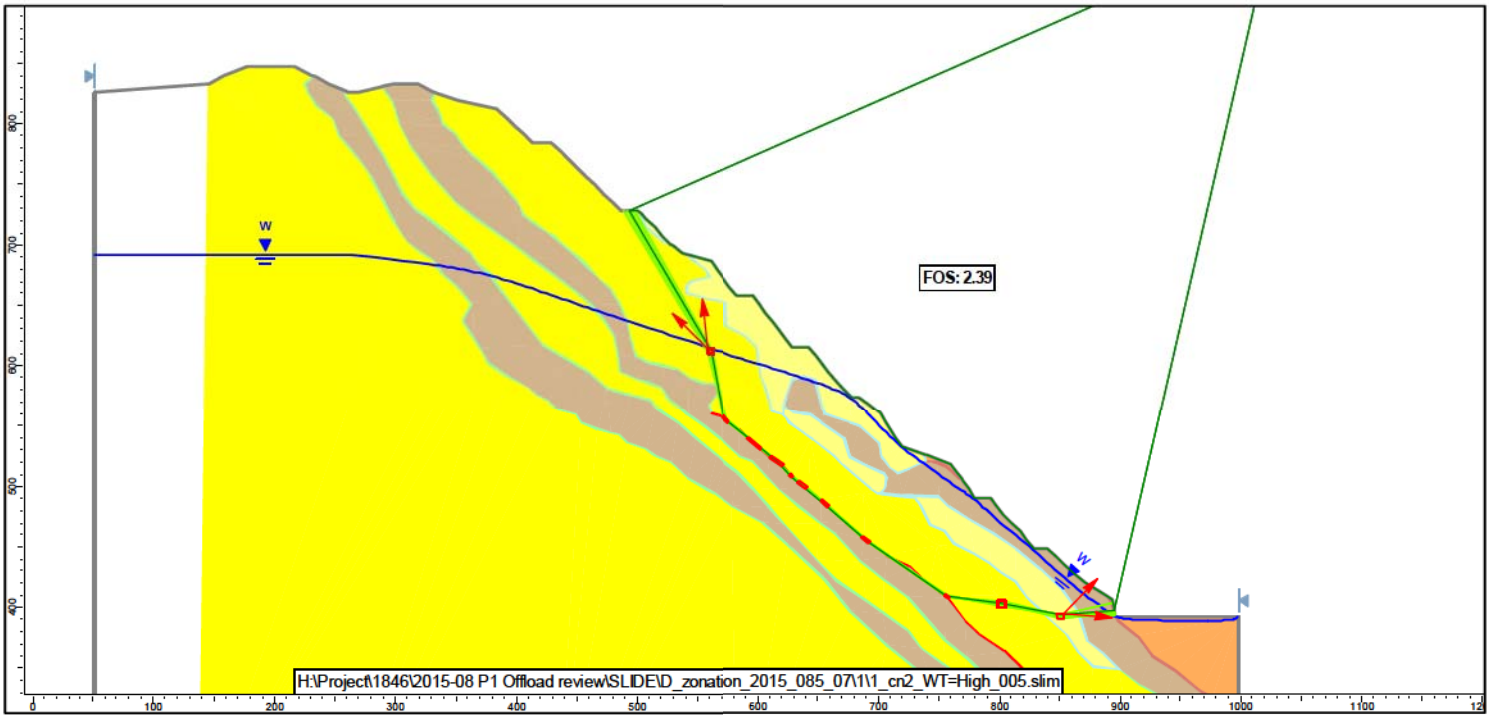


Fig. D8: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.39 between the 392 and 728m levels.

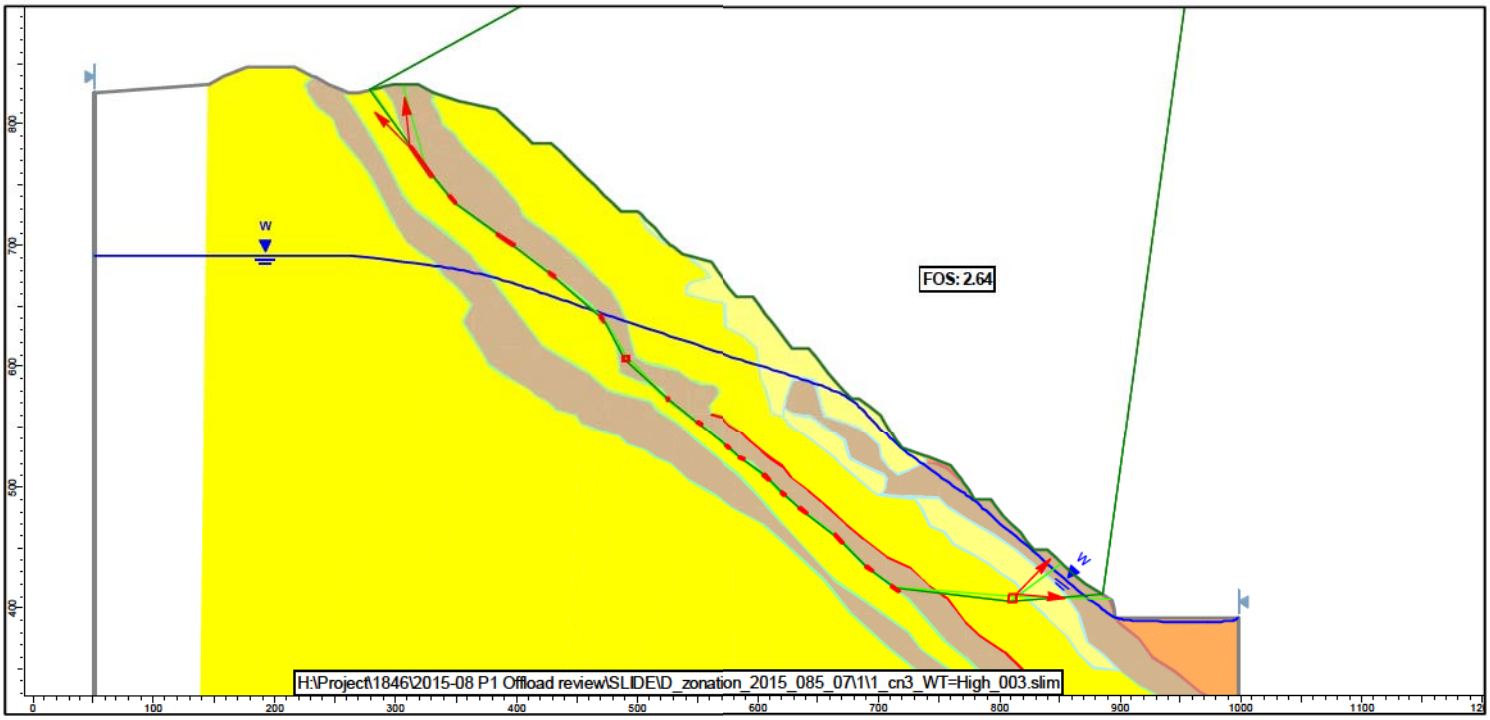


Fig. D9: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.64 between the 406 and 828m levels.

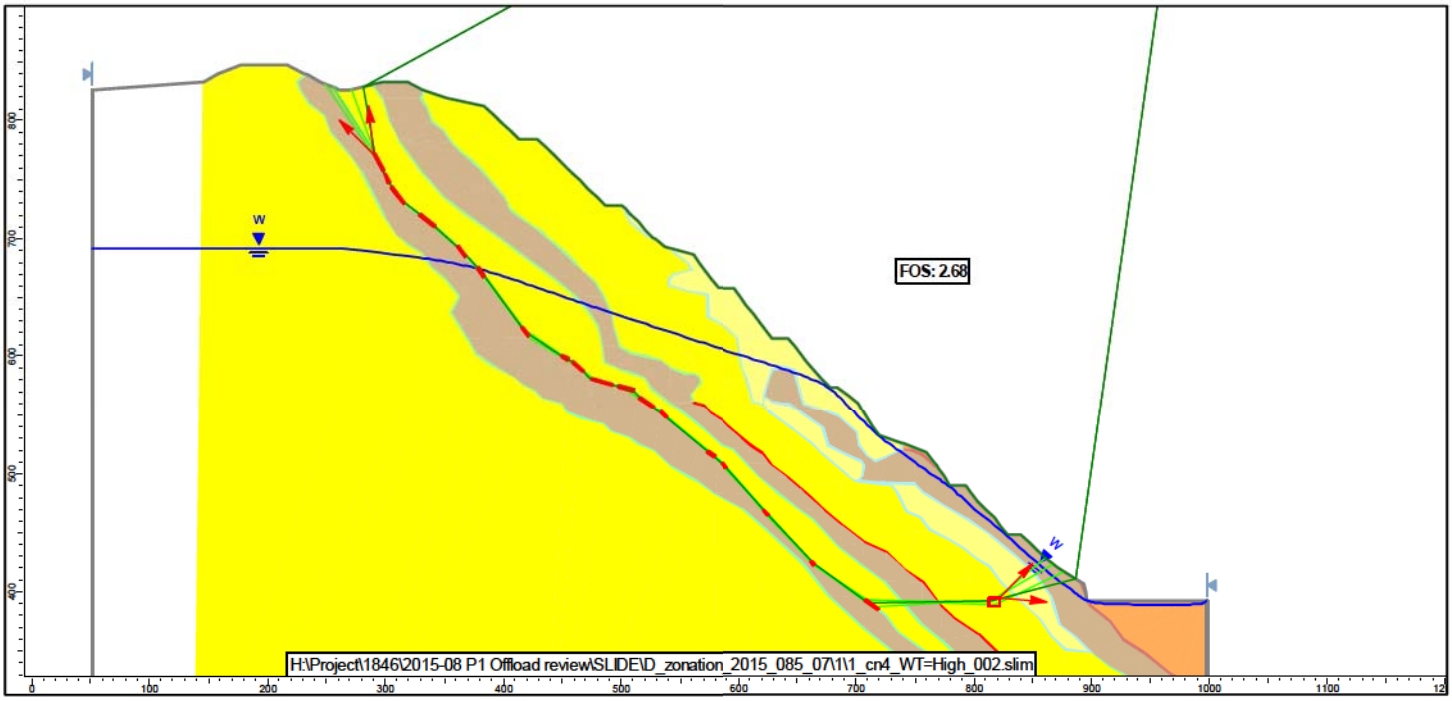


Fig. D10: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.68 between the 406 and 828m levels.

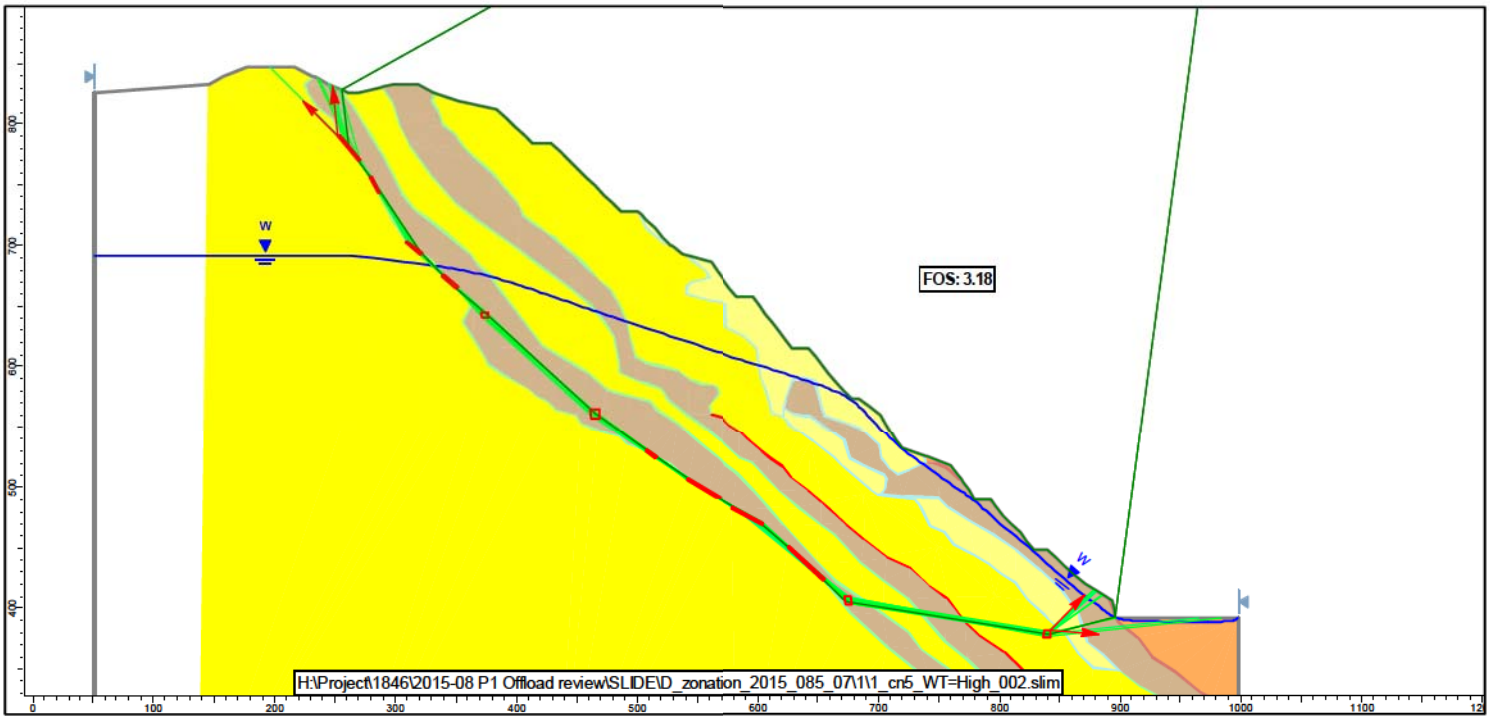


Fig. D11: Section 1 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 3.18 between the 392 and 826m levels.

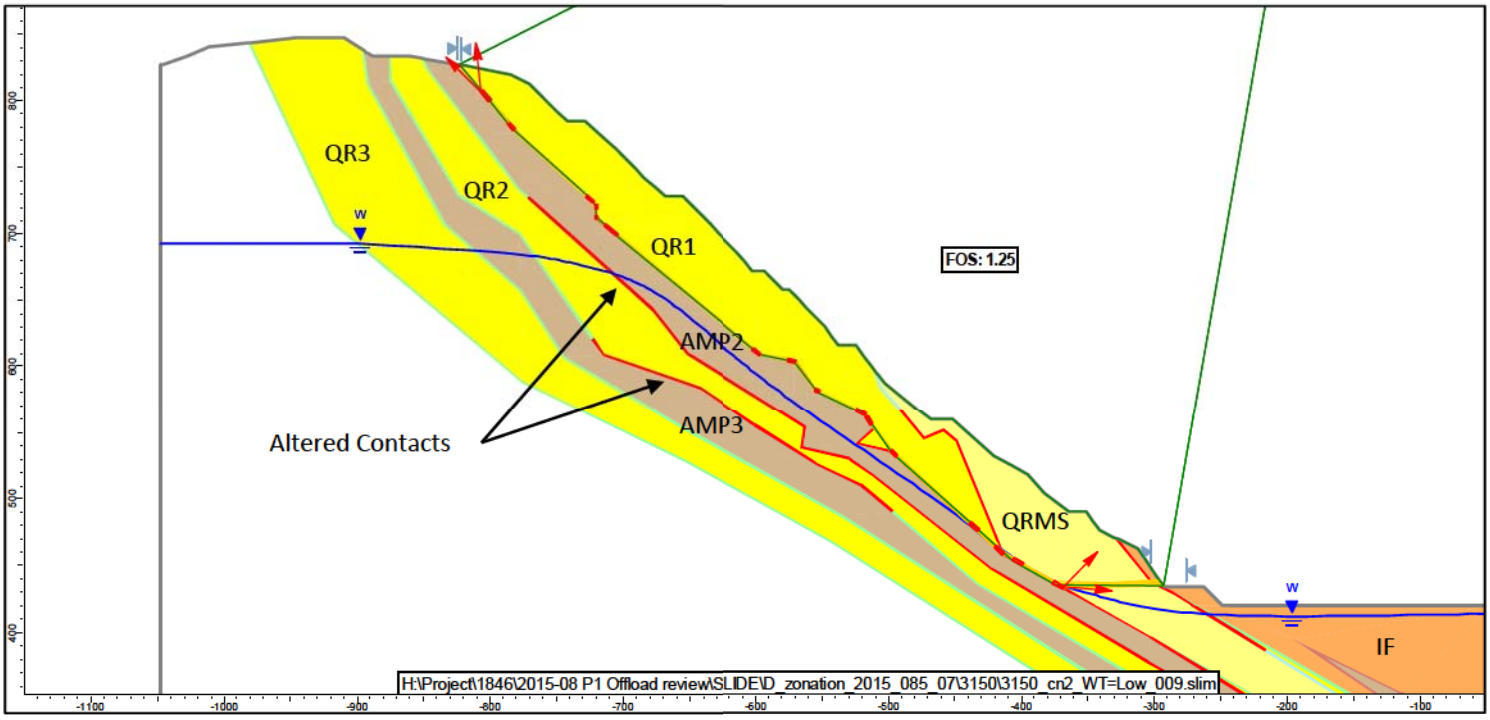


Fig. D12: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.25 between the 434 and 826m levels.

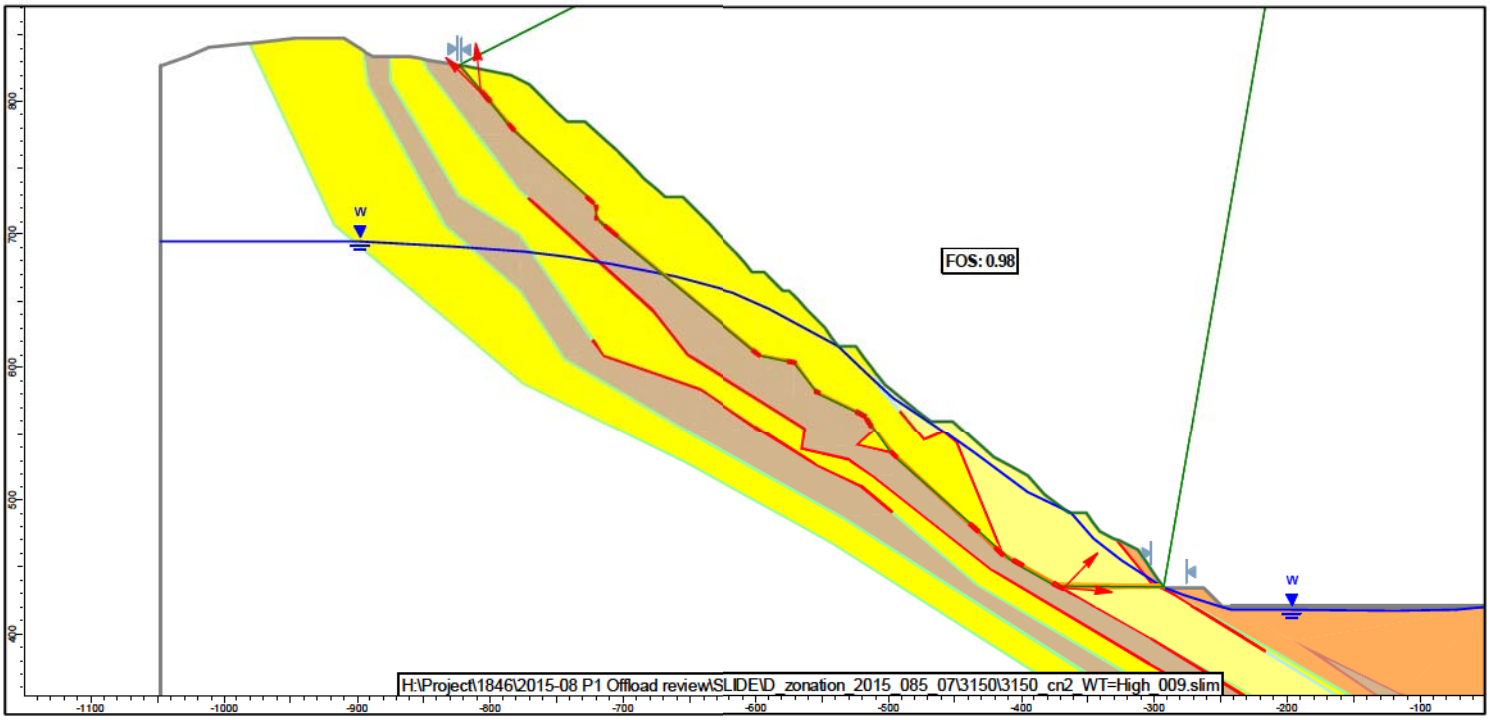


Fig. D13: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 0.98 between the 434 and 826m levels.

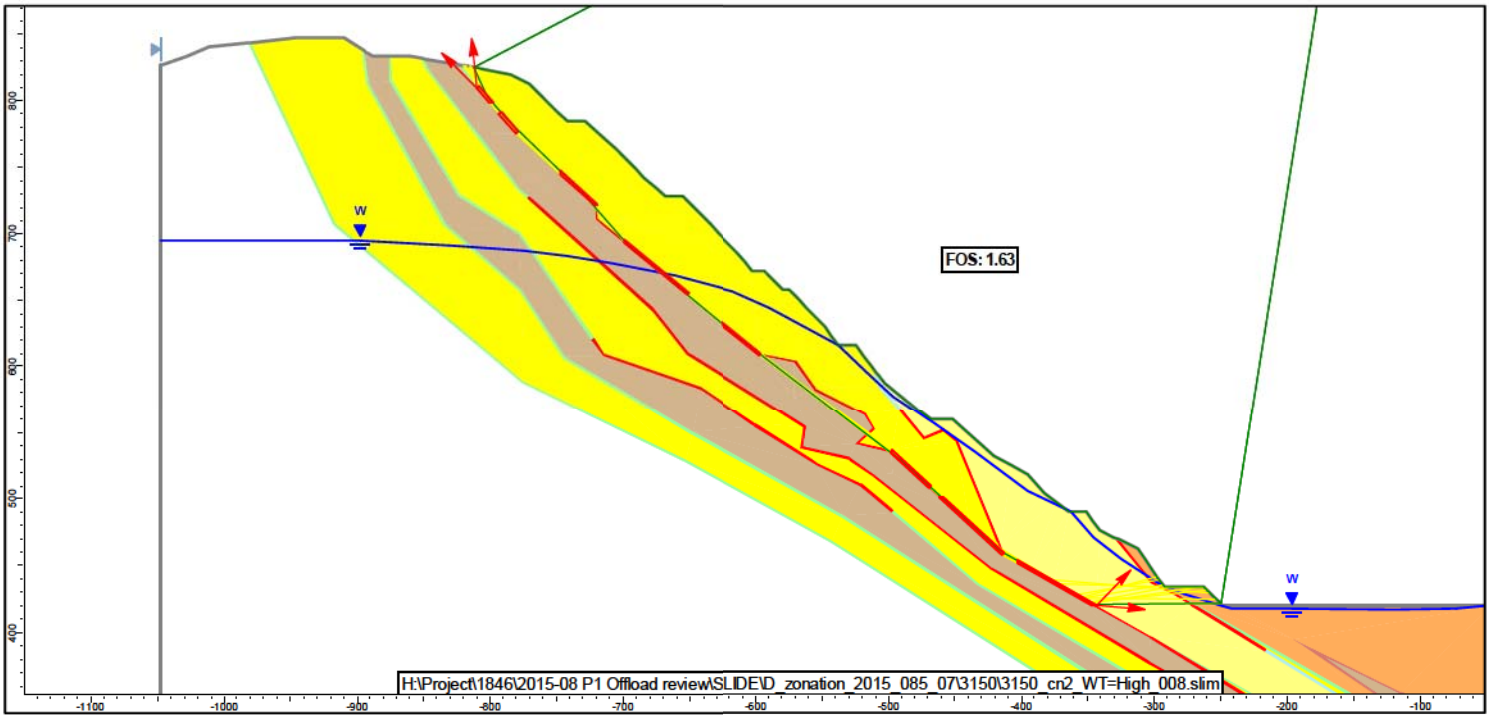


Fig. D14: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.63 between the 420 and 824m levels.

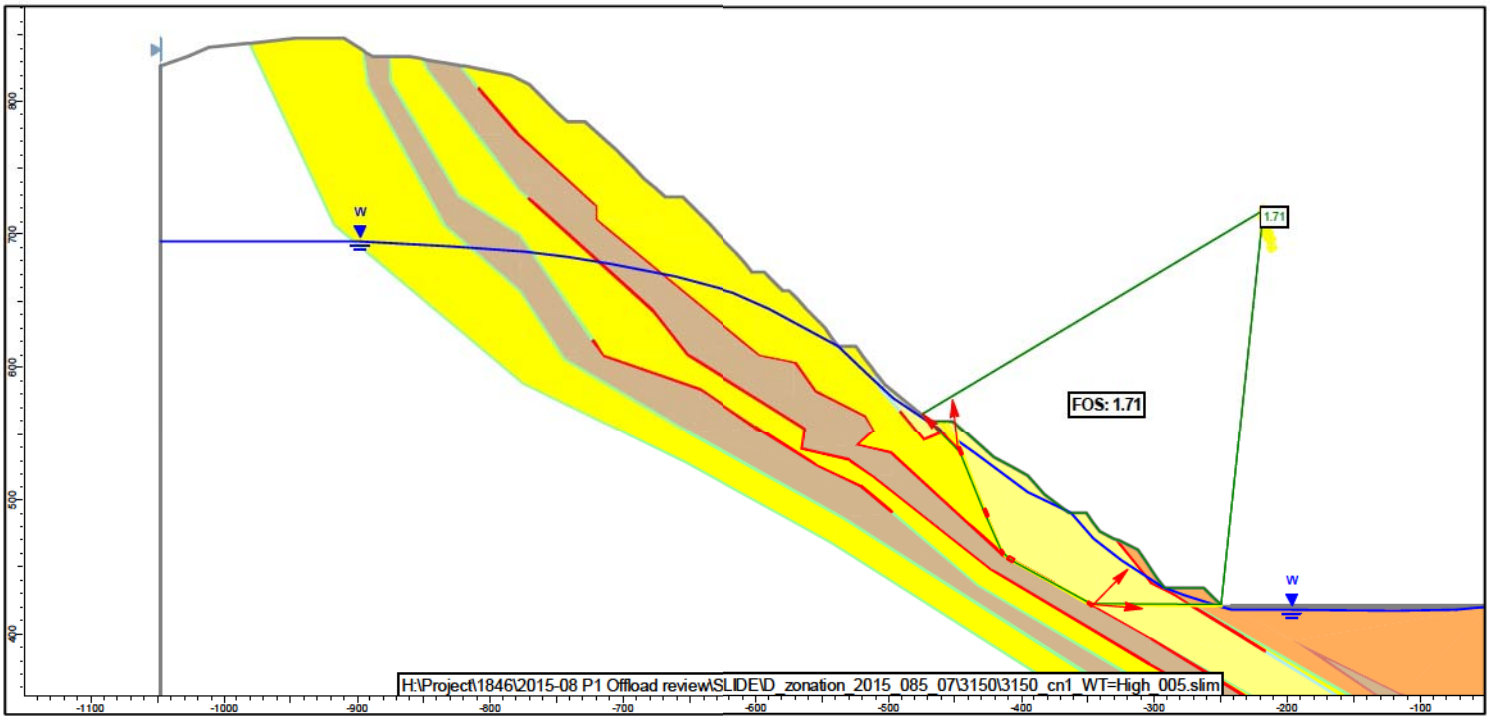


Fig. D15: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.71 between the 420 and 560m levels.

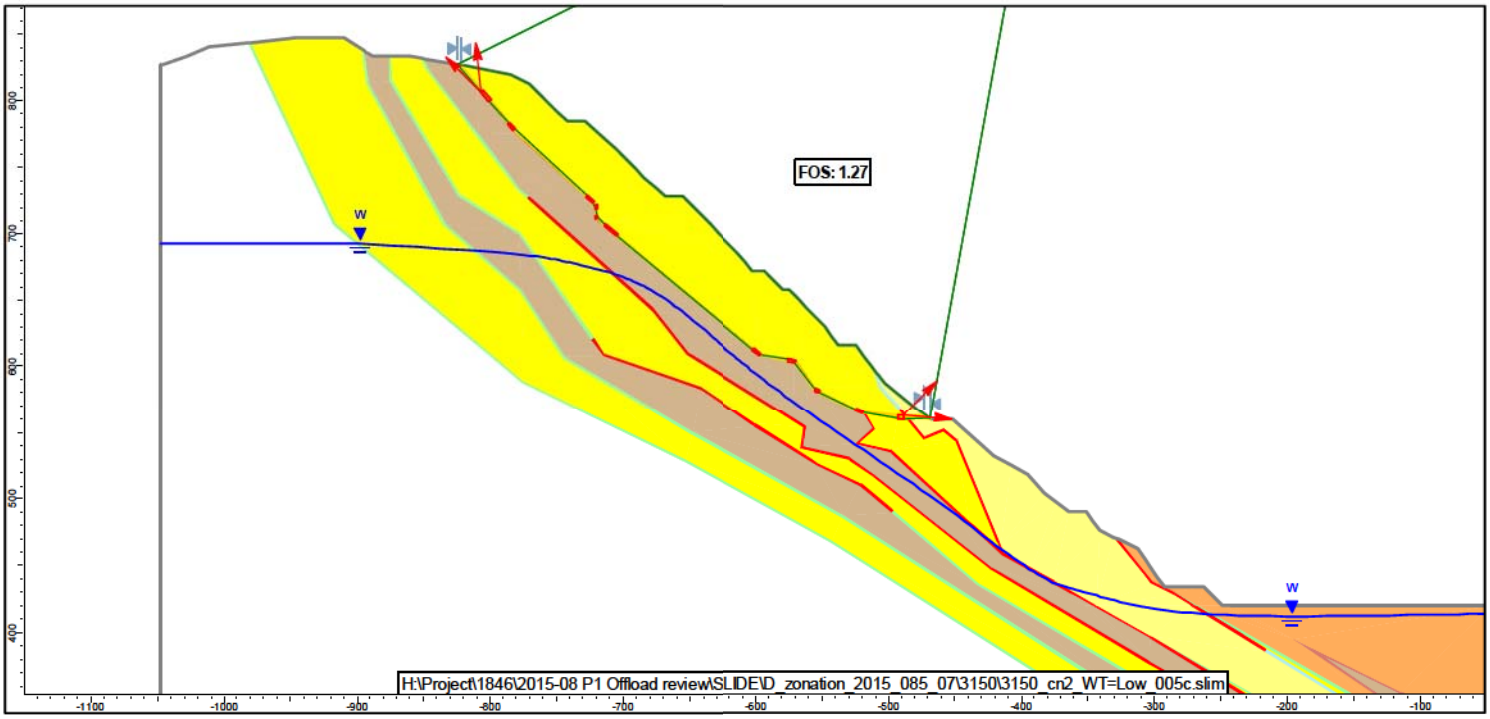


Fig. D16: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.27 between the 560 and 826m levels.

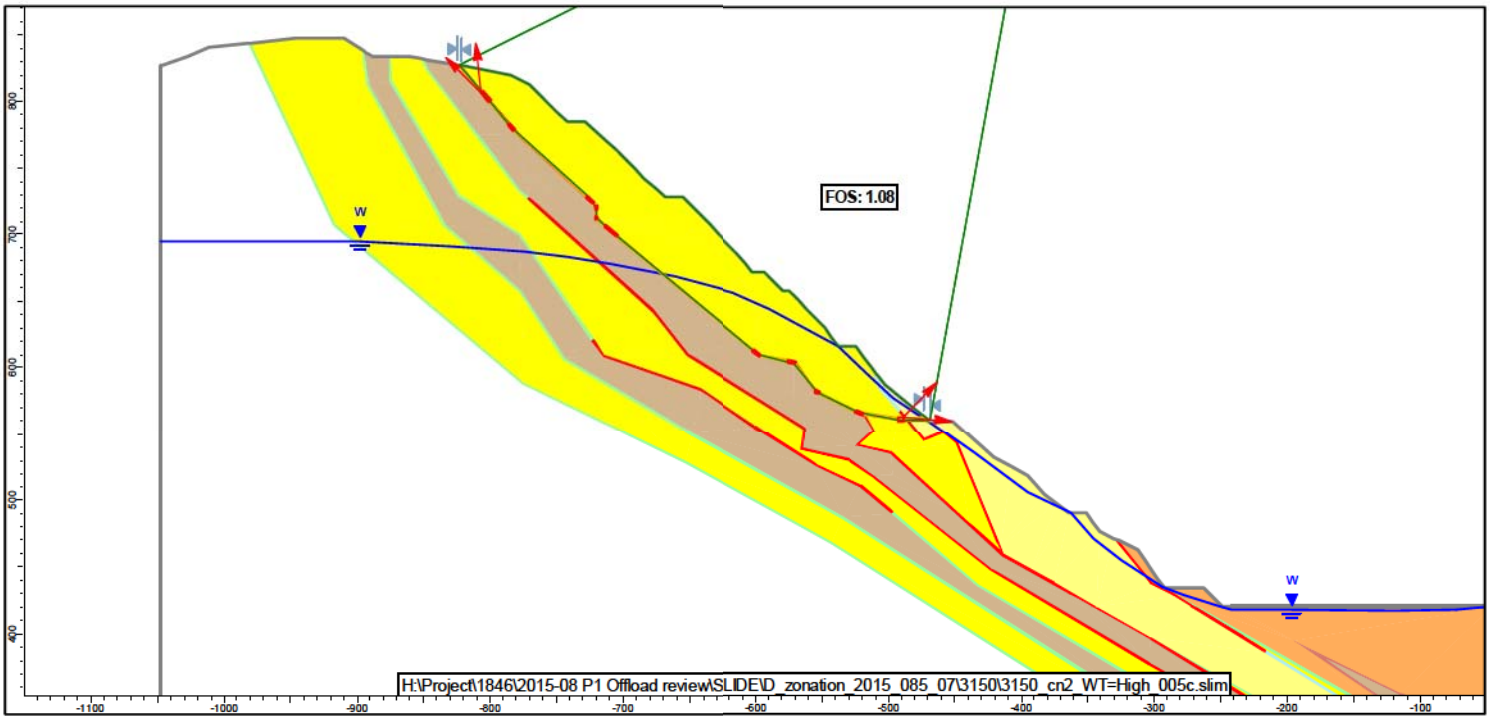


Fig. D17: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.08 between the 560 and 826m levels.

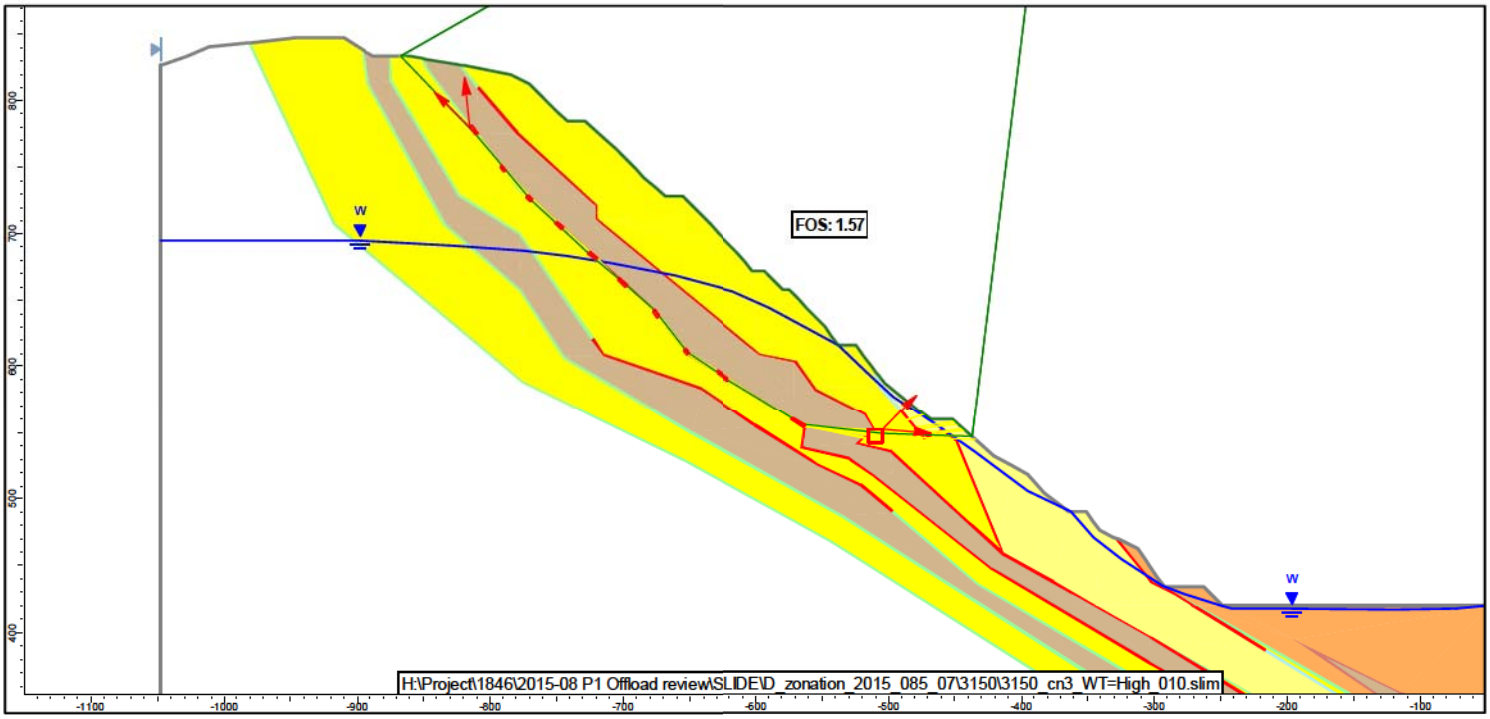


Fig. D18: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.57 between the 546 and 833m levels.

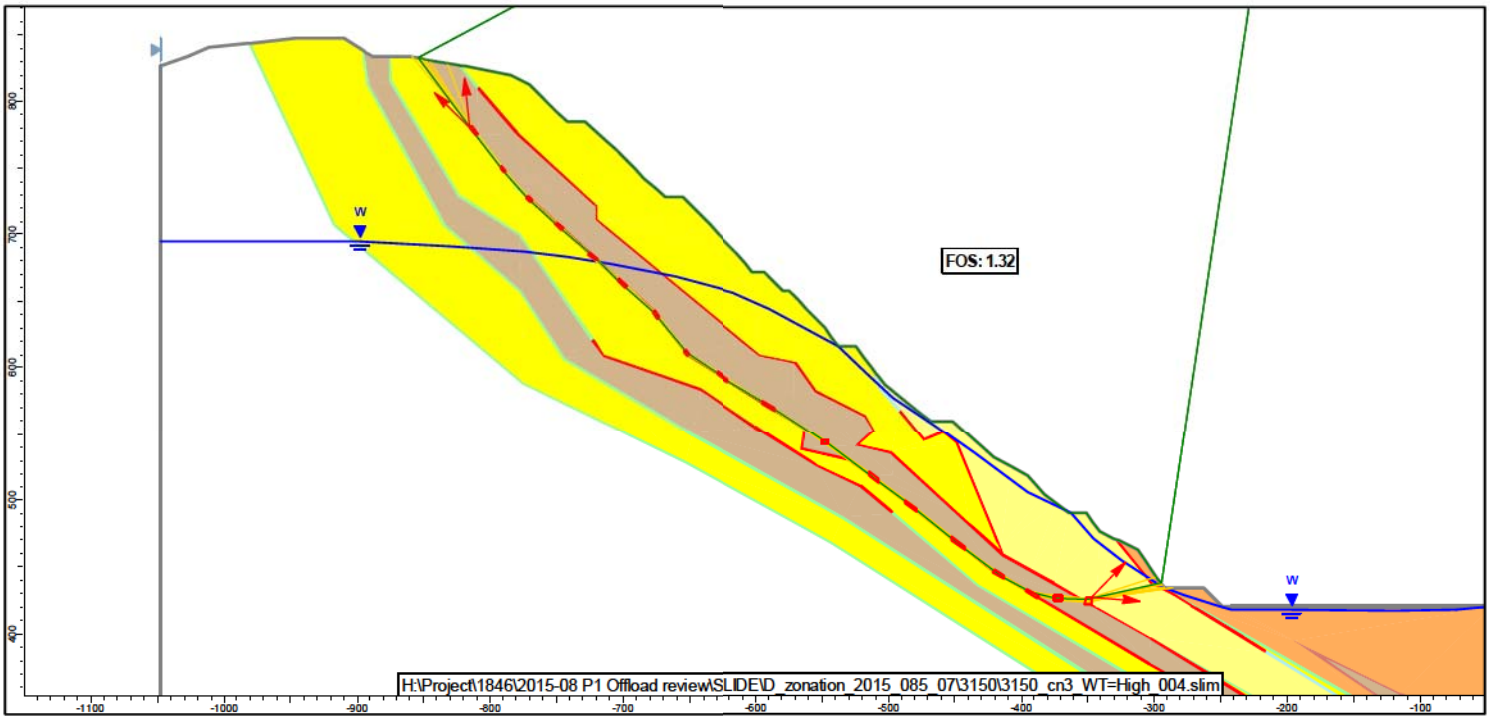


Fig. D19: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.32 between the 434 and 833m levels.

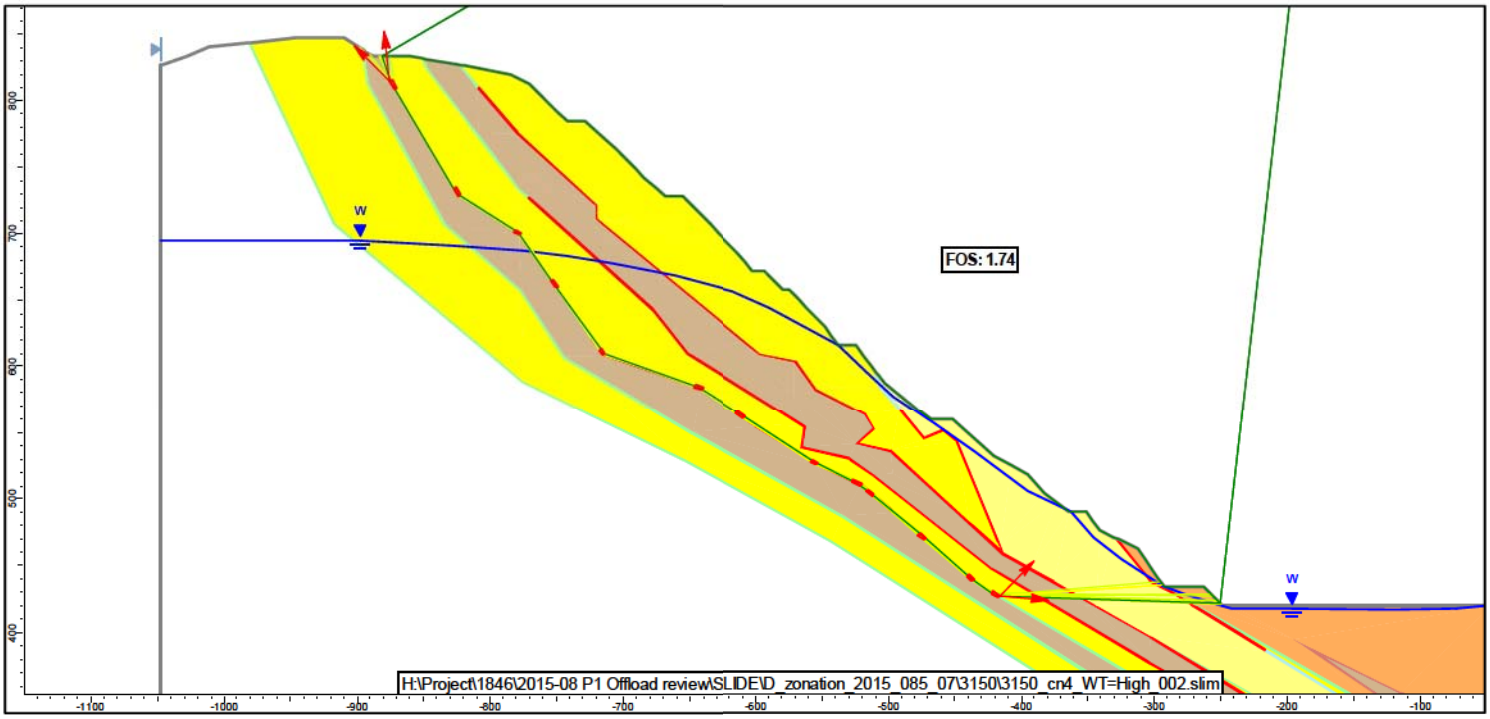


Fig. D20: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.74 between the 420 and 833m levels.

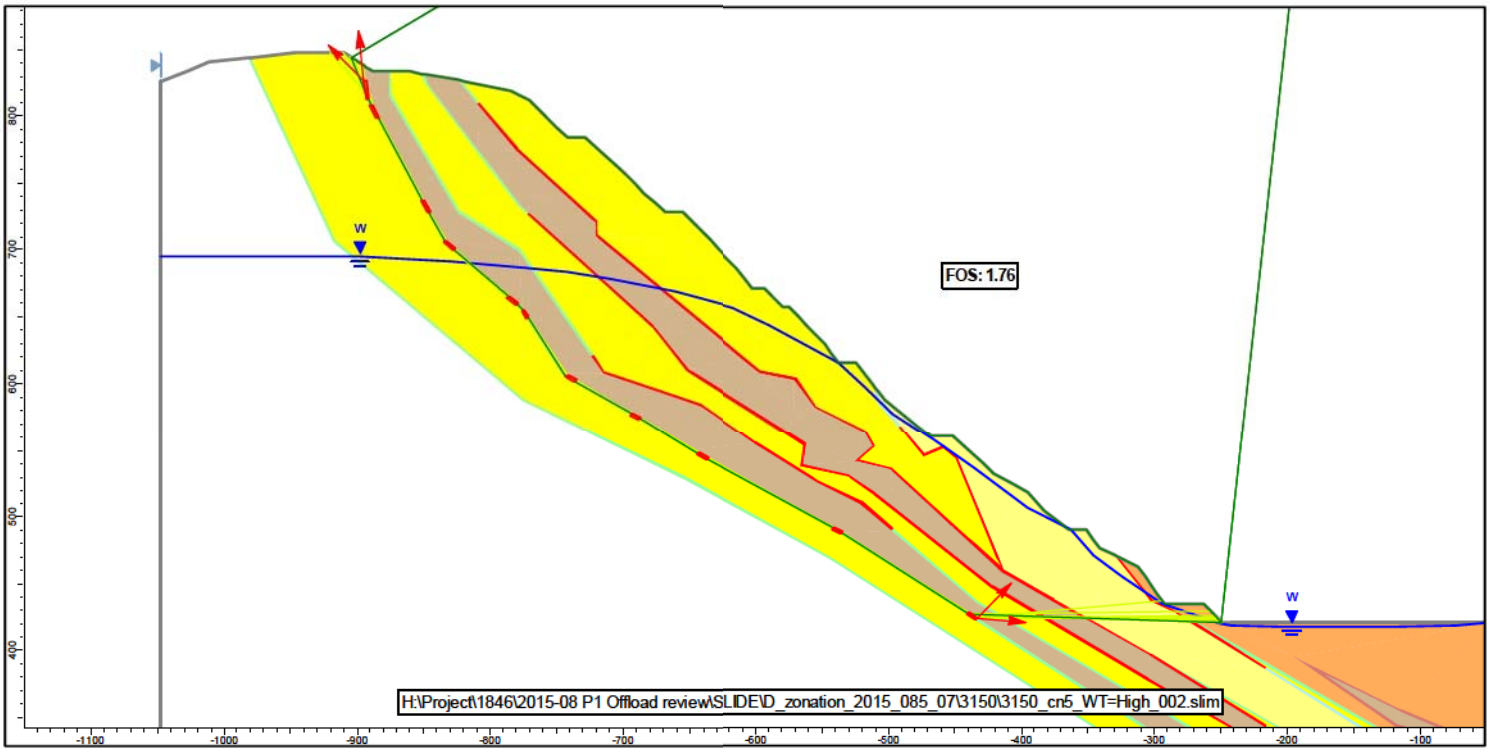


Fig. D21: Section 3150 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.76 between the 420 and 837m levels.

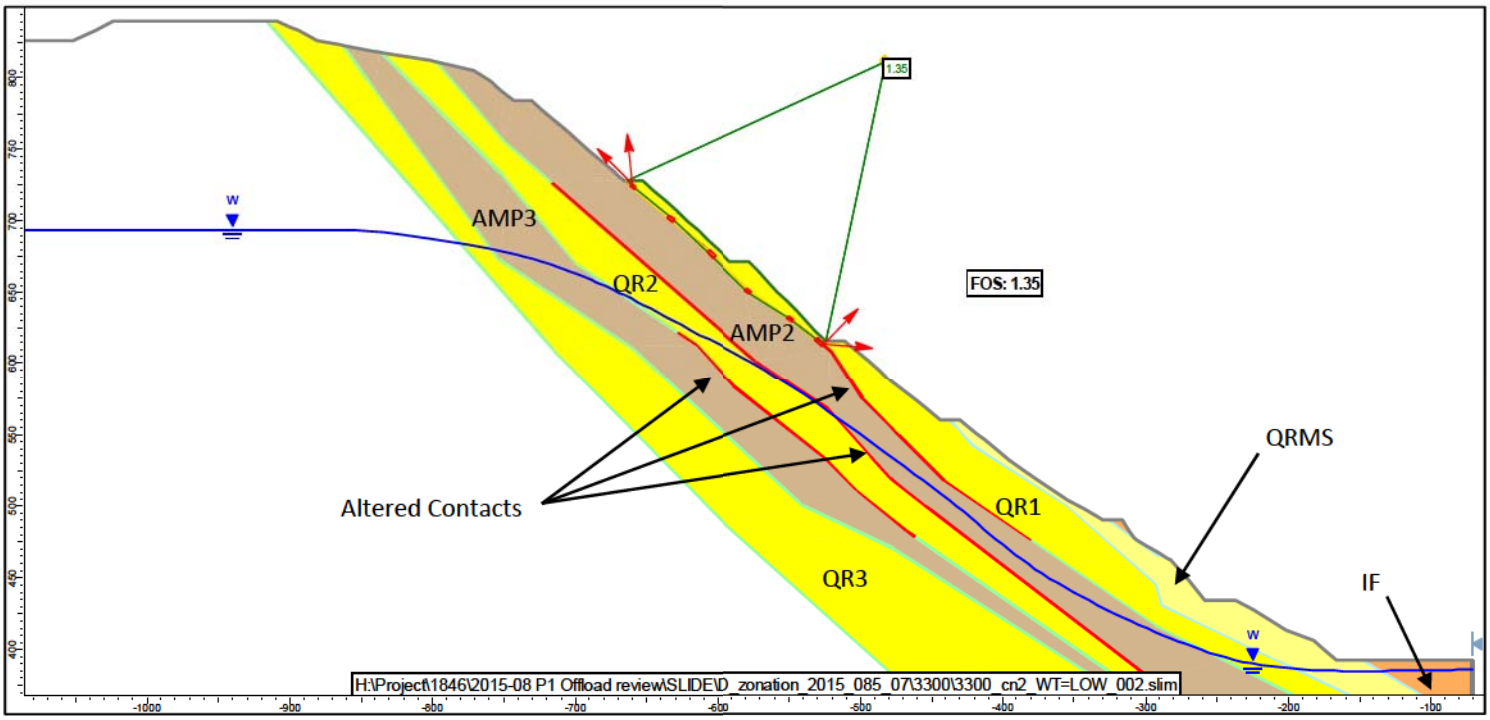


Fig. D22: Section 3300 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.35 between the 616 and 728m levels.

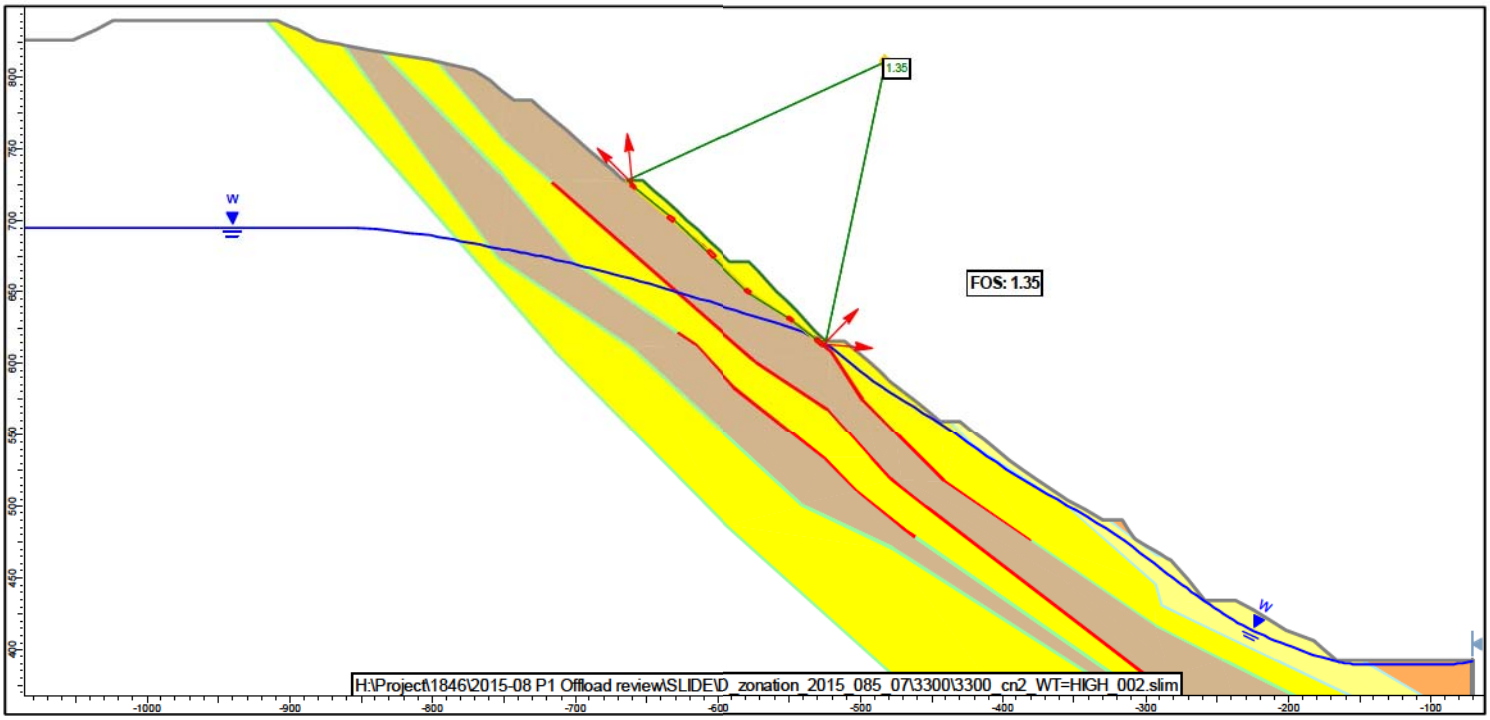


Fig. D23: Section 3300 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.35 between the 616 and 728m levels.

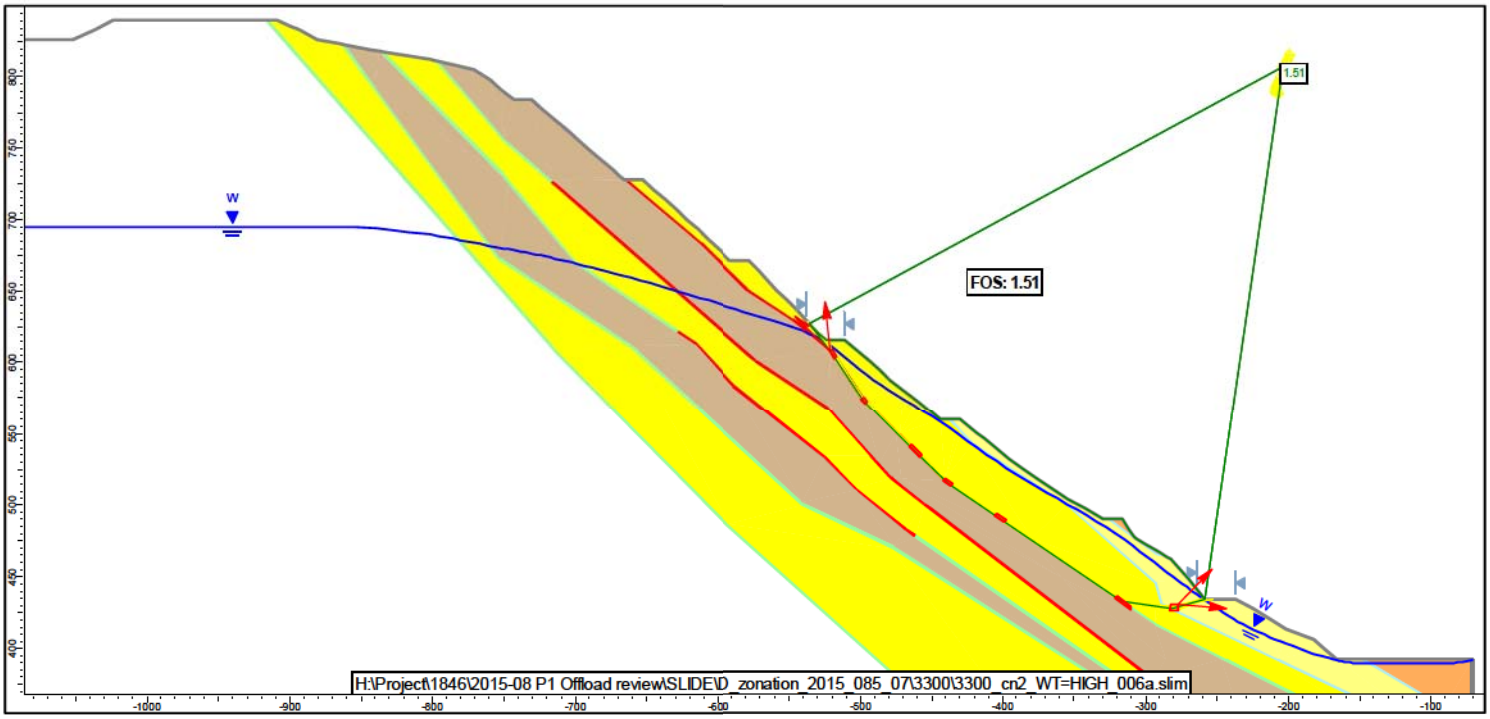


Fig. D24: Section 3300 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.51 between the 434 and 616m levels.

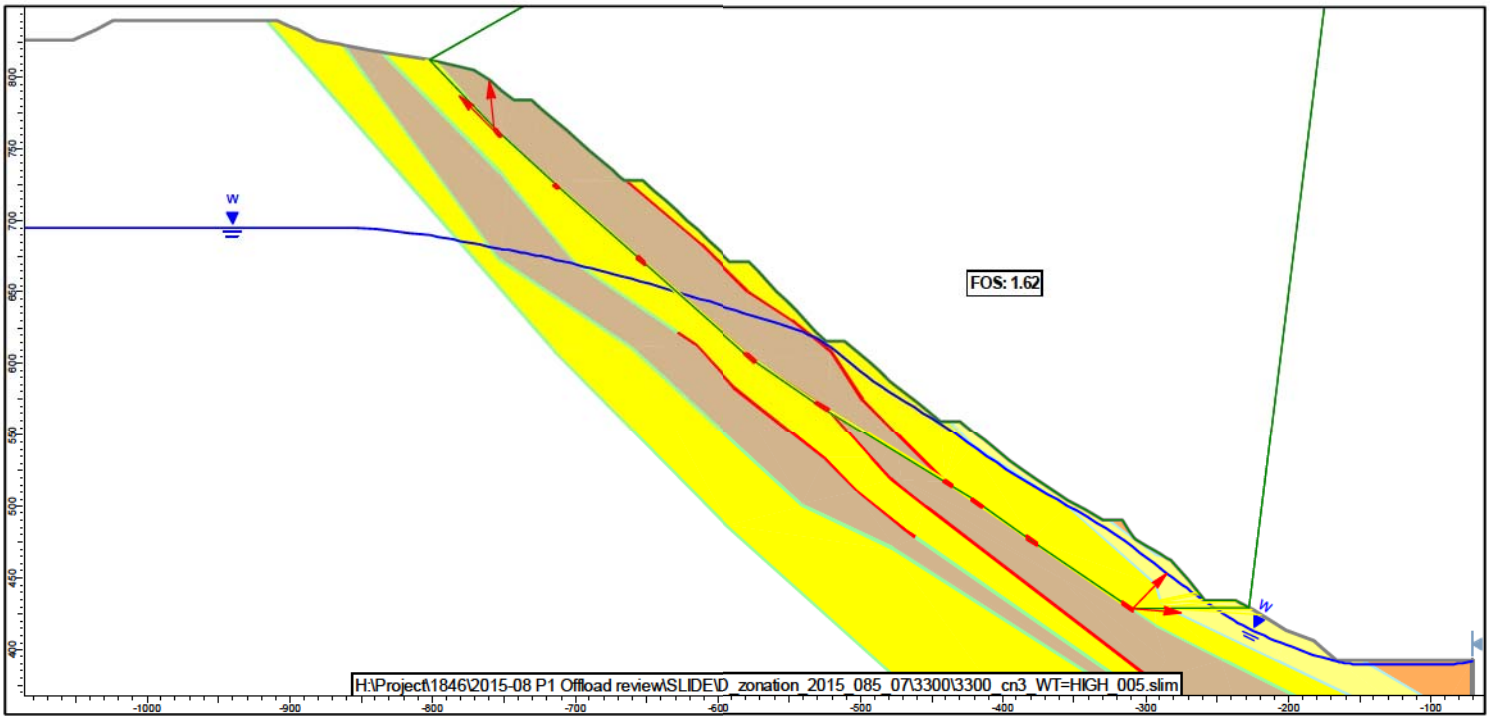


Fig. D25: Section 3300 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.62 between the 434 and 826m levels.

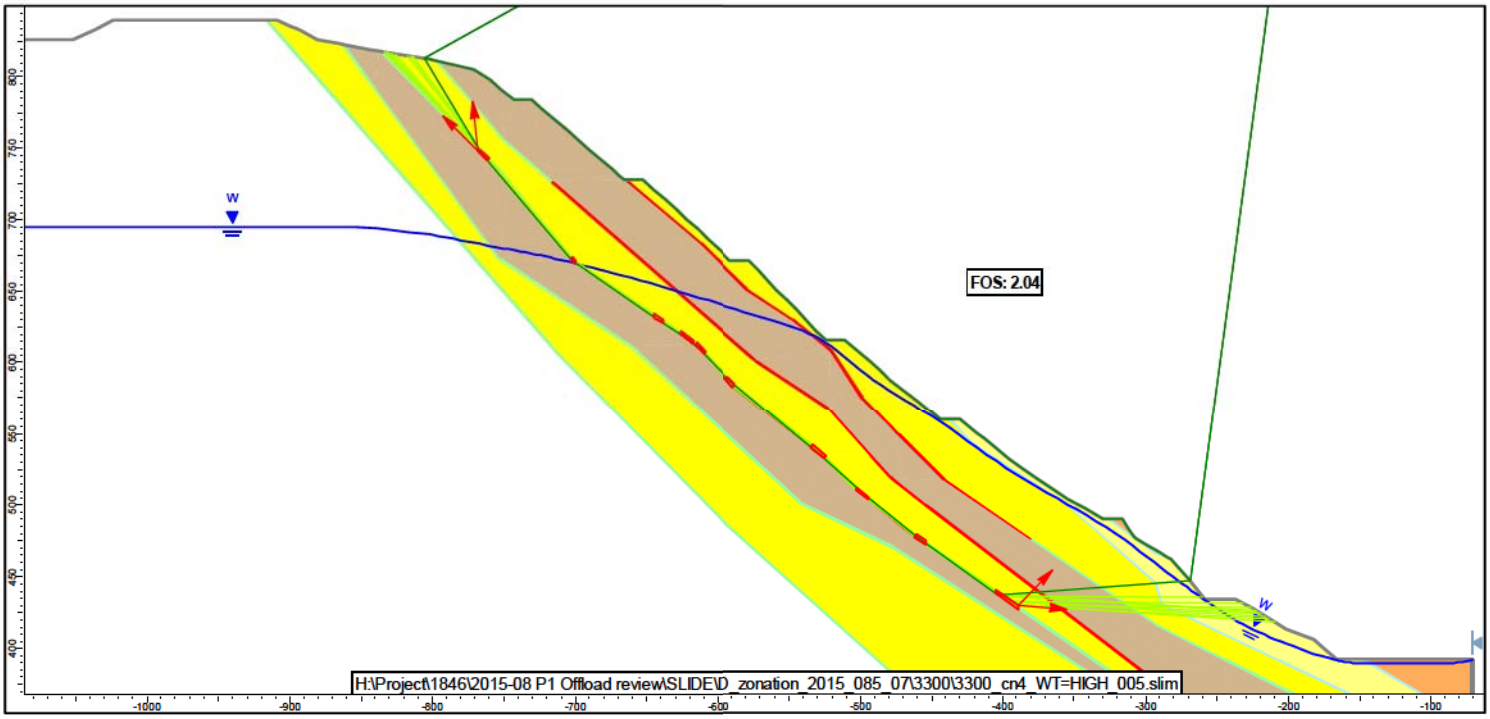


Fig. D26: Section 3300 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.04 between the 434 and 826m levels.

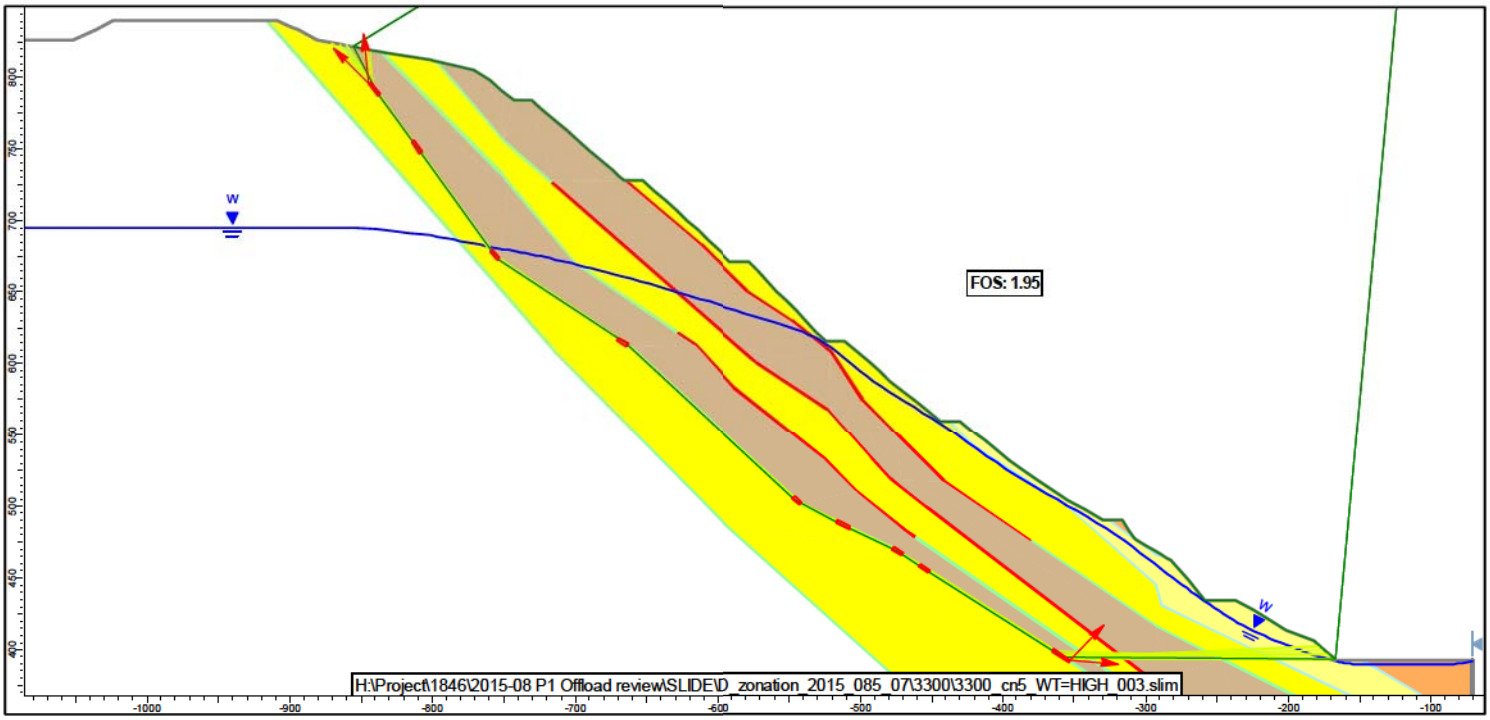


Fig. D27: Section 3300 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.95 between the 392 and 826m levels.

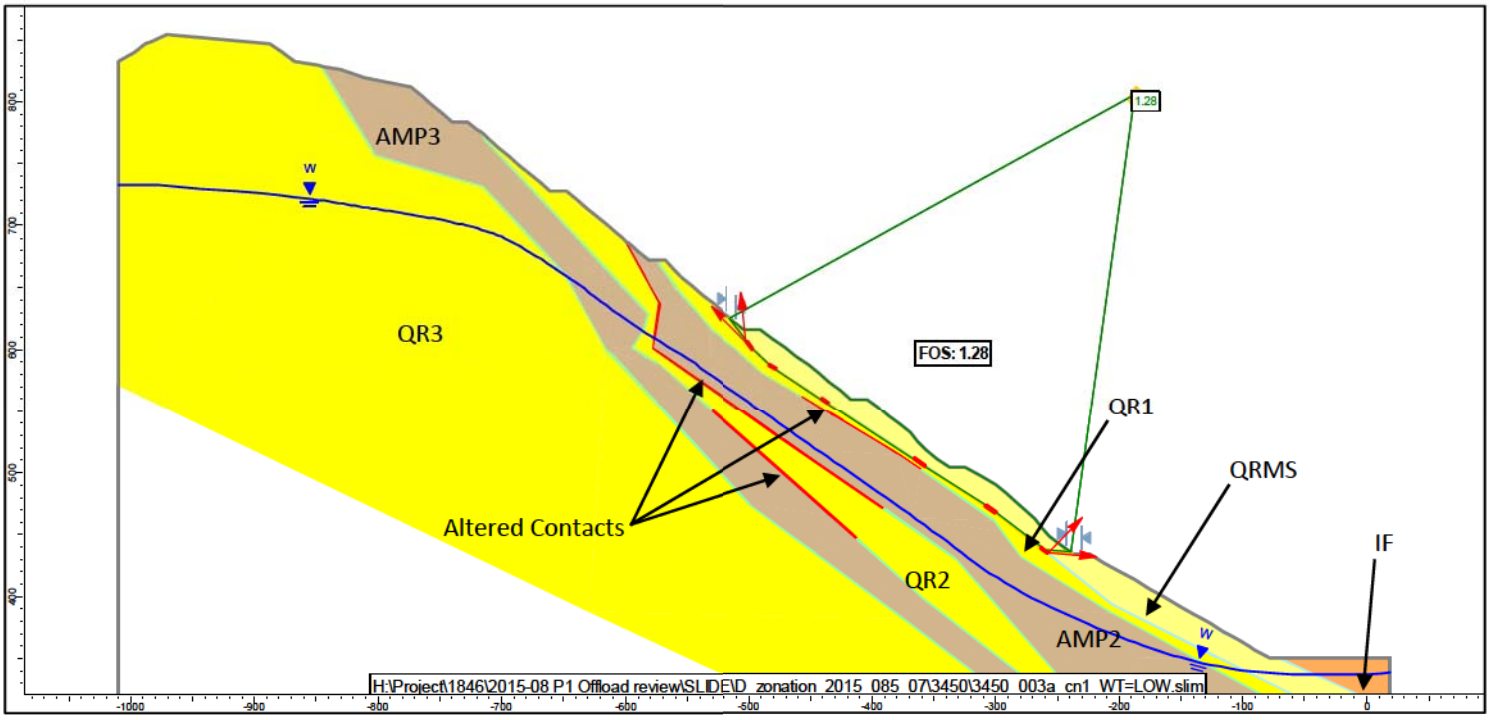


Fig. D28: Section 3450 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.28 between the 434 and 616m levels.

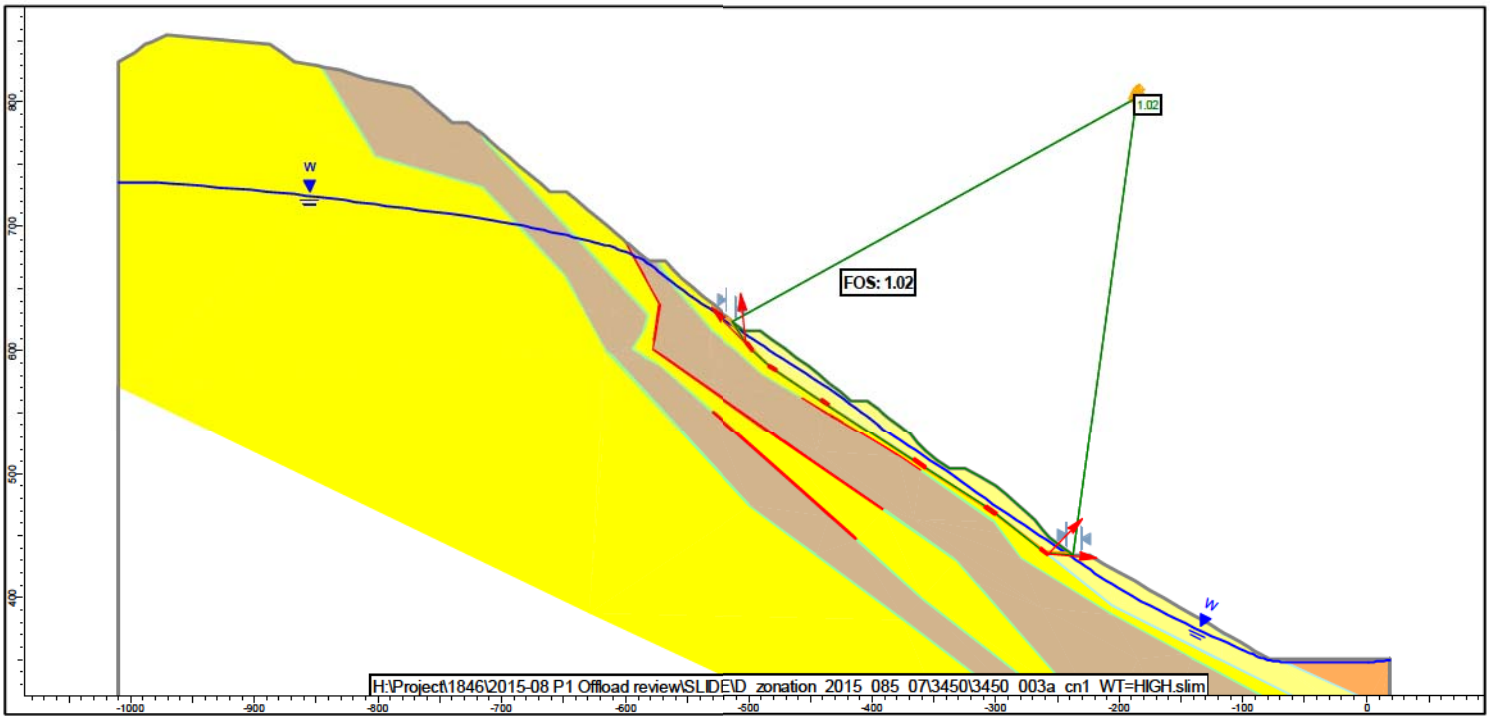


Fig. D29: Section 3450 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.02 between the 434 and 616m levels.

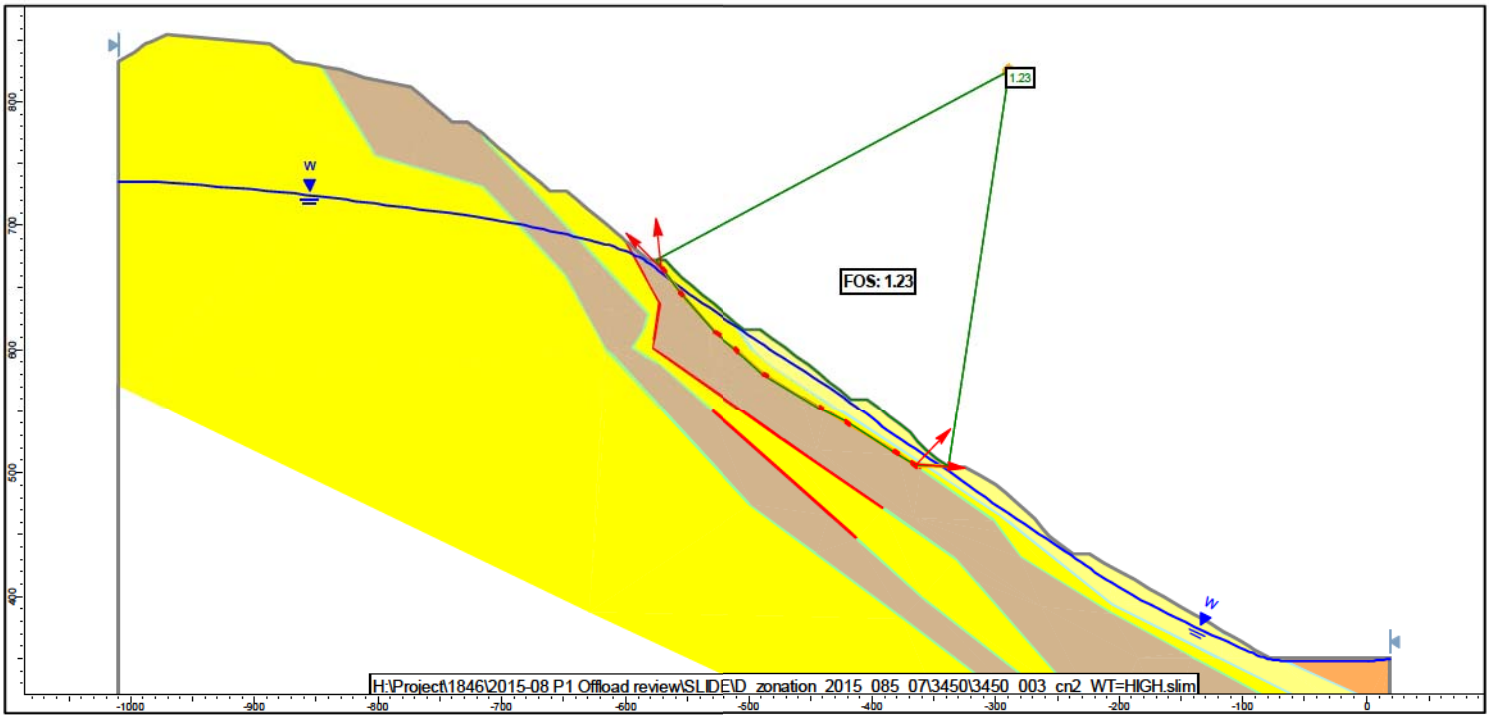


Fig. D30: Section 3450 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.23 between the 504 and 672m levels.

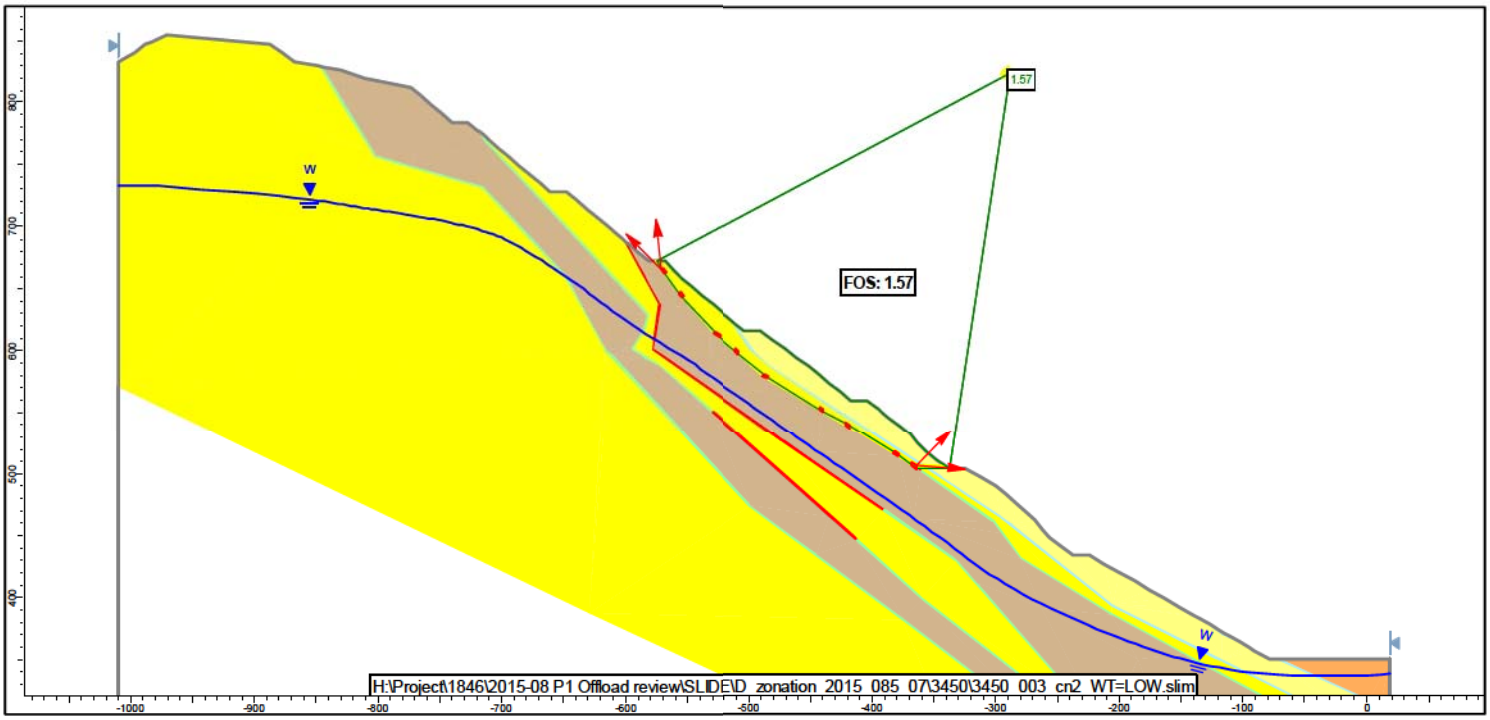


Fig. D31: Section 3450 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.57 between the 504 and 672m levels.

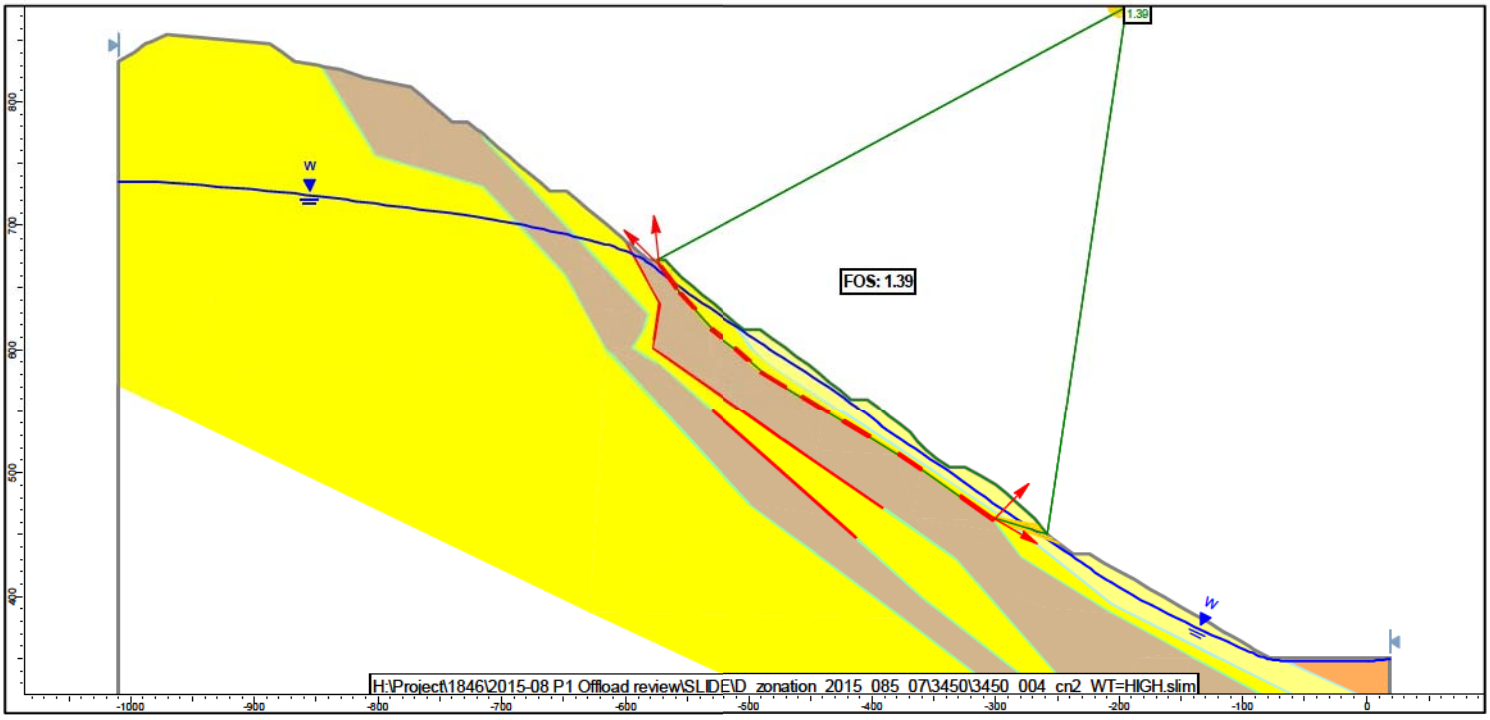


Fig. D32: Section 3450 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.39 between the 434 and 672m levels.

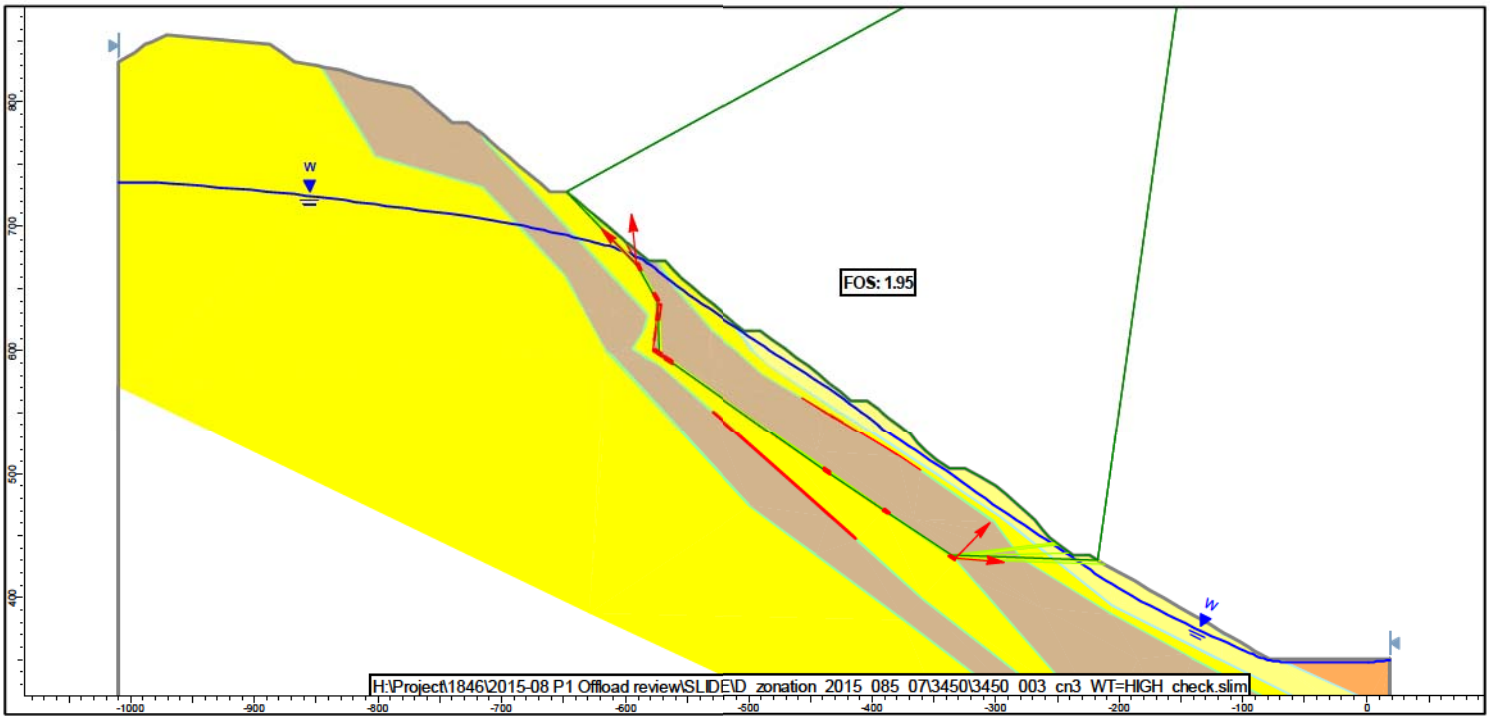


Fig. D33: Section 3450 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.95 between the 434 and 728m levels.

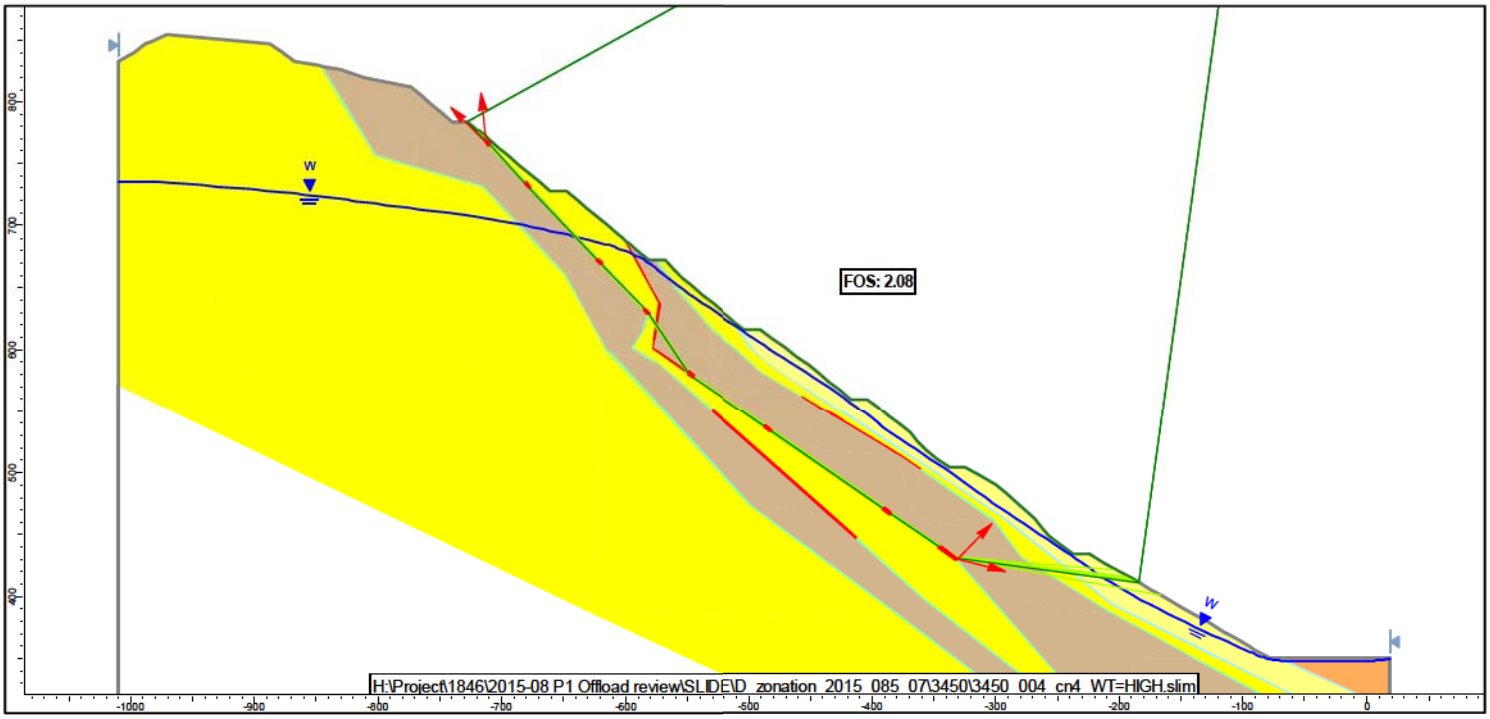


Fig. D34: Section 3450 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.08 between the 434 and 784m levels.

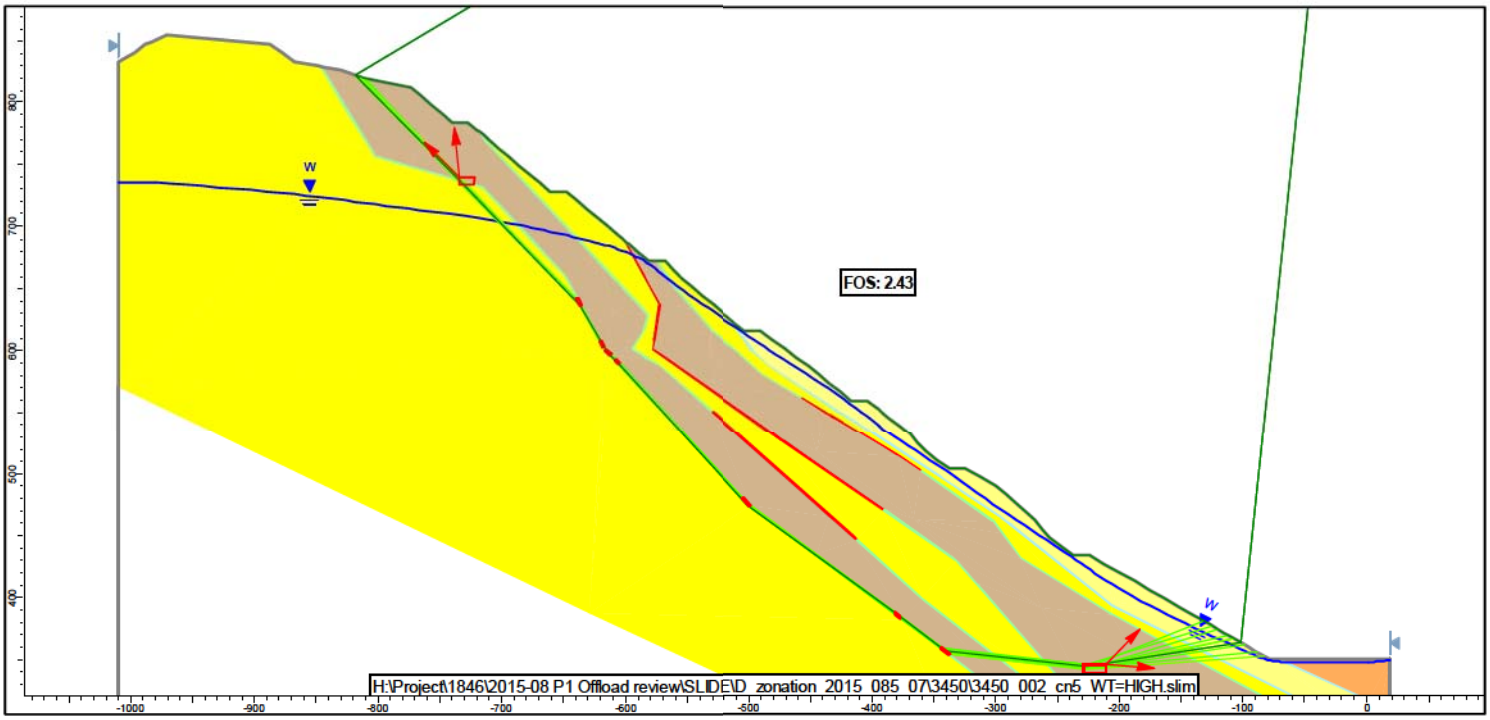


Fig. D35: Section 3450 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.43 between the 350 and 826m levels.

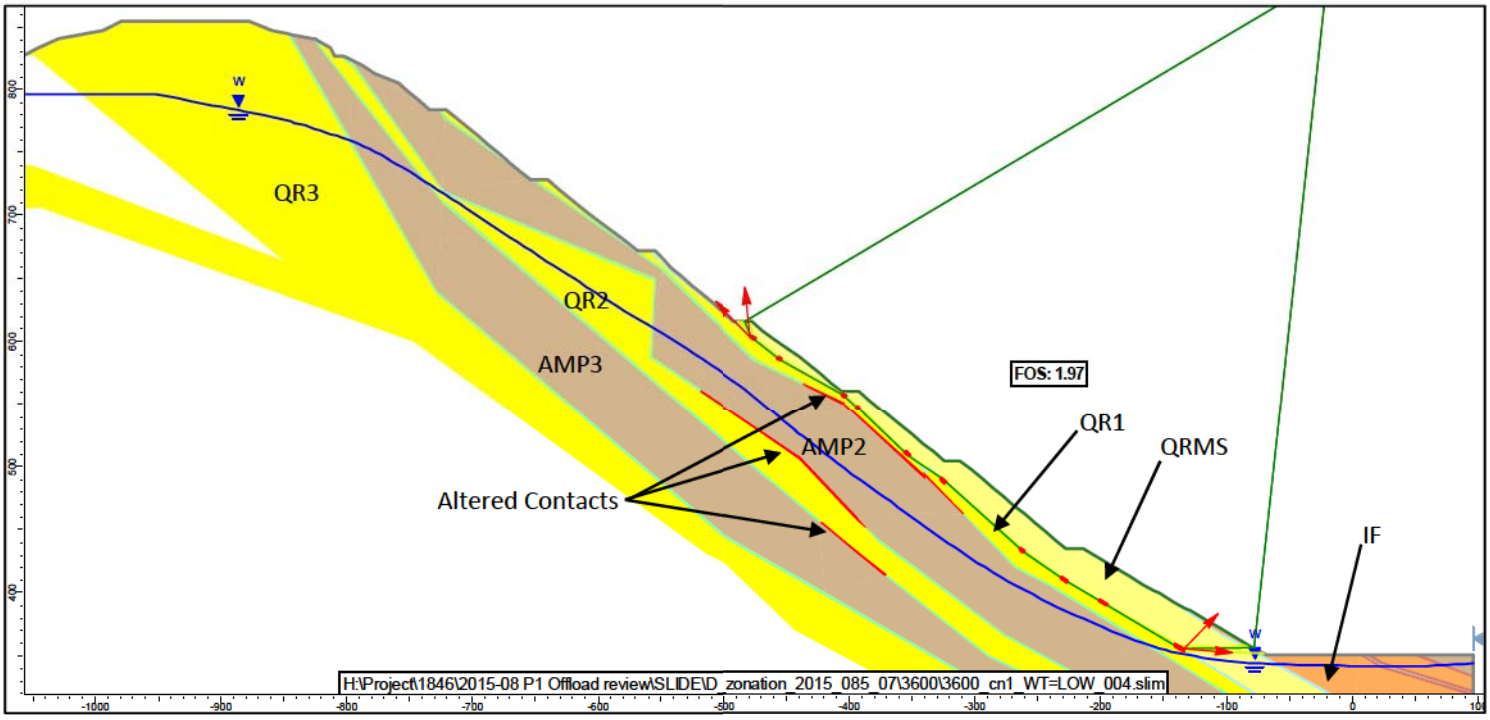


Fig. D36: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.97 between the 350 and 616m levels.

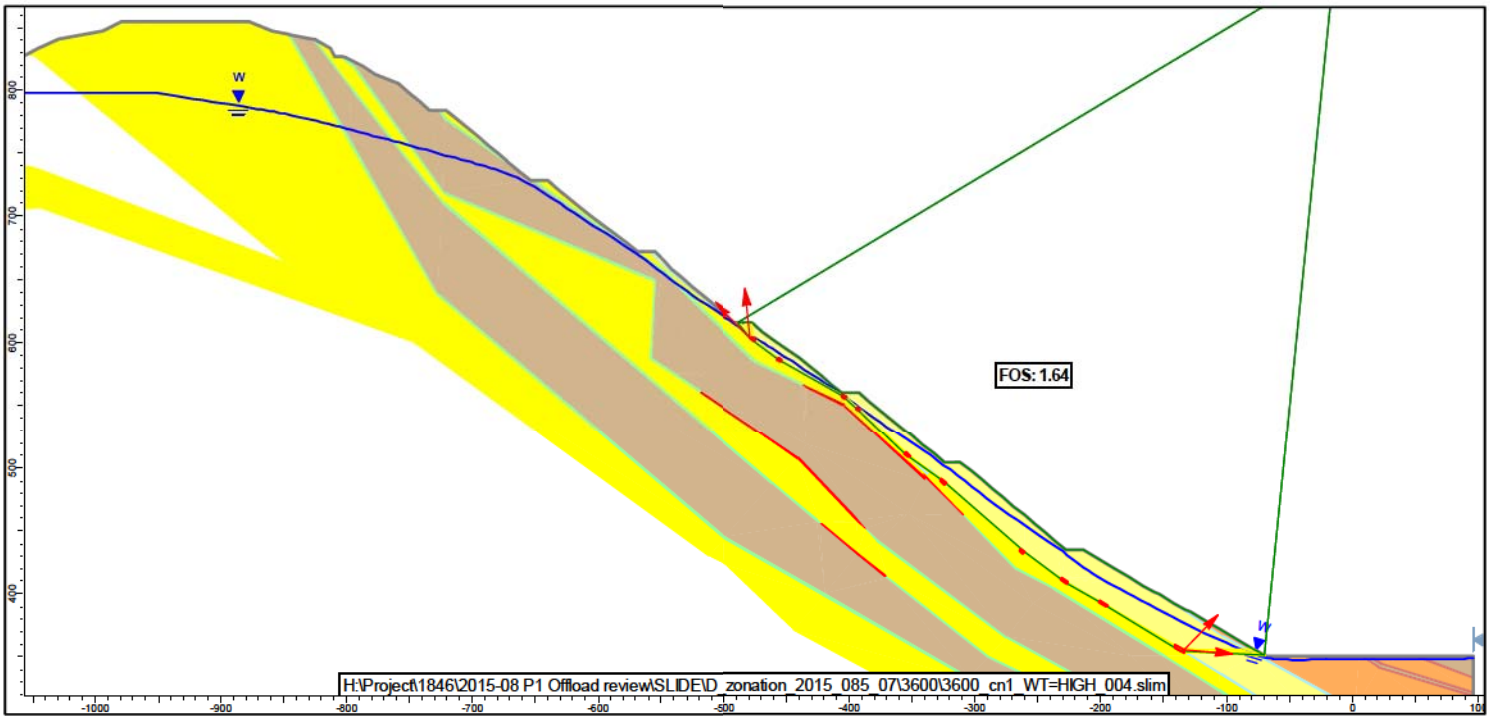


Fig. D37: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.64 between the 350 and 616m levels.

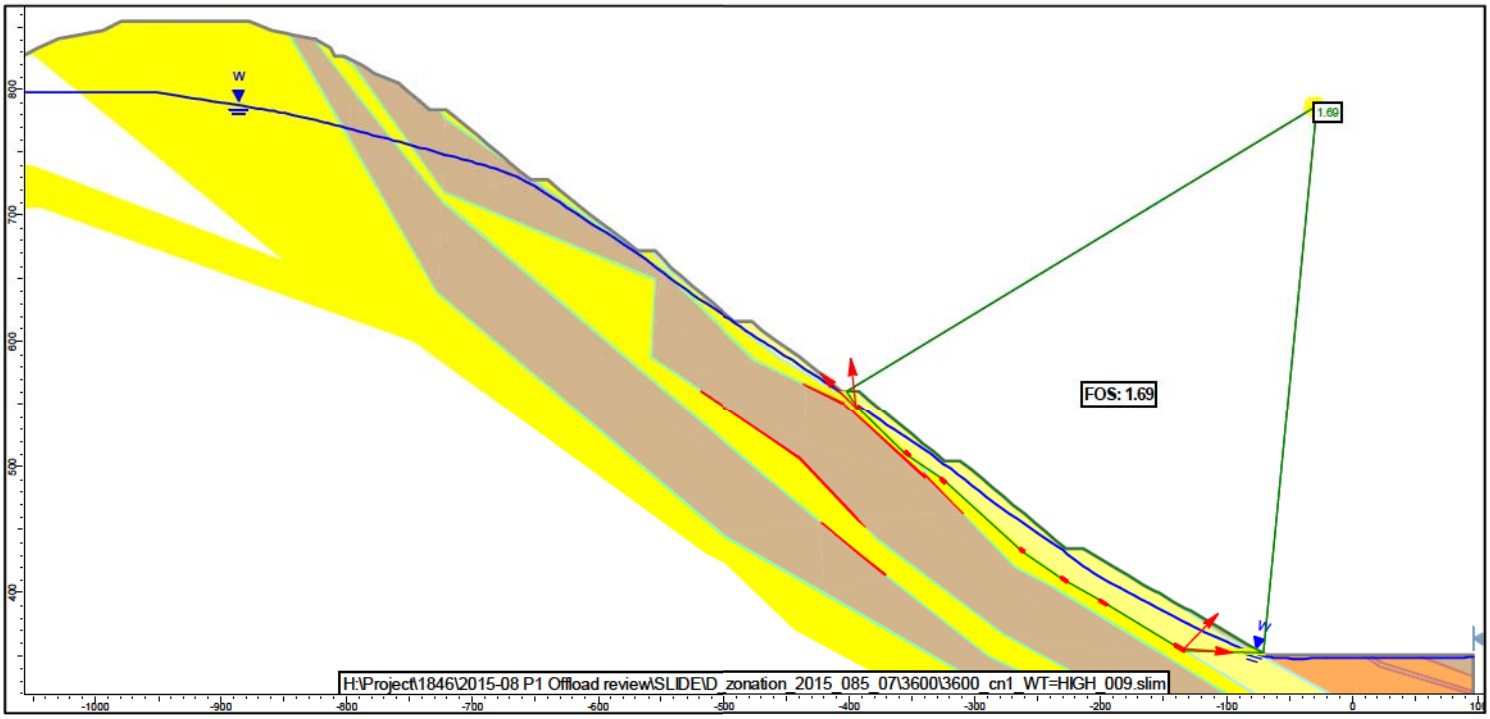


Fig. D38: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.69 between the 350 and 560m levels.

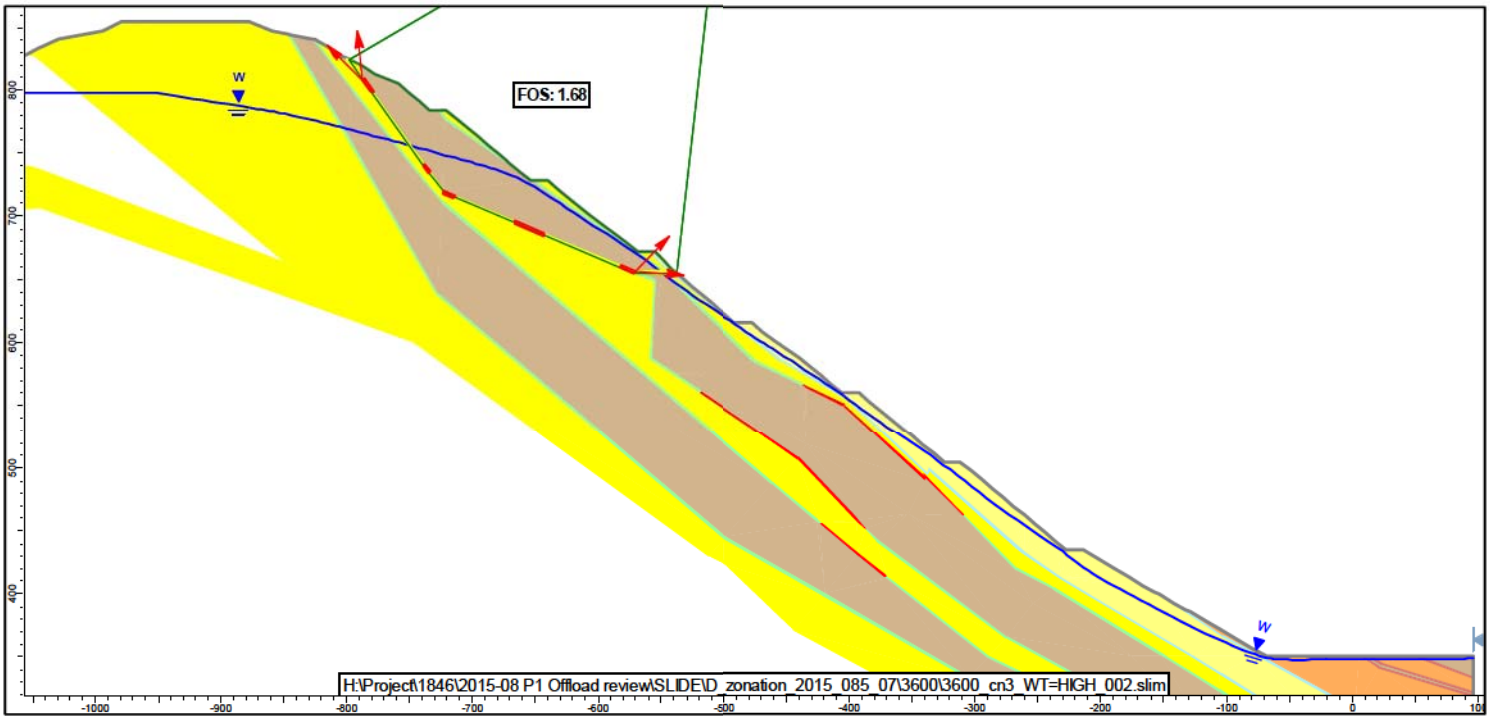


Fig. D39: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.68 between the 655 and 826m levels.

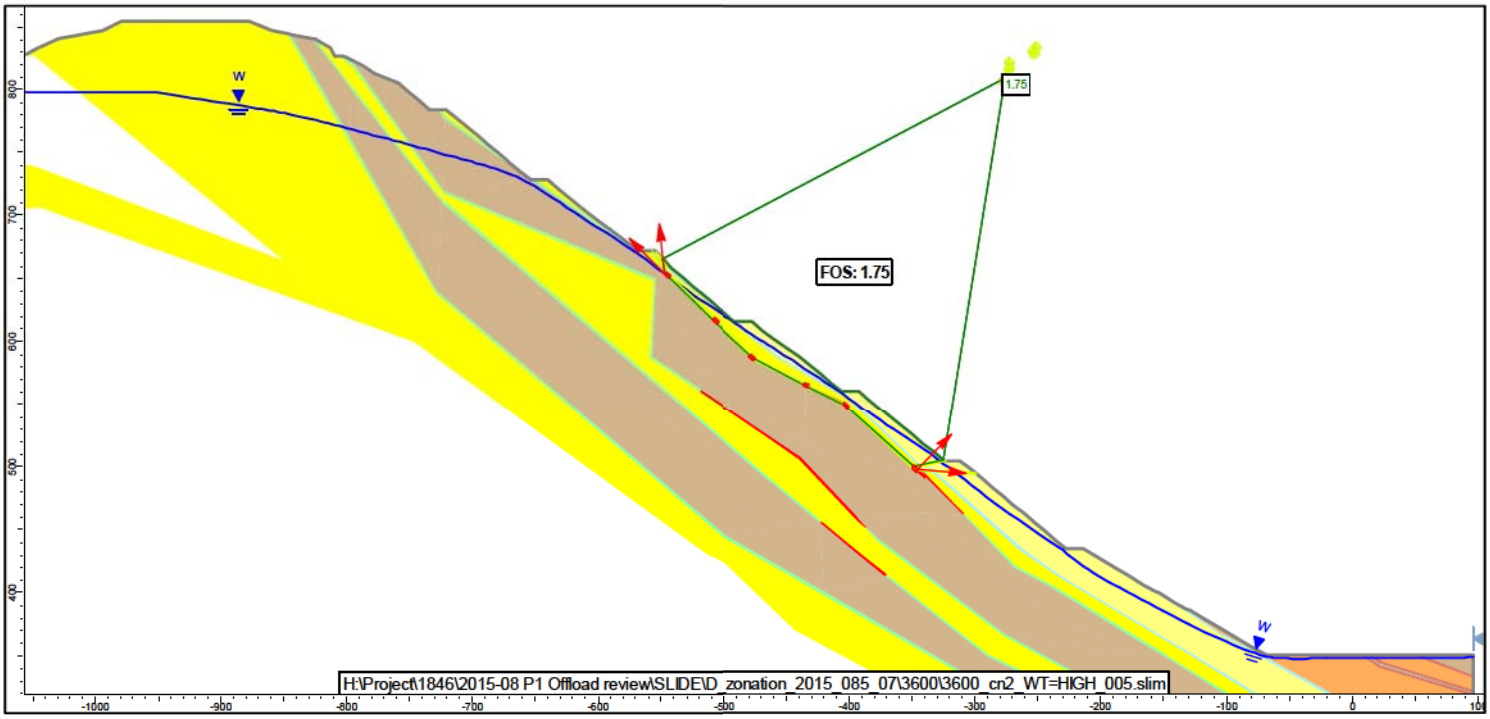


Fig. D40: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.75 between the 504 and 672m levels.

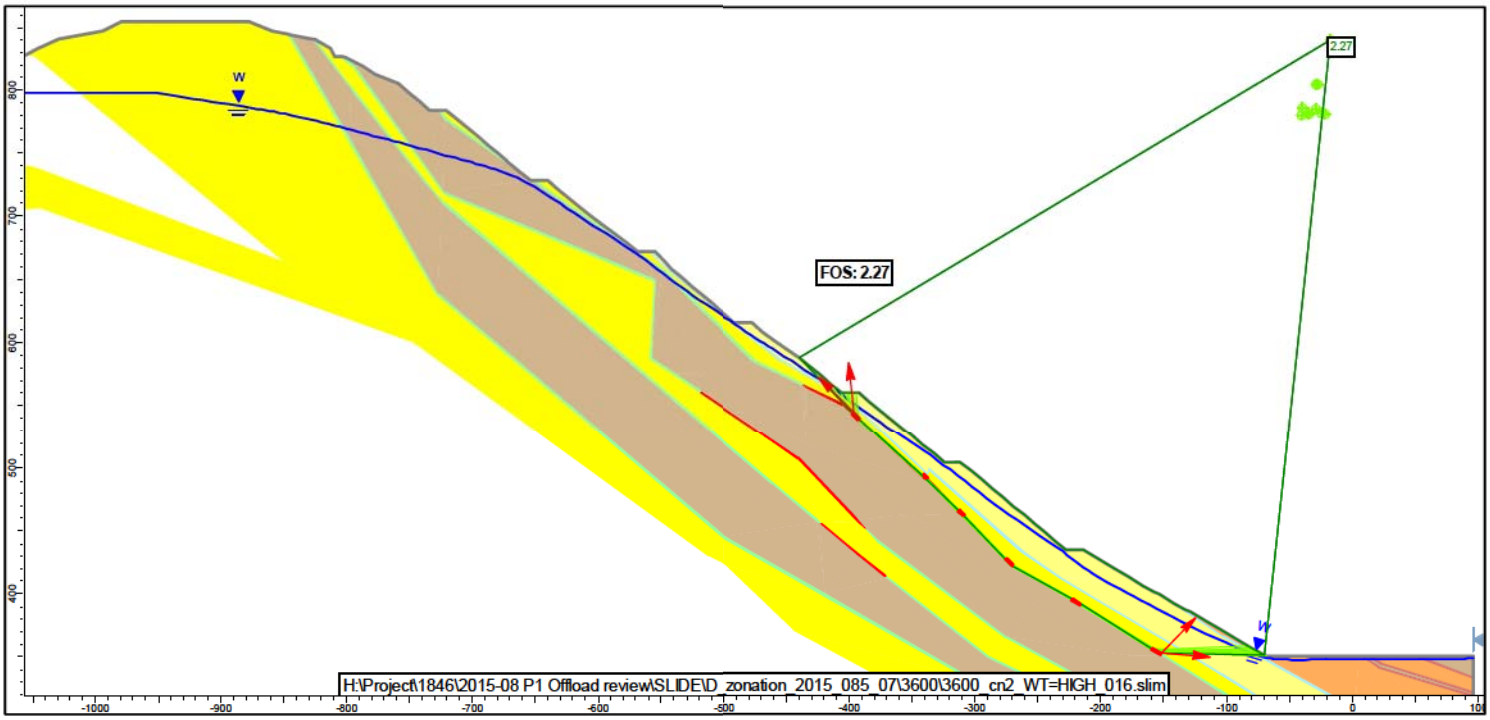


Fig. D41: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.27 between the 350 and 560m levels.

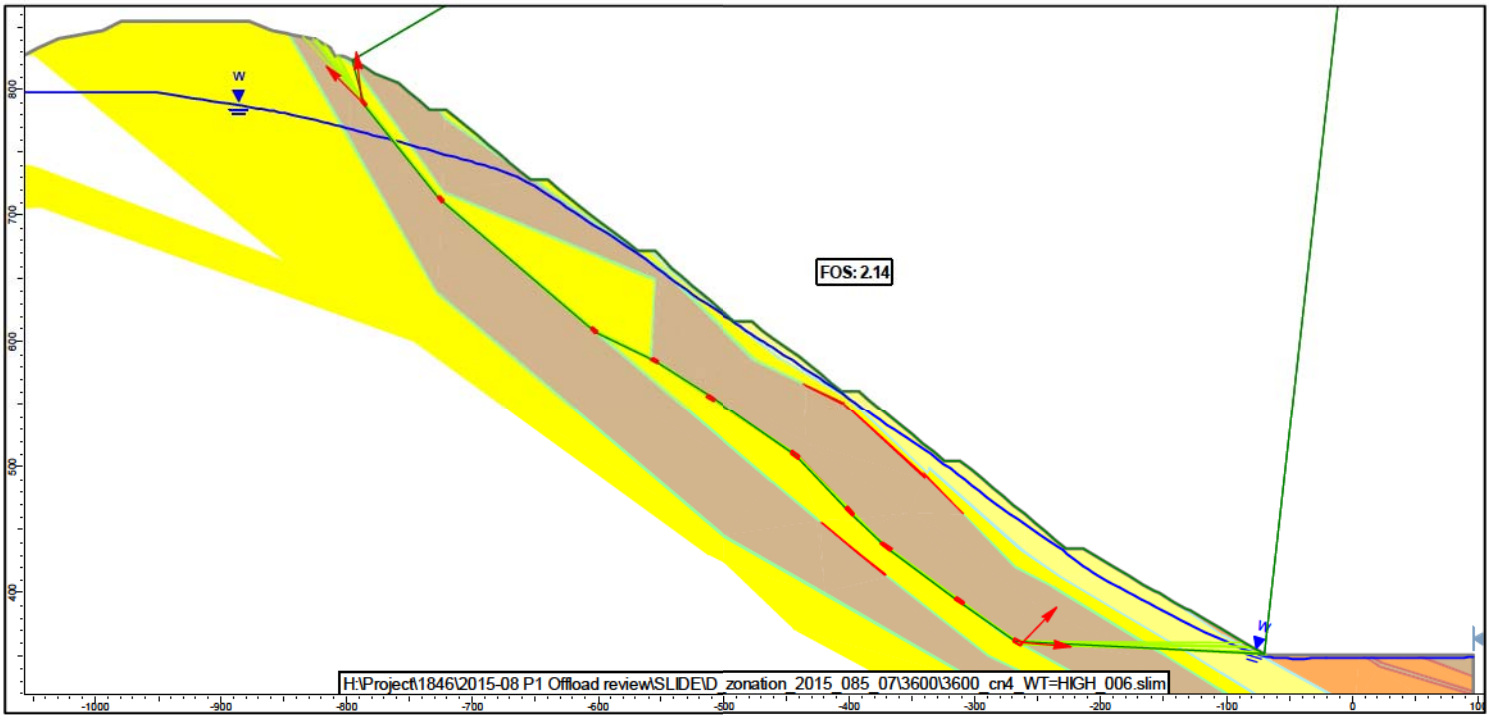


Fig. D42: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.14 between the 350 and 826m levels.

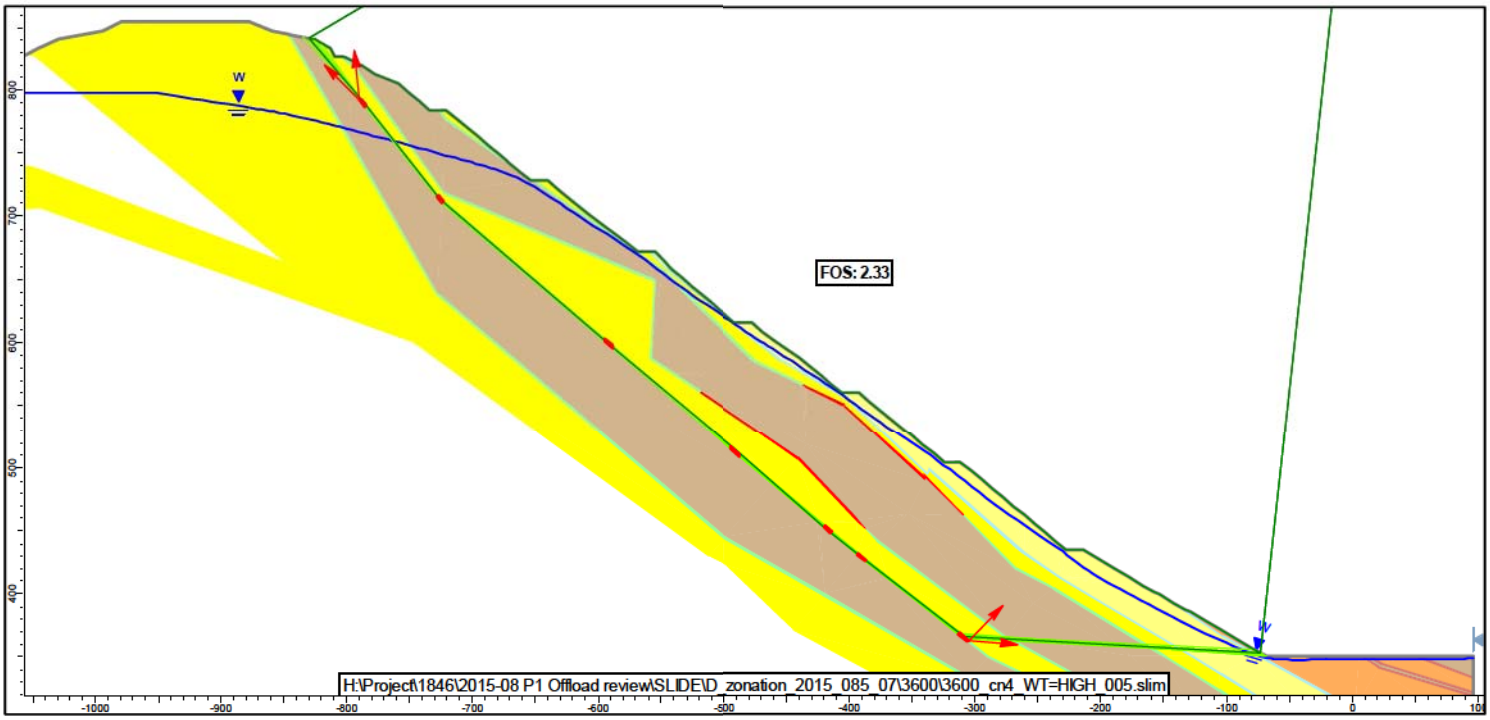


Fig. D43: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.33 between the 350 and 840m levels.

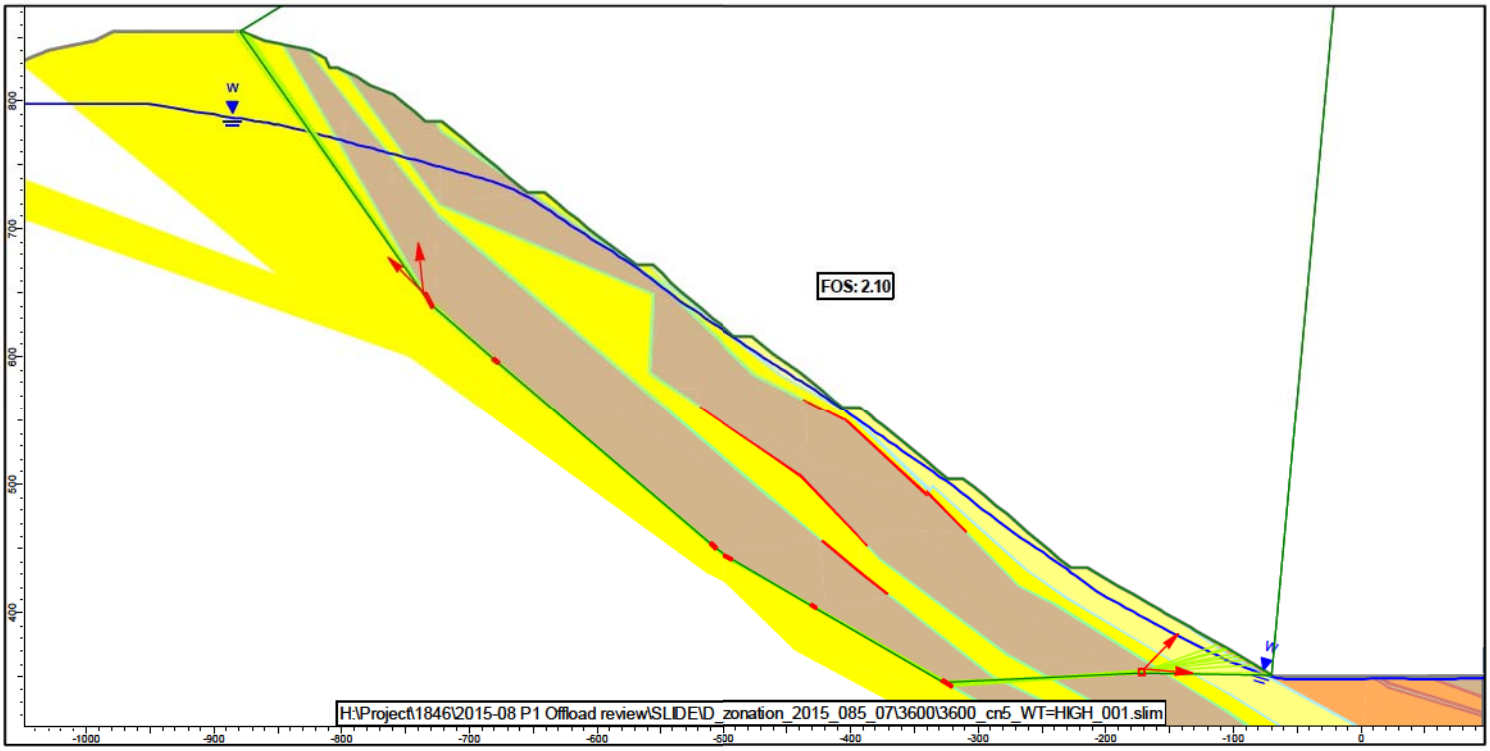


Fig. D44: Section 3600 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.10 between the 350 and 854m levels.

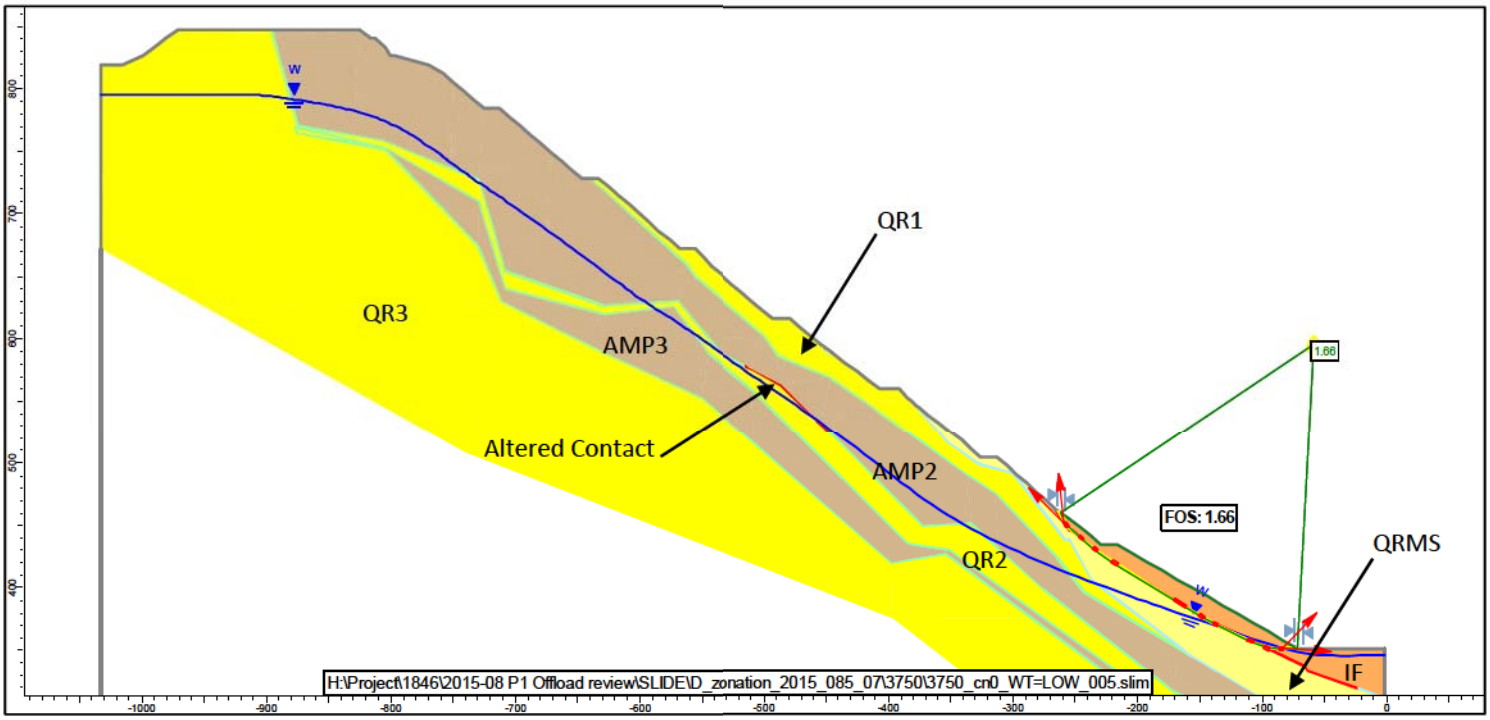


Fig. D45: Section 3750 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.66 between the 350 and 460m levels.

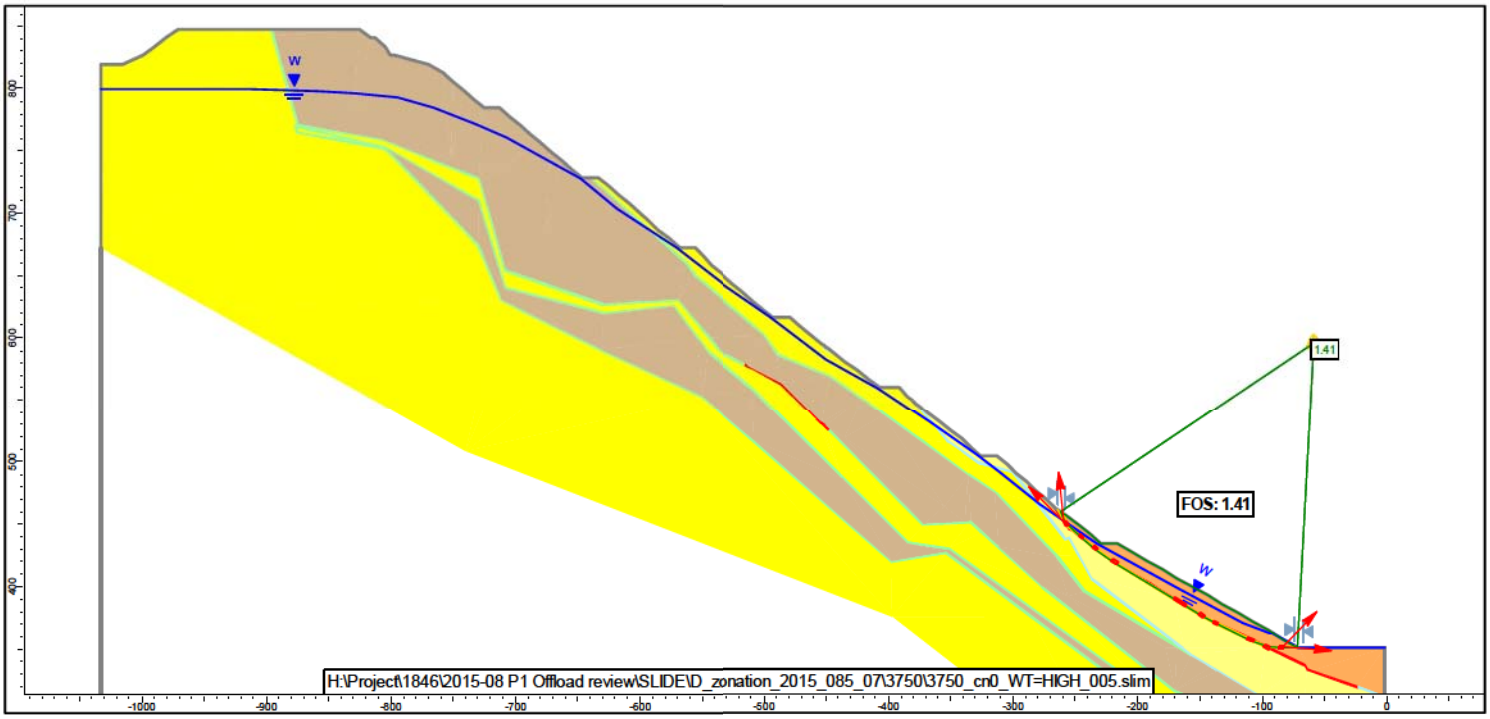


Fig. D46: Section 3750 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.41 between the 350 and 460m levels.

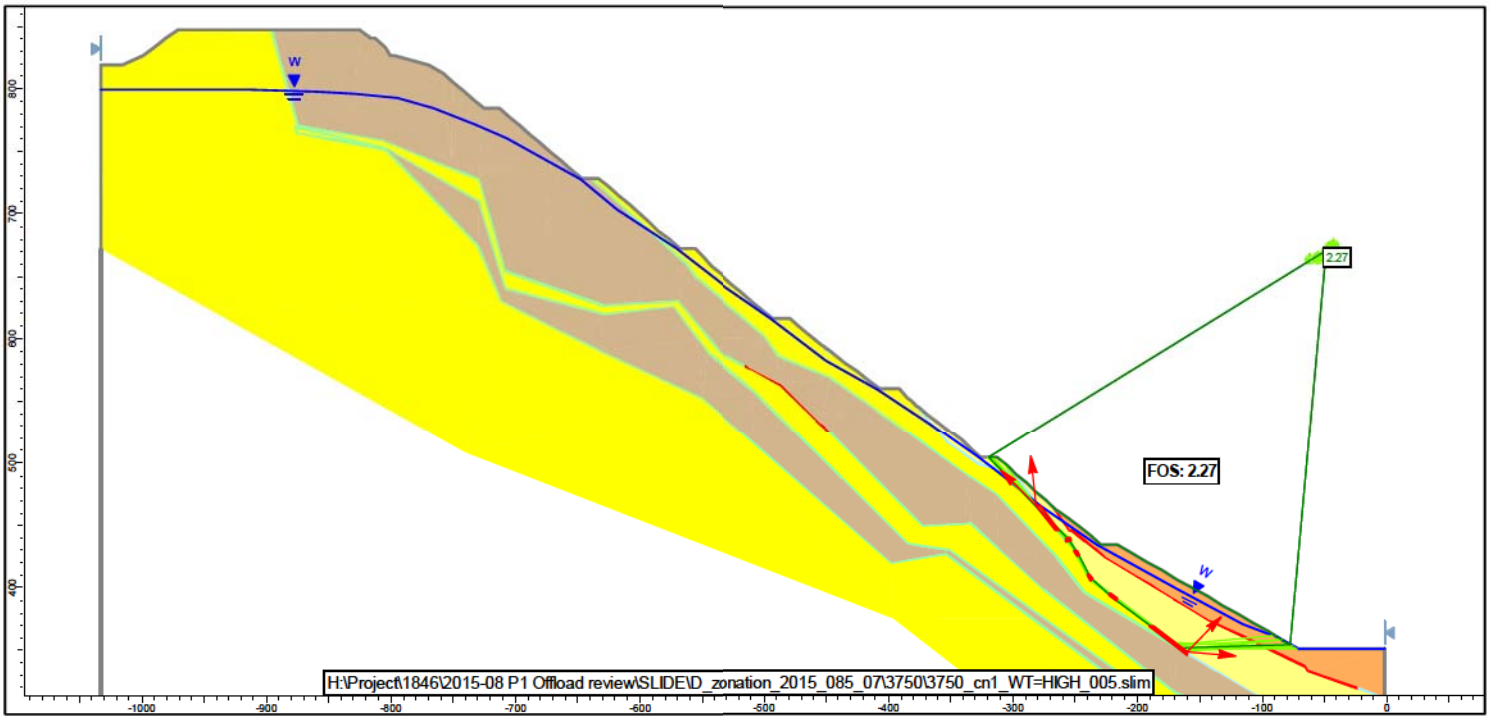


Fig. D47: Section 3750 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.27 between the 350 and 504m levels.

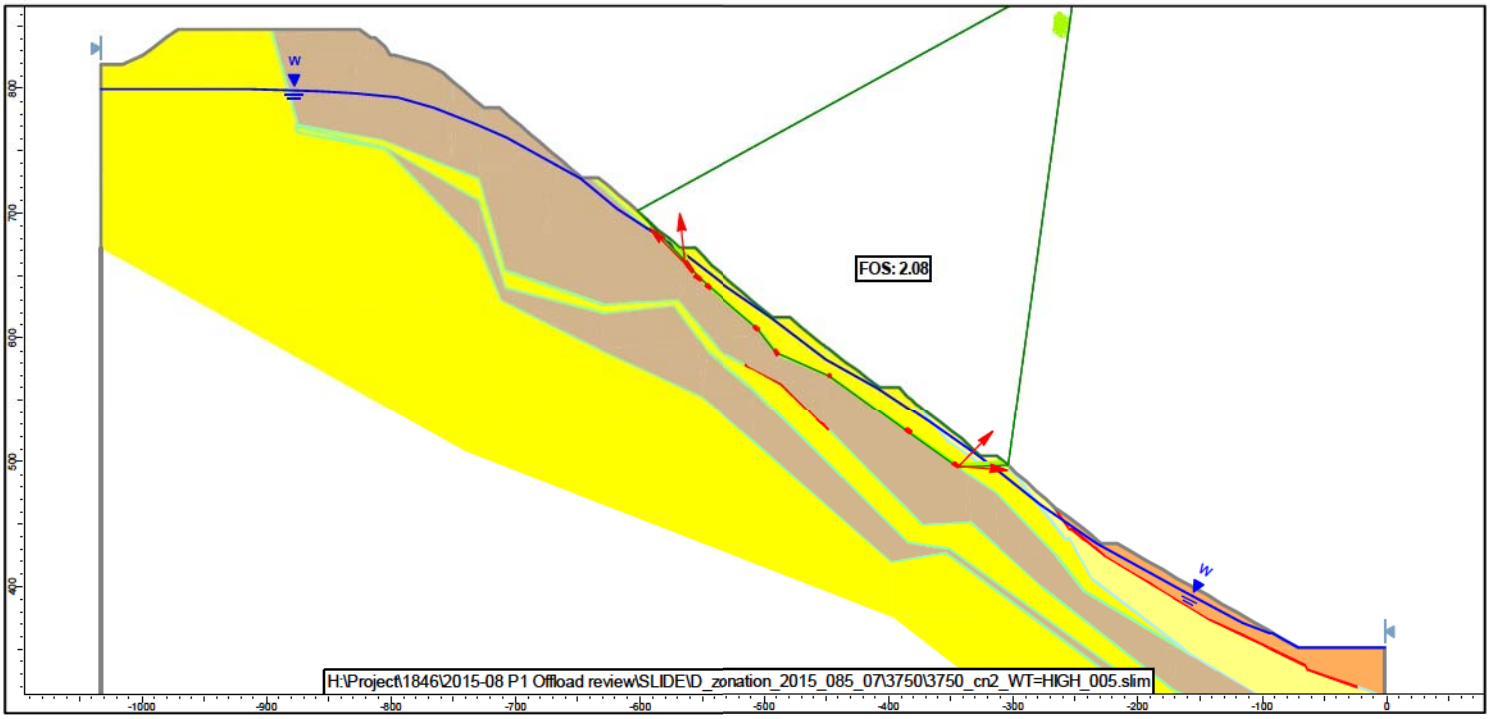


Fig. D48: Section 3750 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.08 between the 504 and 672m levels.

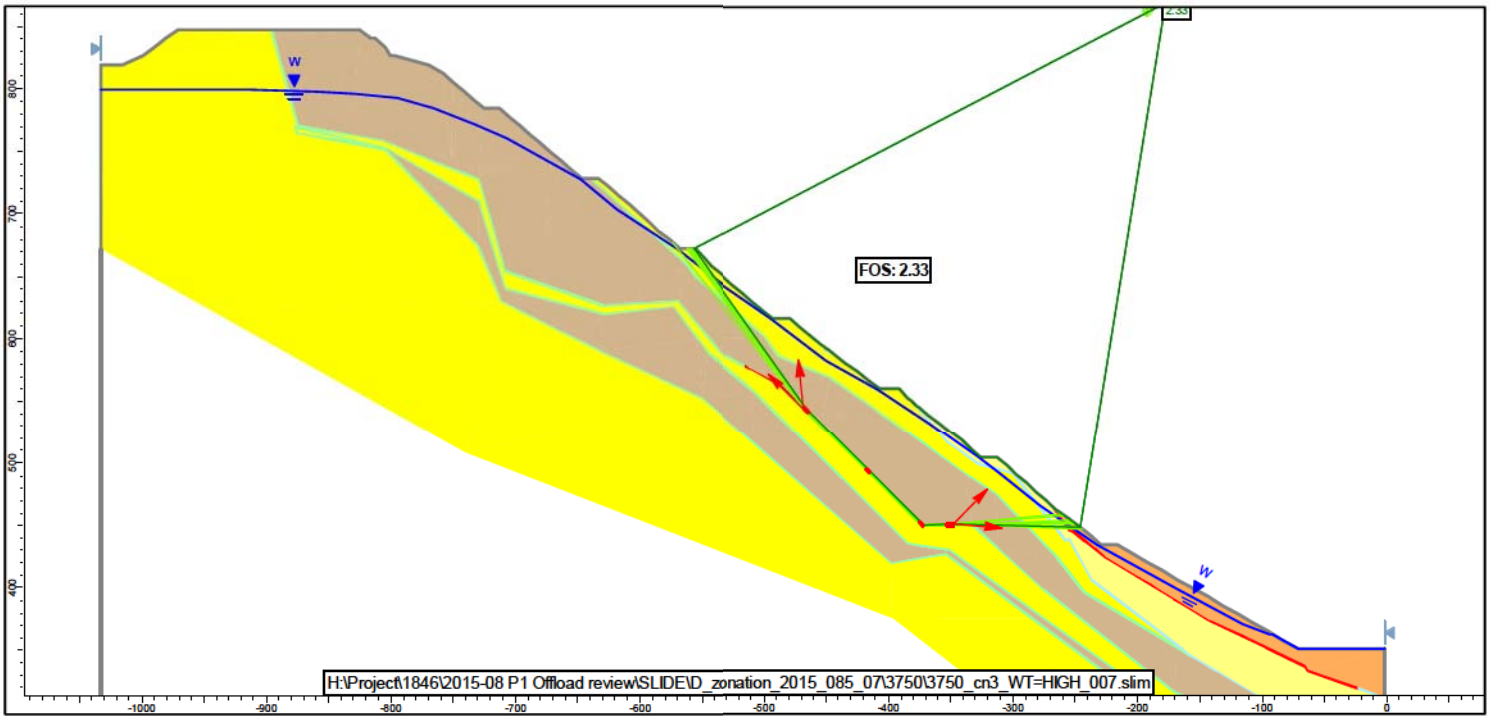


Fig. D49: Section 3750 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.33 between the 434 and 672m levels.

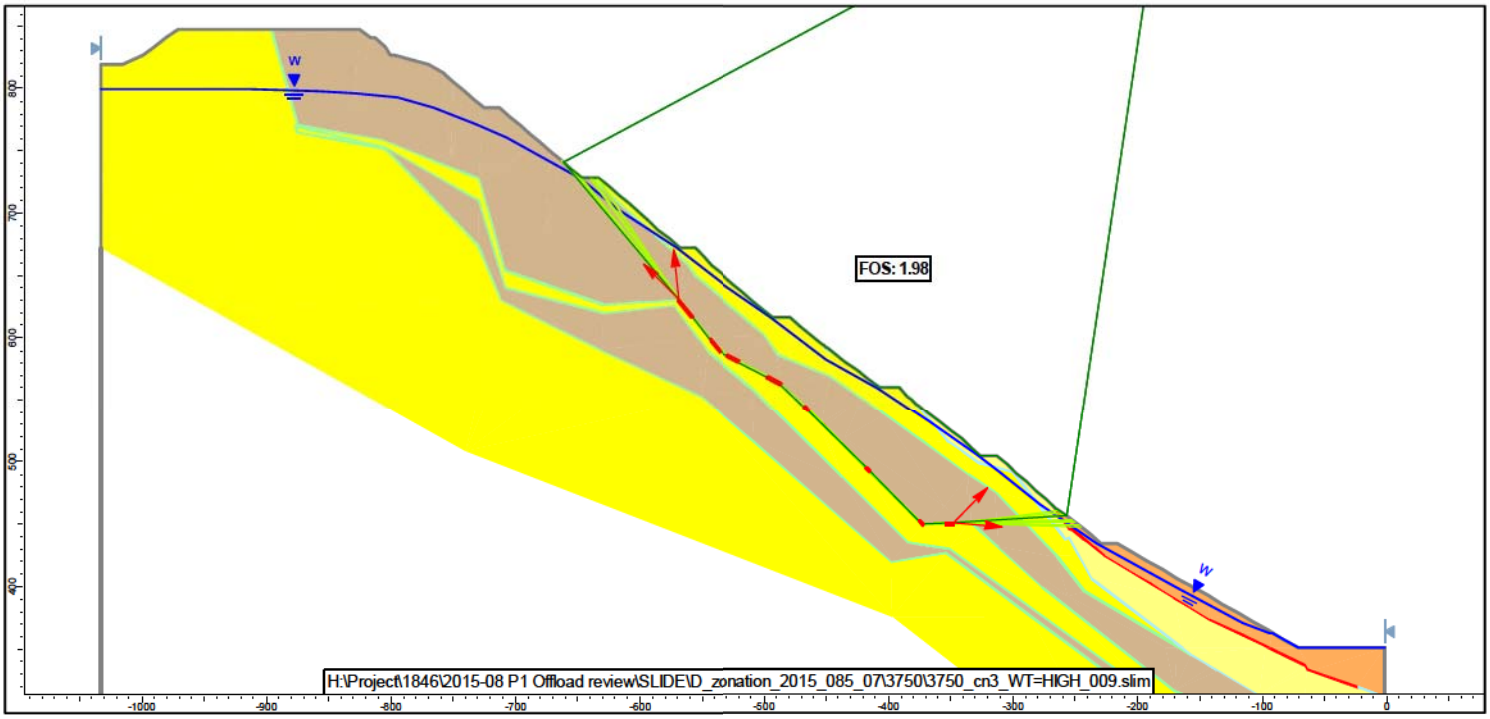


Fig. D50: Section 3750 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.98 between the 434 and 728m levels.

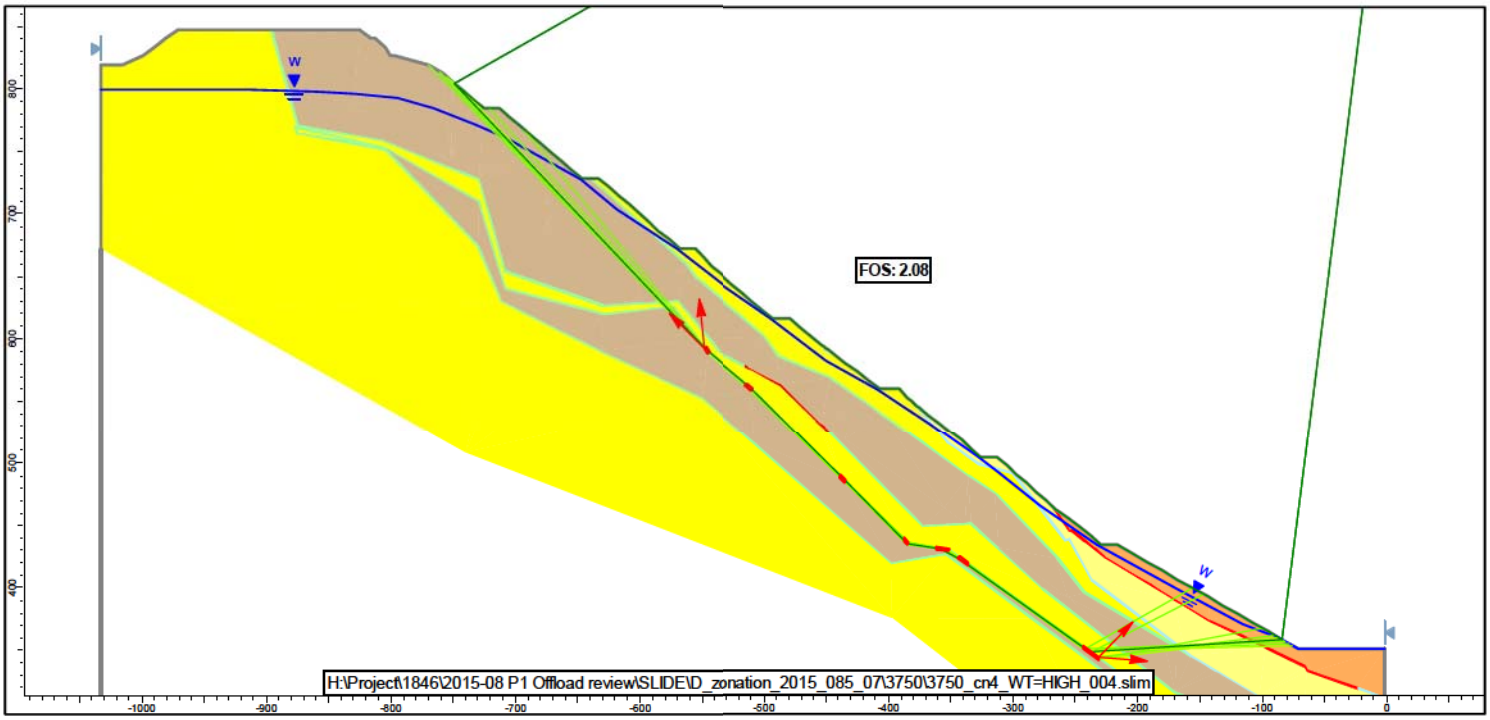


Fig. D51: Section 3750 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.08 between the 350 and 784m levels.

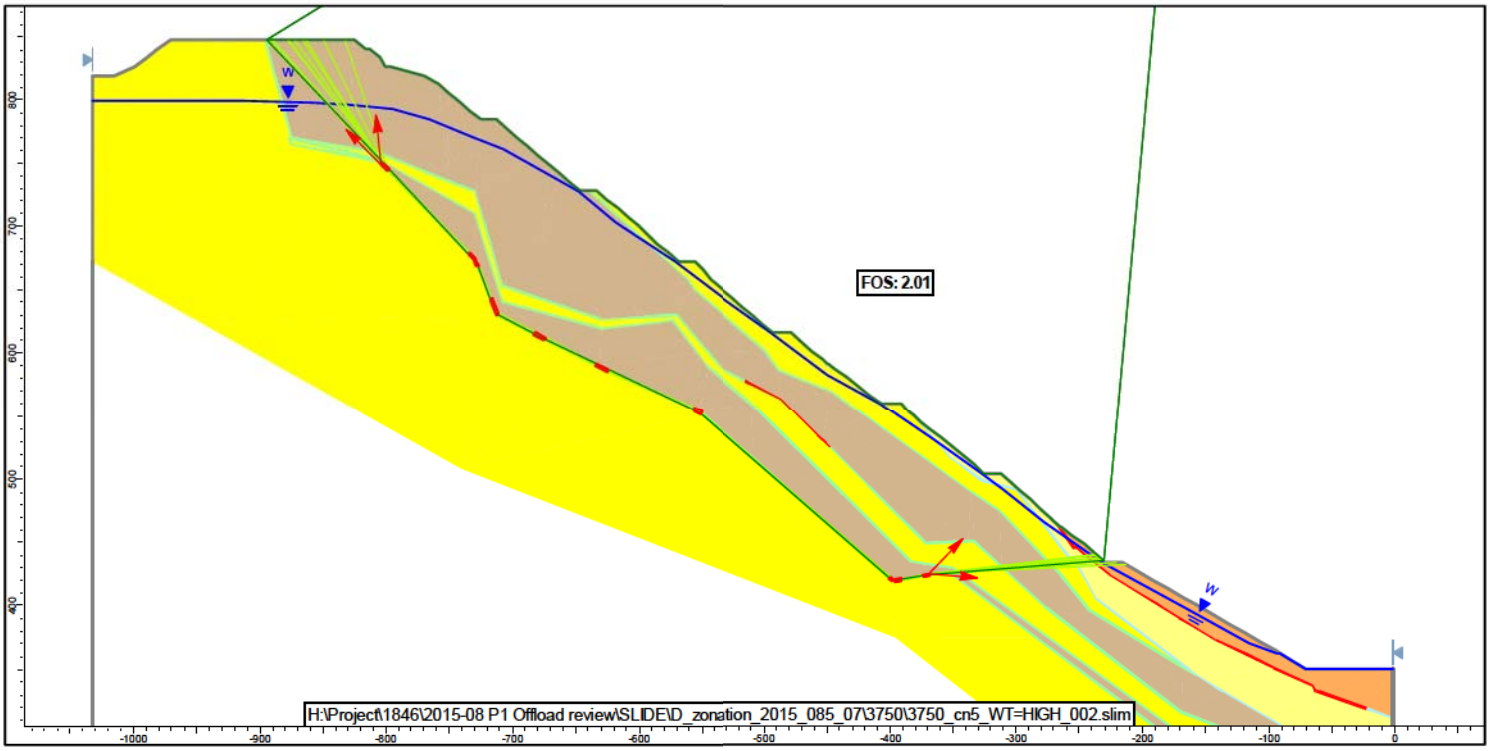


Fig. D52: Section 3750 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.01 between the 434 and 847m levels.

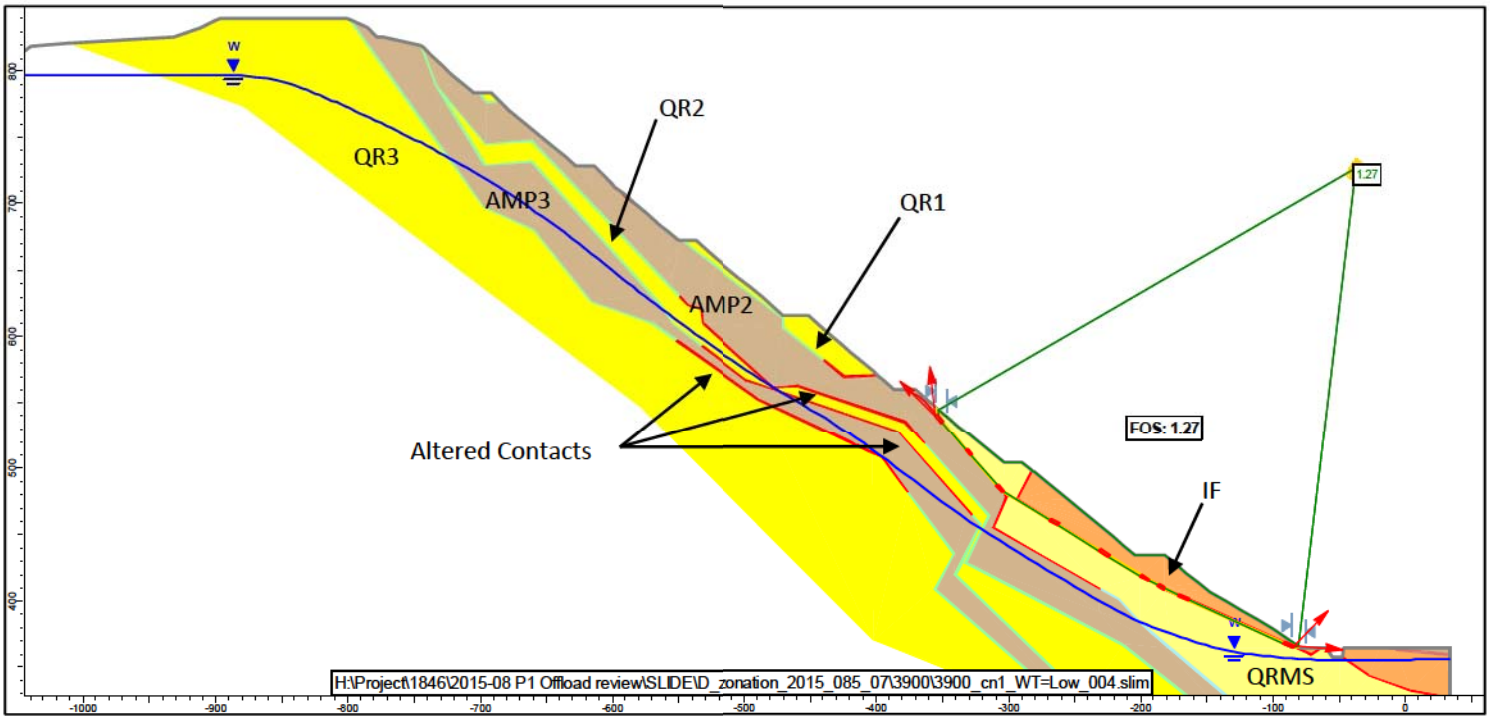


Fig. D53: Section 3900 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.27 between the 364 and 560m levels.

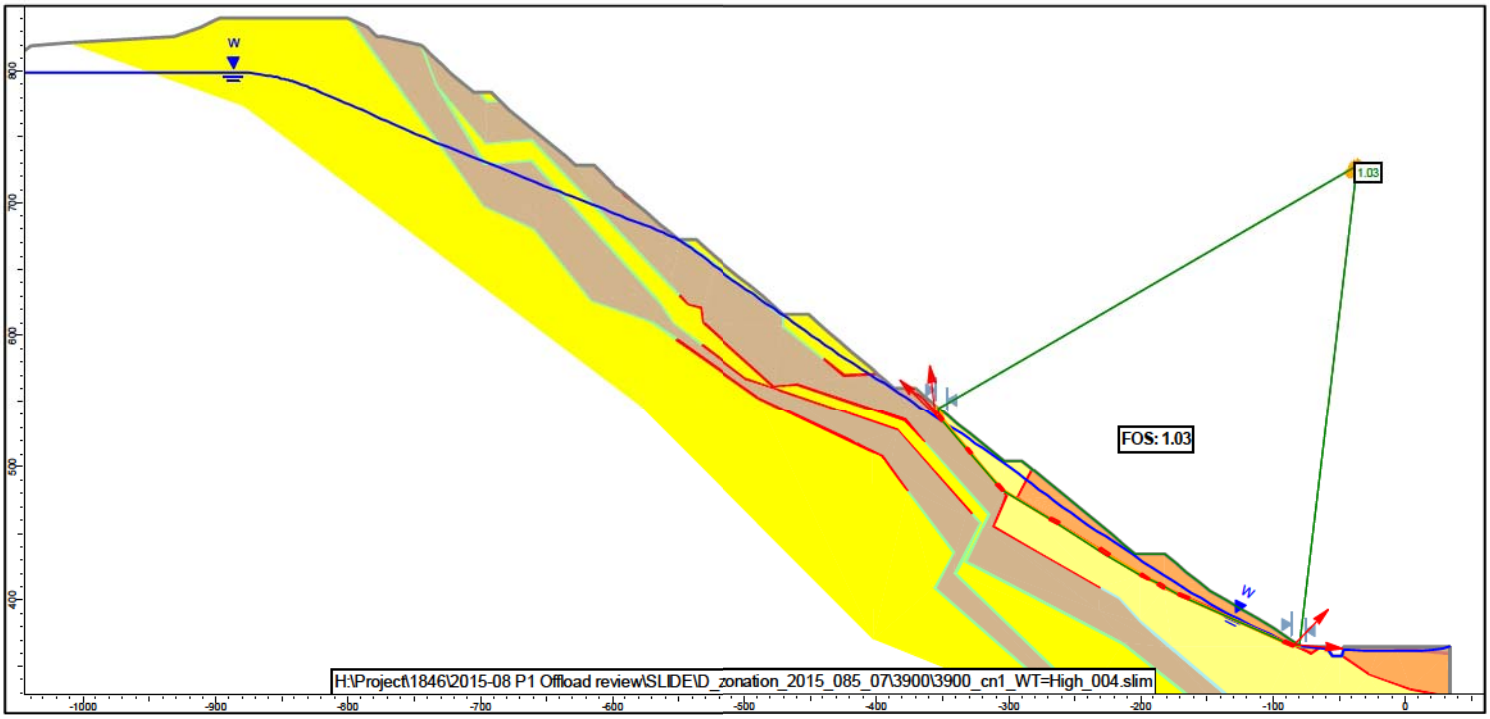


Fig. D54: Section 3900 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.03 between the 364 and 560m levels.

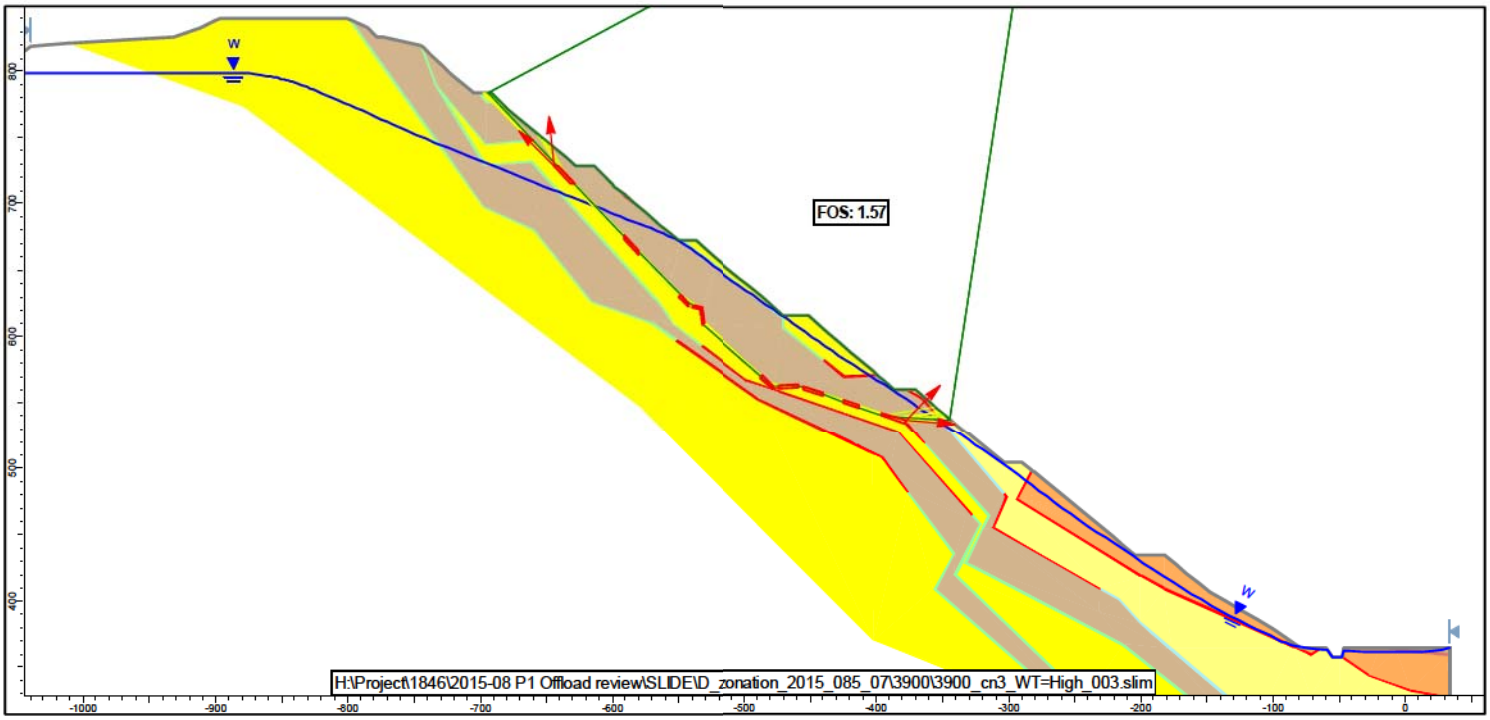


Fig. D55: Section 3900 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.57 between the 537 and 784m levels.

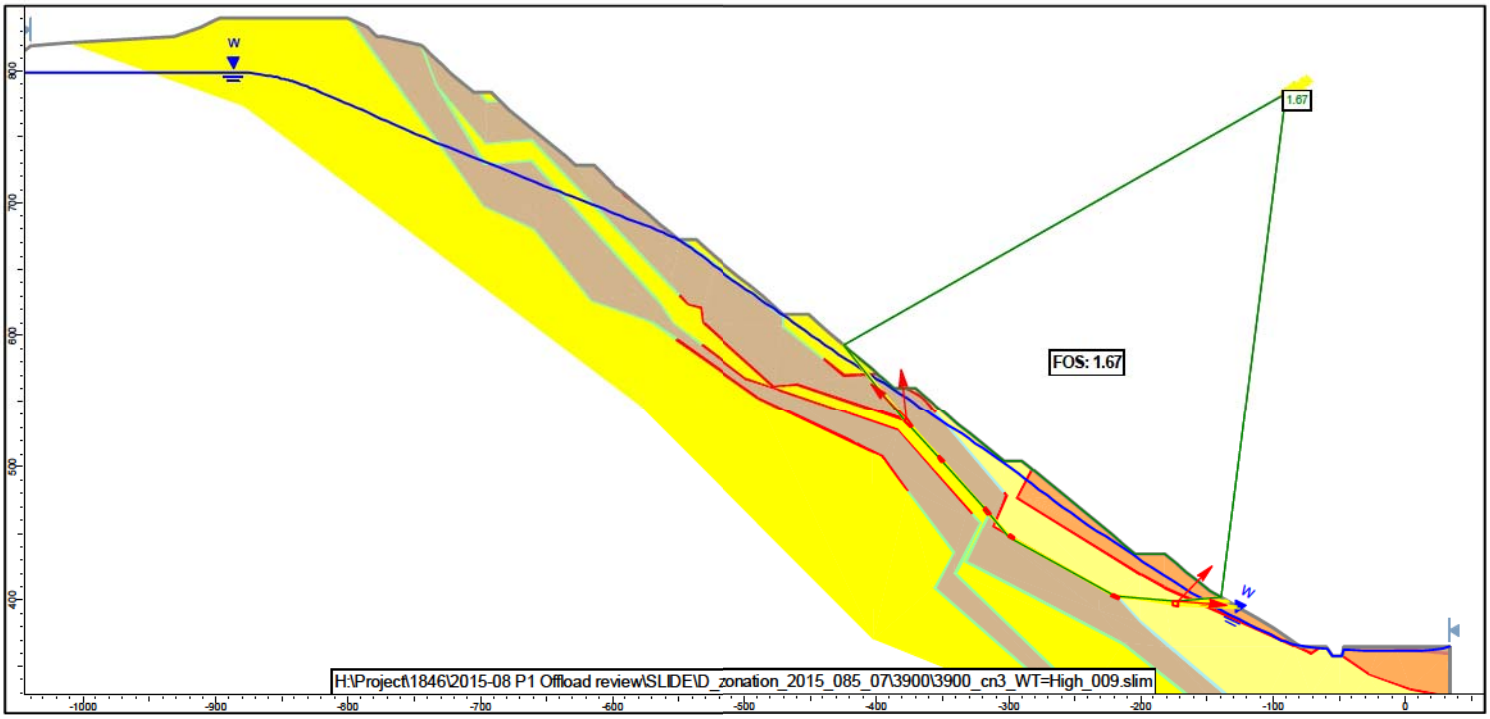


Fig. D56: Section 3900 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.67 between the 400 and 593m levels.

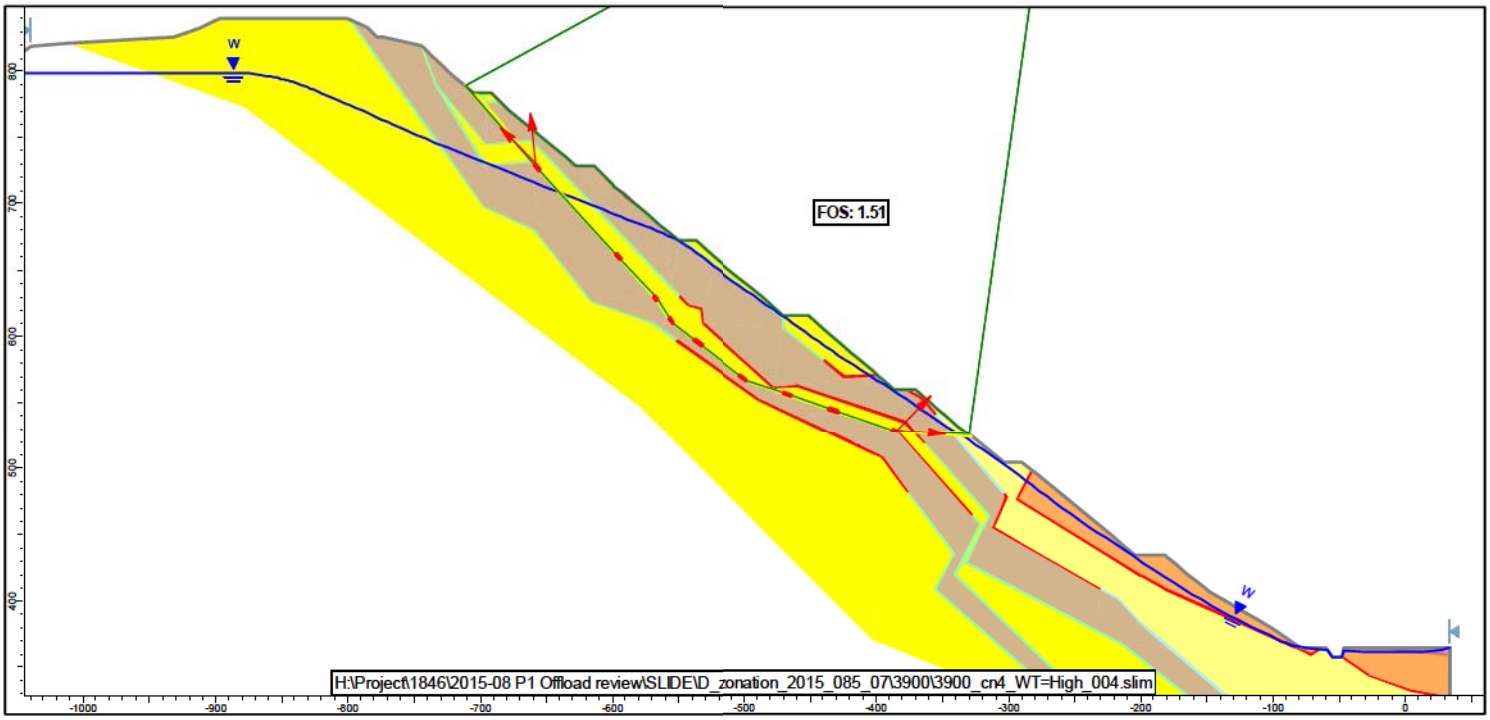


Fig. D57: Section 3900 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.51 between the 525 and 784m levels.

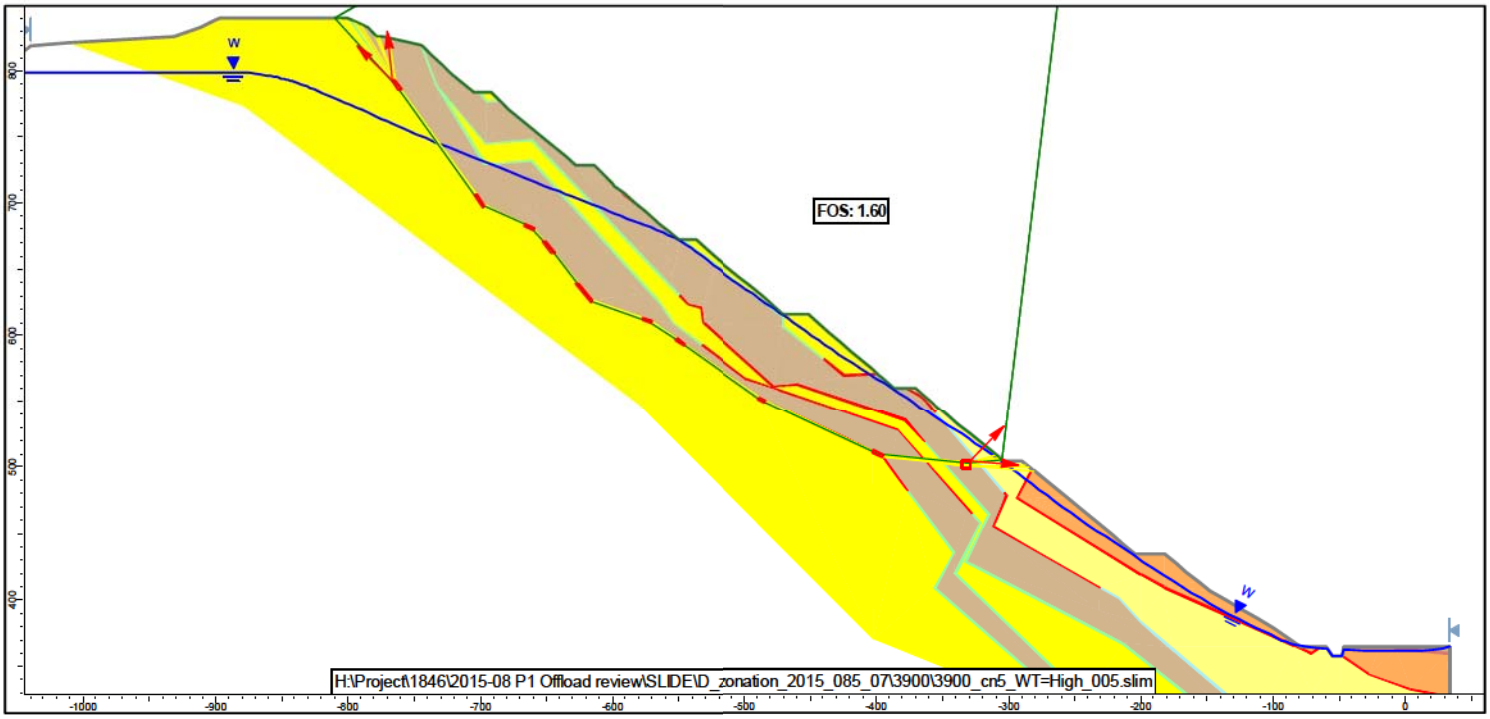


Fig. D58: Section 3900 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.60 between the 504 and 840m levels.

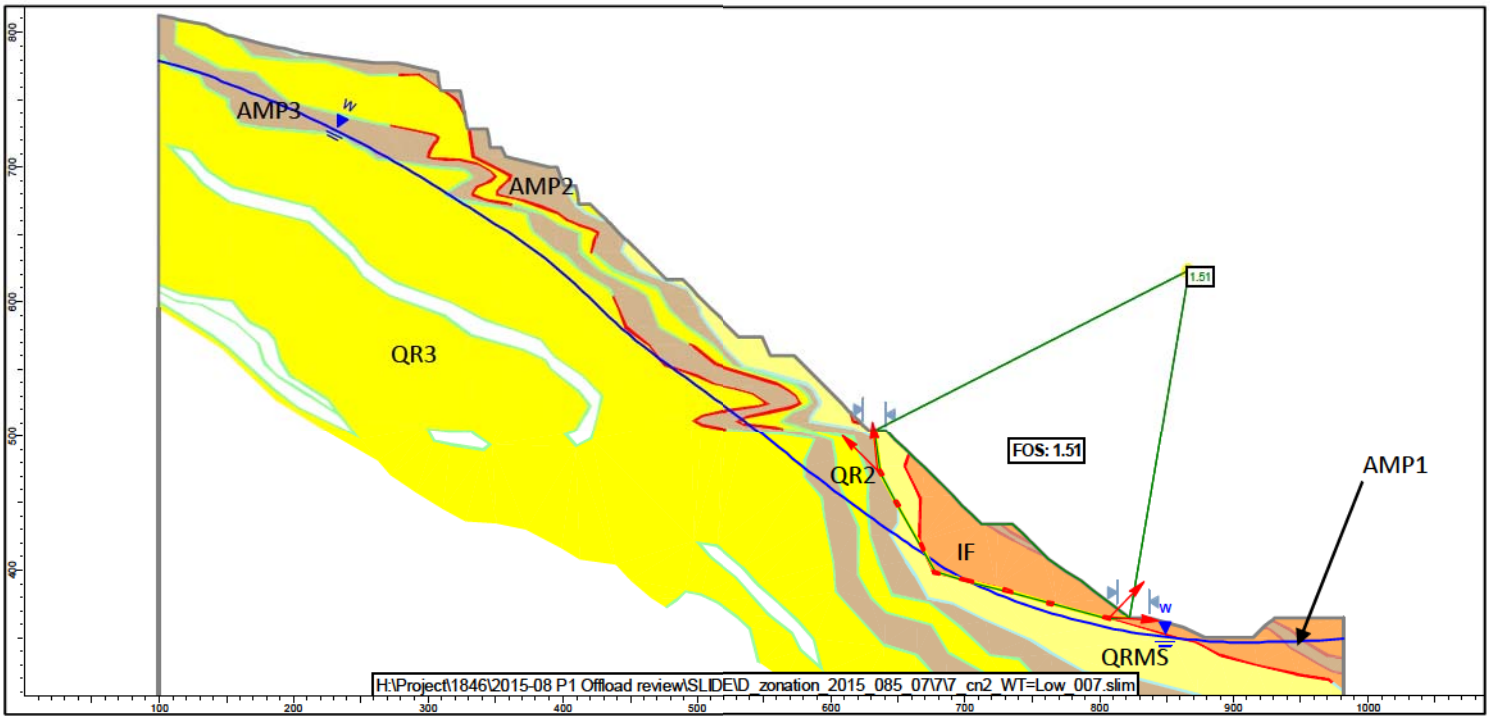


Fig. D59: Section 7 - SLIDE analysis of the 2015 South Wall Mine Plan assuming depressurized slope. Minimum FOS = 1.51 between the 364 and 504m levels.

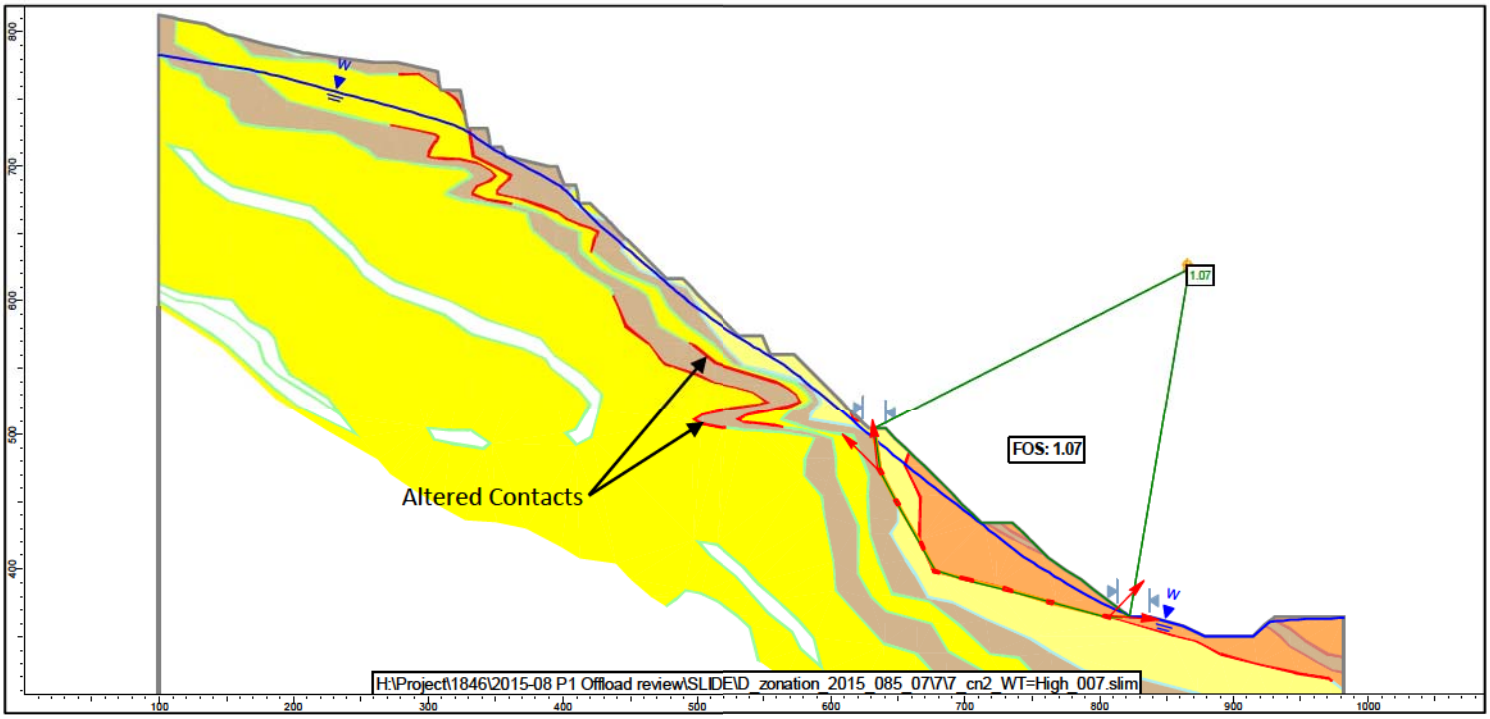


Fig. D60: Section 7 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.07 between the 364 and 504m levels.

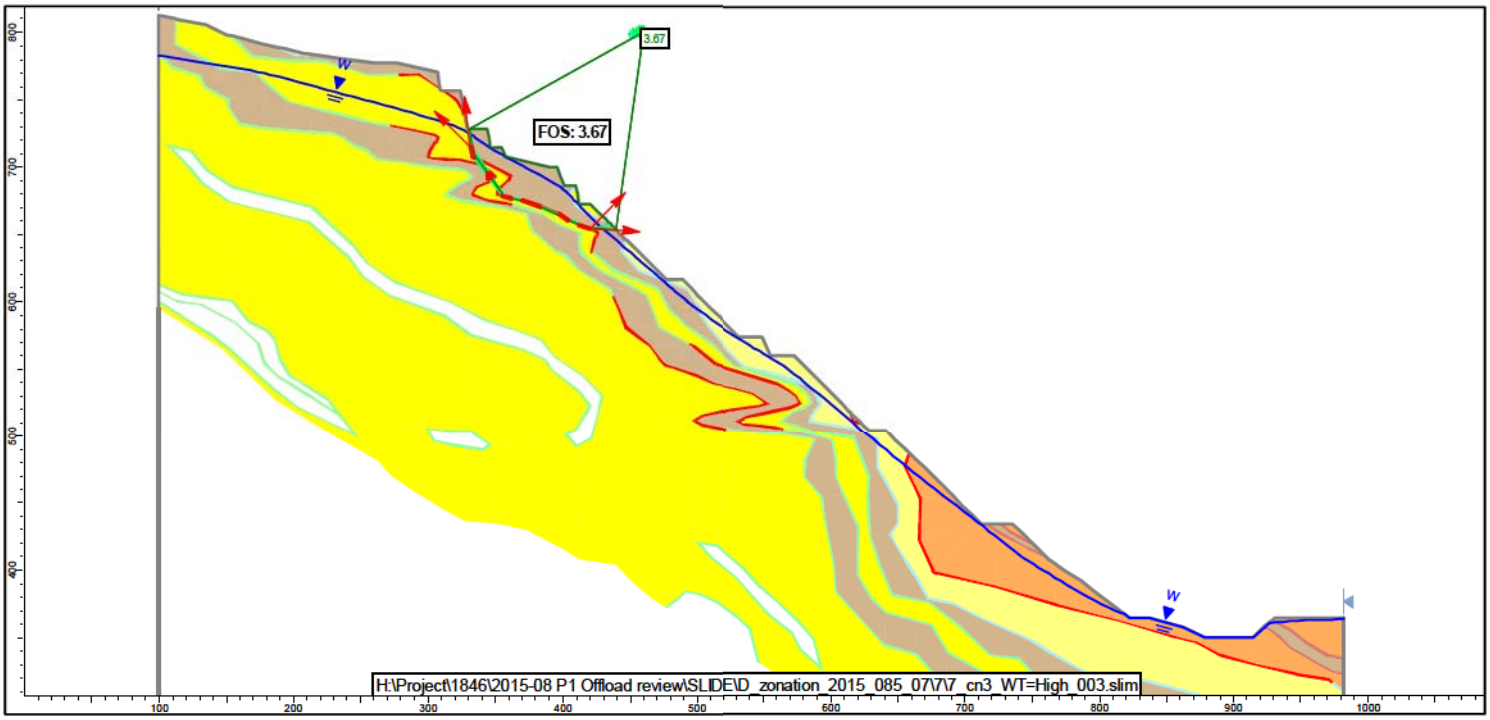


Fig. D61: Section 7 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 3.67 between the 653 and 728m levels.

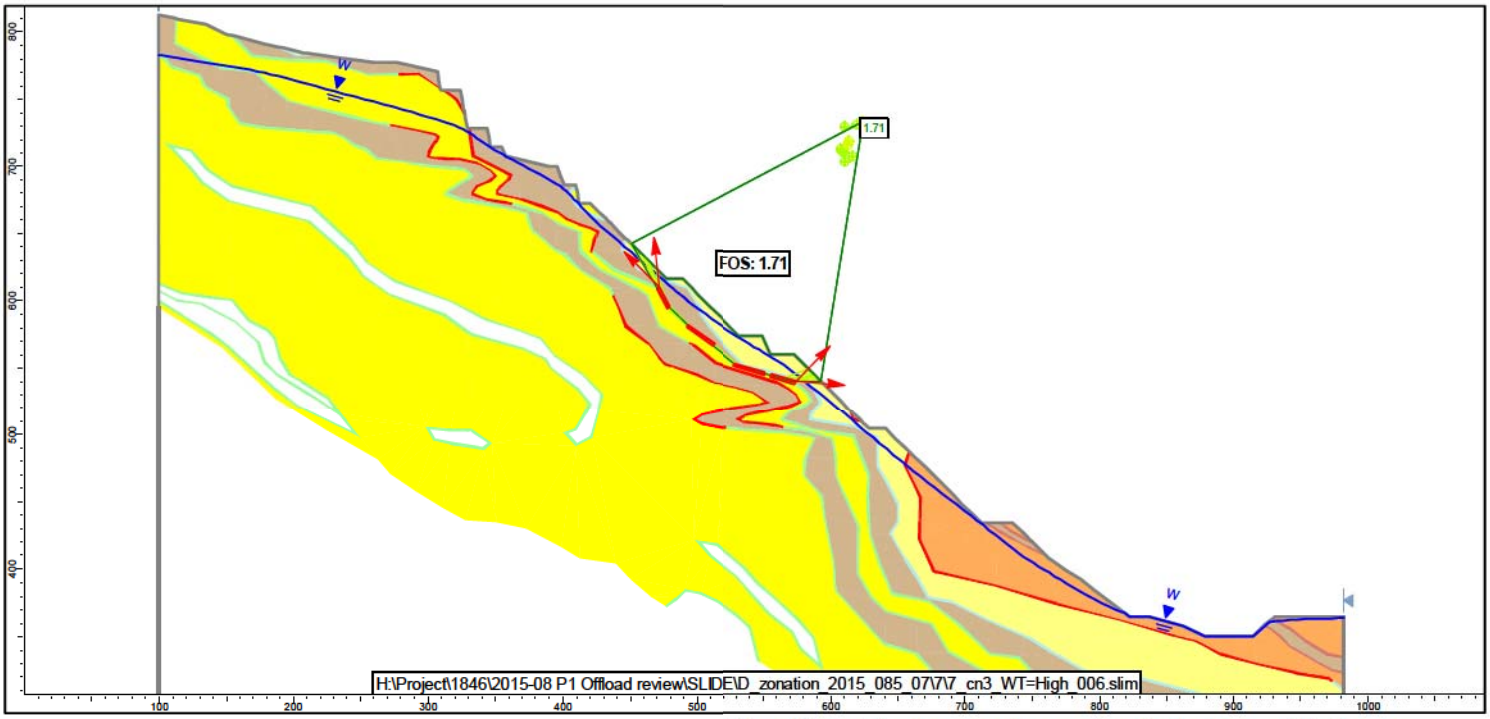


Fig. D62: Section 7 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.71 between the 540 and 642m levels.

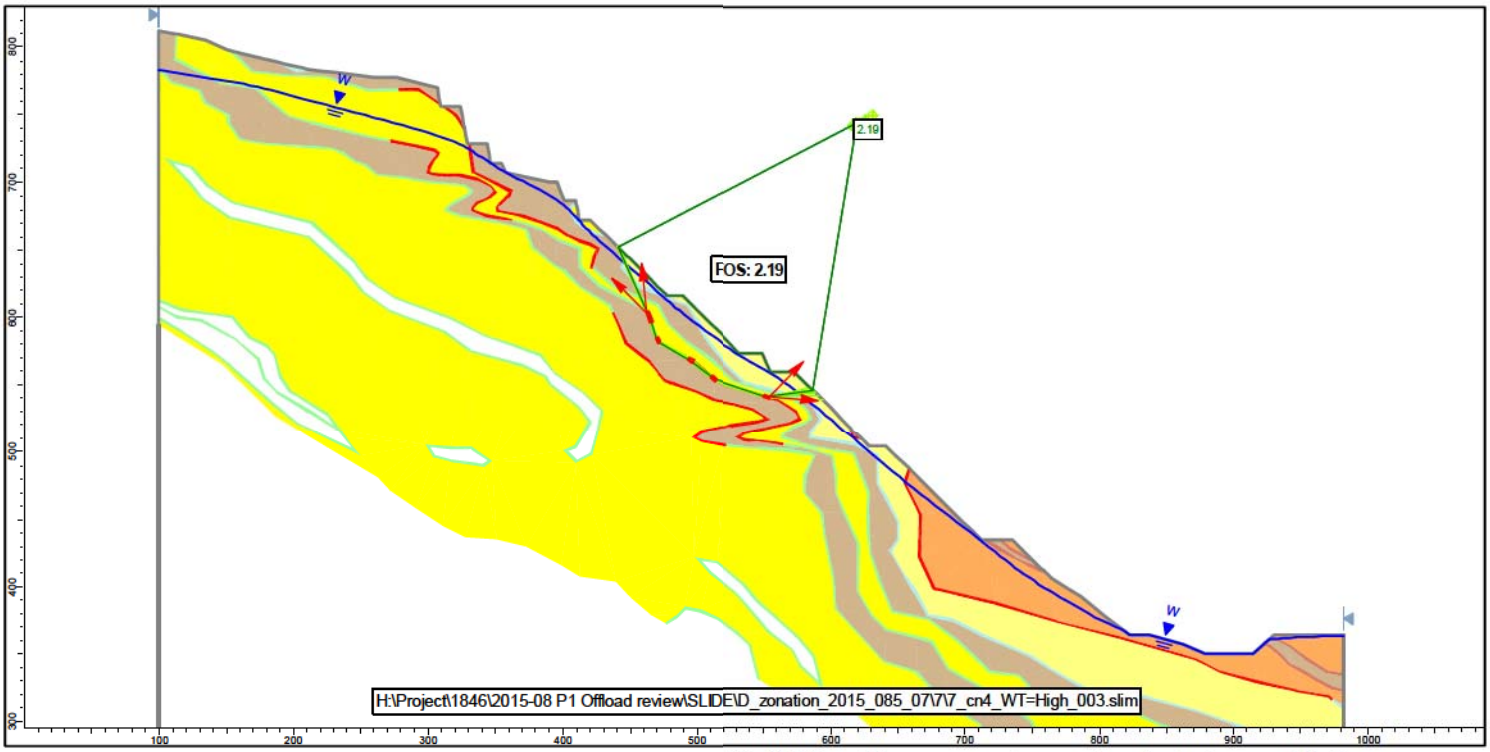


Fig. D63: Section 7 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 2.19 between the 546 and 651m levels.

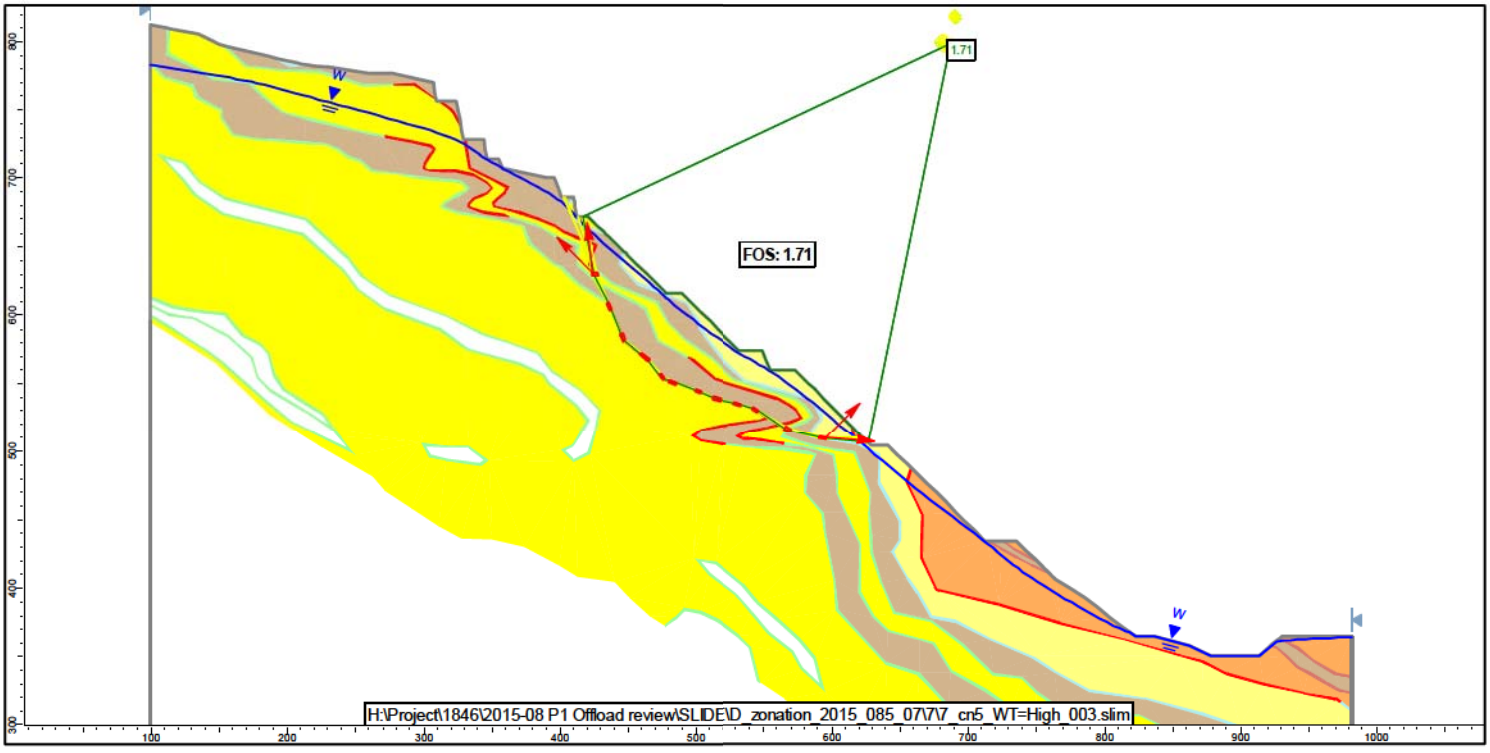


Fig. D64: Section 7 - SLIDE analysis of the 2015 South Wall Mine Plan assuming saturated slope. Minimum FOS = 1.71 between the 504 and 672m levels.

ANNEXE

F-2 ANALYSE DE STABILITÉ FOSSE IRÈNE (PITEAU, 2016b)

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ARCELORMITTAL MINES CANADA

GEOTECHNICAL
SLOPE STABILITY ANALYSIS AND DESIGN
FOR THE 2015 PIT IRÈNE MINE PLAN

Prepared by

PITEAU ASSOCIATES ENGINEERING LTD.

FILE 1846-16-R02 **MAY 2016**

EXECUTIVE SUMMARY

This report details the results of the 2015 geotechnical and hydrogeological field investigations, laboratory testing, and stability assessments carried out by Piteau Associates Engineering Ltd. (Piteau), and provides slope design criteria and recommendations for mining the ultimate pit slopes of Pit Irène, operated by ArcelorMittal Mining Canada (AMMC).

GEOTECHNICAL INVESTIGATIONS

A geotechnical investigation program was conducted to assess site geotechnical conditions and gather data for the preparation of geotechnical design criteria and slope recommendations for Pit Irène (Fig. 1). The investigations consisted of geomechanical logging and core orientation of geotechnical drillholes, photogrammetry of exposed benches, sampling of core for rock strength testing, and piezometer installations.

The following geomechanical, structural, and hydrogeological data were collected:

- 16 geotechnical NQ3 drillholes, totalling 2546m;
- geomechanical core logging from all 16 coreholes, including parameters to determine Rock Mass Rating (RMR) after Bieniawski (1976);
- 545 joint and 142 bedding joint measurements from photogrammetry carried out by Piteau;
- 656 discontinuity measurements from photogrammetry carried out by AMMC;
- 134 fault, 968 joint, and 146 bedding joint measurements from oriented core, using the CorientR core orientation system developed by Fordia;
- 1055 Point Load Index (PLI) tests at nominal 3m intervals;
- laboratory testing of intact rock and natural discontinuity core samples, carried out by AMEC Foster Wheeler (AMEC) in Hamilton, Ontario, including:
    - 25 uniaxial compressive strength (UCS) tests,
    - 27 triaxial compressive strength (TCS) tests,

  - 15 Brazilian indirect tensile strength (BTS) tests,
  - 15 direct shear (DS) tests;
- four vibrating wire piezometers (VWPs) installed in two of the 2015 geotechnical drillholes (two per drillhole).

ENGINEERING GEOLOGY

The local sequence at the Irène deposit starts with gneiss rocks interpreted to be Archean in age, overlain by the Wishart Formation quartzite. The Sokoman Iron Formation overlies the quartzite. A few relatively thin quartz-muscovite schist bands are interlayered with the Iron Formation. The Iron Formation is overlain by graphite gneisses and schists that are the metamorphic equivalent of the Menihek Formation. Mafic sills that vary from 1m to more than 50m in thickness are found at different stratigraphic levels.

At least 13 distinct lithologies have been recognized in the 2015 drill core logs. Some of these lithologies represent slight mineralogical gradations and many are sufficiently similar to be considered as a single geotechnical unit. On this basis, five main geotechnical units (i.e., Gneiss, Quartz Rock, Iron Formation, Quartz Rock Mica Schist, and Amphibolite) have been identified for design purposes. These main geotechnical units are expected to compose the majority of the walls of the proposed Pit Irène, as illustrated on Fig. 2.

The proposed 2015 Pit Irène Mine Plan (v7.0) is expected to be excavated in seven principal structural domains. These domains are referred to as the North, East, Southeast, Central, South, West, and Northwest domains, as shown on Fig. 2. Boundaries between structural domains are delineated mainly based on the orientation of bedding joint planes within the proposed pit area and by interpretation of lithologic contacts projected to the Pit Irène Mine Plan.

Structural analysis of discontinuity data was carried out for each structural domain to determine the peak orientations of well-defined structural fabric for kinematic and anisotropic stability assessments. Peak discontinuity orientations are shown on stereonets included in Appendix A.

Rock mass strengths were assessed based on the results of geomechanical core logging, PLI testing, and laboratory strength testing of core from the 2015 geotechnical drilling program. Intact rock strength was determined by correlating PLI testing to UCS testing and, subsequently, logged

Hardness (H) to UCS from PLI. Values for the m_i strength parameter (Hoek et al., 2002) were derived using average values from UCS, TCS, and BTS strength testing. Discontinuity shear strengths were based on the results of laboratory testing and from joint roughness coefficient (JRC) and joint compressive strength (JCS) data from geomechanical logging of core from the 2015 geotechnical drilling program. Results of geomechanical core logging and rock mass strength parameters are summarized in Tables II and III.

Rock mass quality is generally classified as good to very good, with Bieniawski (1976) average RMR values weighted based on core length ranging from 74 to 84 and UCS_{PLI} (UCS estimated from PLI testing) ranging from 69 to 284 MPa. Gneiss is the least competent of the geotechnical units with a weighted-average RMR of 74 and a weighted-average UCS_{PLI} of 69 MPa. Quartz Rock is the most competent geotechnical unit with a weighted-average RMR of 84 and a weighted-average UCS_{PLI} of 284 MPa.

Although no major faults parallel to bedding and lithologic contacts were observed in the pit area, it is likely that some of the bedding joints and contact surfaces have undergone shearing during folding and deformation. Contacts that were logged in core as weak or altered were identified and incorporated into the two-dimensional Slide® limit equilibrium analyses, as indicated in Appendix G.

HYDROGEOLOGY

For the present study, 2015 piezometric data were collected and reviewed, and phreatic surfaces were reinterpreted along representative sections cut through the proposed Pit Irène Mine Plan.

Due to the limited groundwater monitoring points and hydrogeological information available for Pit Irène, and considering the proximity of Paul's Peak Pit, which is located in a similar geologic setting, the hydrogeological model for Pit Irène was developed in analogy to the one developed for Paul's Peak.

Two cases were considered for the prediction. The first case predicted groundwater responses to mining only without considerations to dewatering wells and drains. The second case considered a series of 150 m-long horizontal drains, installed upwards at a 5° angle along the face of the

bench. The drains were designed to be staggered on two benches with a lateral distance of 150m between drains. The drains were assumed to drain up to about half of their lengths.

SLOPE STABILITY ANALYSES AND DESIGN

Slope stability analyses for the proposed Pit Irène Mine Plan involved assessment of kinematically possible failure modes (i.e., wedge, planar, and toppling) exploiting geologic structural discontinuities that could result in shallow failure of individual benches and deeper failure of multibench and interramp slopes. Slopes were also assessed for the potential for bench- or multibench-scale failures in the footwall involving shearing through contact zones or bedding planes (i.e., bilinear slab failure analysis). Results of these assessments were used to develop recommendations for preliminary interramp slope angles (IRAs). Analyses were then conducted, in conjunction with assessments of rock mass quality, to assess the potential for deep-seated, structurally controlled or non-circular, rotational rock mass failure of interramp and overall slopes. The IRAs were adjusted where necessary to reflect the recommended slope designs assuming a minimum required Factor of Safety (FoS) of 1.2 for interramp and overall slopes.

CONCLUSIONS AND RECOMMENDATIONS

Recommended slope designs for the Pit Irène Mine Plan consist of six design sectors as summarized in Tables V and VI, and shown on Fig. 19. The slope designs are summarized as follows:

- Recommended bench designs consist of a bench face angle (BFA) of 80° for presplit blasting and a double bench height of 28m in all design sectors in the hanging wall (Design Sectors II to VI).
- In the footwall the average dip of Joint Set JS1 (i.e., bedding joints) in any given area is considered as the BFA in that portion of the slope. Recommended bench stack heights for the footwall (Design Sector I) are specified based on the average dip of JS1 as summarized in Table V.
- Design bench widths for the various design sectors in the hanging wall (Design Sectors II to VI) are calculated based on the design BFA, bench heights, and IRAs in Table VI. For the footwall, an effective catch bench width of 13m is specified. Design bench widths, with allotment for crest breakback, range from 13m in Design Sector I to 22.1m in Design Sector IV.

- In Design Sector II, the recommended IRA is 48° based on the performance of documented bench breakback. However, a potential increase in the design IRA to 53°, from the proposed 48°, was identified based on compound-angle kinematic assessments, provided that effective BFAs of 74° can be achieved at a 70% reliability (30% cumulative frequency).
- In Design Sector III, the recommended IRA is of 51°, based on the performance of documented bench breakback.
- In Design Sector IV, the recommended IRA is 46°, based on the performance of documented bench breakback. However, a potential increase in the design IRA to 52°, from the proposed 46°, was identified based on compound-angle kinematic assessments, provided that effective BFAs of 72° can be achieved at a 70% reliability (30% cumulative frequency).
- In Design Sector V, the recommended IRA is 53°, based on the performance of documented bench breakback.
- In Design Sector VI, the recommended IRA is 52°, based on the performance of documented bench breakback.

The ongoing development of Pit Irène will require regular monitoring using survey prisms in combination with an observational approach to access slope stability and performance. Depending on the performance of the slopes at Pit Irène, monitoring with a Slope Stability Radar (SSR) unit may be required.

Regular inspection of the crest and exposed benches on the pit walls is required to identify any signs of tension cracking, increased ravelling, or other signs of instability. The locations of observed tension cracks will be surveyed and added to geotechnical plans to allow assessment of slope deformation with respect to slope monitoring data and any potential mechanism(s) of instability. Any unusual signs of slope ravelling or distress should be communicated to the Mine Geotechnical Department and assessed accordingly.

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Fig. 18	Manhattan Diagram Showing Documented and Expected Bench Breakback and Recommended Feasibility-Level Design Bench and Interramp Slope Angles for the Pit Irène Mine Plan (v7.0)
Fig. 19	Recommended Feasibility-Level Slope Designs for the Pit Irène Mine Plan (v7.0)

1. INTRODUCTION

1.1 MINE DESCRIPTION

Mining of iron ore in the Mont-Wright area, located approximately 375 km north of Port Cartier, Québec, has been in progress since the early 1970s. The Mont-Wright Mine is currently operated by ArcelorMittal Mines Canada (AMMC), formerly Compagnie Minière Québec Cartier (CMQC) prior to January 2008. The Mont-Wright Mine consists of multiple deposits within a structurally complex sequence of metamorphosed sedimentary rocks. These various deposits are currently being mined (or have been mined in the past) in a series of open pits.

Pit Irène is a new pit with a planned Life of Mine (LoM) end date of 2022; based on the proposed Pit Irène Mine Plan, version 7.0 (v7.0) (AMMC, 2016b), the ultimate pit depth is 532m. At the time of the preparation of this report, mining in Pit Irène was active at various levels between the 728m and 770m levels.

1.2 SCOPE OF WORK

Piteau Associates Engineering Ltd. (Piteau) was requested by AMMC to prepare updated pit slope designs for Pit Irène at the Mont-Wright Mine. The scope of work for the geotechnical slope stability analysis and design for the 2015 Pit Irène Mine Plan is outlined in Piteau's proposal dated July 14, 2015 (Piteau, 2015). In summary, the scope of work includes the following main tasks:

- Project Management;
- Geotechnical field investigations, including:
    - Preparation of drilling specifications and related requirements,
    - Office support and supervision,
    - Mobilization/demobilization of field personnel,

  - Photogrammetric mapping of exposed benches,
  - Geomechanical core logging and supervision of the drilling program including core orientation and detailed structural logging, and
  - Point Load Index (PLI) testing;
- Core sampling and laboratory testing, including:
  - uniaxial compressive strength (UCS) testing,
  - triaxial compressive strength (TCS) testing,
  - Brazilian indirect tensile strength (BTS) testing, and
  - direct shear (DS) testing;
- Development of geotechnical slope design criteria, including:
  - Assessment of engineering geology and groundwater conditions based on data from the 2015 geotechnical drilling program and hydrogeological monitoring programs,
  - Structural analysis and kinematic assessments based on oriented core and photogrammetric mapping data, collected from the current pit (AMMC, 2015a) (Fig. 1); development of structural domains for the current pit and the proposed Pit Irène Mine Plan (AMMC, 2016b) (Fig. 2),
  - Assessment of fault, bedding joint, and joint sets defining shear strength anisotropy (Table I),
  - Development of rock mass strength parameters based on geomechanical core logging, and field and laboratory strength testing of drill core from the 2015 geotechnical drillholes (Tables II and III),
  - Statistical kinematic assessments of bench breakback potential defining allowable bench and interramp slope angles,
  - Limit equilibrium stability analyses defining allowable bench stack heights of footwalls, and
  - Deep-seated anisotropic limit equilibrium rock mass stability analyses on seven cross sections (Figs. 3 to 9) incorporating the combined influence of adverse structural orientations and potential for shearing through intact rock mass;
- Reporting.

1.3 DESCRIPTION OF SITE INVESTIGATIONS

The primary focus of the geotechnical investigations was to define geologic, structural, and geomechanical characteristics of the geotechnical units expected to be encountered in Pit Irène to enable the development of bench and interramp slope design criteria. Close attention was paid to the delineation of potential fault zones and weak contacts due to their potential to adversely influence stability. Preliminary hydrogeological investigations focused on characterizing the groundwater distribution and dewatering potential for the various geotechnical units.

1.3.1 Geotechnical Field Investigations

Geotechnical field investigations for Pit Irène have included the following:

- Drilling, geomechanical logging, and sampling of 16 NQ3 drillholes between August and September 2015 (i.e., GT15-I001 to GT15-I015, including GT15-I002a) totalling 2546m of drilling.
- Photogrammetric mapping of geologic structure conducted by both Piteau and AMMC, using 3DM ADAM Technology (AdamTech®) and Sirovision® tridimensional measurement technology, respectively.

i) Geotechnical Drilling Program

Location, orientation, and length of the geotechnical drillholes for the 2015 geotechnical drilling program were selected to provide adequate spatial distribution of data across the pit, to provide a variety of drillhole orientations to appropriately sample subsurface structural orientations, to provide samples for laboratory testing in all rock types, and to allow for piezometric monitoring of groundwater pressures in bedrock.

ii) Geomechanical Core Logging

Geomechanical core logging of drill core was carried out using Piteau's standard core logging system to characterize the rock mass quality and the strength of the various rock types that will be encountered during mining. The key geomechanical parameters that were logged include:

- Core Recovery;

- Hardness (H) (ISRM, 1981);
- Rock Quality Designation (RQD) (Deere et al., 1967);
- Fracture Frequency (FF) (i.e., joints per metre) used to calculate Joint Spacing;
- Joint Condition (JC) (Bieniawski, 1976); and
- Degree of Breakage (DOB), and Degree of Alteration (DOA) (Hawley et al., 1994).

These parameters were used to calculate Rock Mass Rating (RMR) (Bieniawski, 1976) for each run interval, which represents one of the key indices used to estimate rock mass strength parameters.

iii) Core Orientation

A total of 134 faults, 968 joints, and 146 bedding joints were logged and oriented using the CorientR core orientation tool from Fordia. From these, 116 fault, 861 joint, and 130 bedding joint measurements (about 89%) were classified as moderate or good, in terms of the quality of the orientation, and were used for structural analysis. Assessments of peak discontinuity orientations from oriented core are shown on stereonets included in Appendix A.

iv) Sampling for Field Testing

A total of 1055 rock samples of drill core were collected in the field for PLI testing at nominal 3m intervals. From the 1055 PLI tests completed, 878 test results (about 83%) were considered valid and used for analysis. Valid PLI test results are shown on graphical logs in Appendix B.

v) Sampling for Laboratory Testing

A total of 82 rock samples of drill core were collected for destructive laboratory testing, including UCS, TCS, and BTS testing of intact core, and DS testing of natural discontinuities.

vi) Photogrammetric Mapping and Slope Documentation

Photogrammetric mapping of all walls that were not significantly covered by ravelled material was carried out by both Piteau and AMMC using photogrammetric techniques. Structural discontinuity data from these programs was used to create a structural discontinuity database for kinematic analyses. Digital Terrain Models (DTMs) created from Piteau photogrammetric surveys were used to create a database of bench breakback, or bench face angles.

The total number of structures mapped with photogrammetric techniques is summarized below:

- Photogrammetry with AdamTech® carried out by Piteau:
  - 545 joint measurements,
  - 142 bedding joint measurements;
- Photogrammetry with Sirovision® carried out by AMMC:
  - 656 discontinuity measurements. No differentiation was made between structure types (i.e., joints, bedding joints, and faults), and all structures were initially considered as joints and later categorized as joints or bedding joints based on comparison to the peak concentrations determined from the AdamTech® database.

Assessments of peak discontinuity orientations from photogrammetry are shown on stereonets included in Appendix A.

1.3.2 Hydrogeological Investigations

Hydrogeological field investigations for Pit Irène included the installation of four vibrating wire piezometers (VWPs) in two NQ3-diameter drillholes (two in drillhole GT15-I003 and two in drillhole GT15-I007).

1.3.3 Laboratory Testing

A comprehensive laboratory testing database was developed from samples that were collected and tested during the 2015 geotechnical drilling program. The laboratory testing focused on the determination of intact rock strength and discontinuity shear strength parameters of the geotechnical units. Laboratory testing was carried out by AMEC Foster Wheeler (AMEC) at their laboratory located in Hamilton, Ontario. The testing results are summarized in Appendix C and consist of the following:

- 25 UCS tests on rock;
- 27 TCS tests on rock;
- 15 BTS tests on rock; and
- 15 DS tests on natural discontinuities.

AMEC's report on rock testing is included in Appendix D.

2. ENGINEERING GEOLOGY

The following sections are included to provide a summary of the rock mass and structural geology conditions of the Irène deposit, based on the 2015 geotechnical drilling program, the 2015 geologic sections (AMMC, 2015b), and the geologic block model provided by AMMC (2015d).

The summary of regional and local geology provided below is based on reports prepared by AMMC (2015c), Piteau (2010, 2016), and others (Bourassa, 1977) involved in past phases of the project, and are included herein for completeness.

2.1 REGIONAL AND LOCAL GEOLOGY

2.1.1 Regional Geology

The Mont-Wright orebody is located in the Severson Range, in the southwestern portion of a 1120 km long band of Proterozoic rocks known as the Québec-Labrador Trough. The oldest rocks are Archean granulites and acidic intrusives. These rocks are overlain by Proterozoic metasediments which are highly metamorphosed and exhibit complex structural deformation and fabric. The metasediments are cut by later granitic and gabbro intrusions. The gabbros form plugs, sills, and dykes, which have been largely metamorphosed into foliated amphibolites.

2.1.2 Local Geology

The Iron Formation at Mont-Wright is the remnants of Proterozoic sediments that form the Mont Severson Hill Range extending from Fermont to Hessé Lake, and is part of the Sokoman Formation which is included in the Ferriman Group.

The structural geology in the Mont-Wright area is complex due to tight folding caused by at least two major orogeny events. Lateral variations in stratigraphy, ore mineralogy, and ore thickness are due to a combination of depositional and structural features. Complex folding has created duplication of the iron bands sometimes resulting in ore lenses attaining 100m in thickness, as observed in some parts of the operating mines at Mont-Wright. The end result of this complex folding at Irène is the creation of a tight fold

with limbs generally dipping southeast with local variations including overturned sections on the south wall (i.e., hanging wall) of the pit. As an example, north-south sections through the pit indicate steep lithologic contacts close to surface on the north wall (i.e., footwall), gradually flattening towards the south and at depth resulting in a generally horizontal to gently south-dipping lithologic contact on the hanging wall.

Stratigraphy of the Mont-Wright deposit is relatively simple as there is little variation in the Iron Formation facies. The local sequence starts with gneiss rocks interpreted to be Archean in age overlain by the Wishart Formation quartzite. The Sokoman Iron Formation overlies the quartzite. A few, relatively thin, quartz-muscovite schist bands are interlayered with the Iron Formation. The Iron Formation is overlain by graphite gneisses and schists that are the metamorphic equivalent of the Menihek Formation. Mafic sills that vary from 1m to more than 50m in thickness are found at different stratigraphic levels.

While some faults have been interpreted on a regional scale, only one major fault has been interpreted in the Pit Irène area (AMMC, 2016a).

In the mine area, rock types consist of gneiss (GN), quartzite (QR), quartz rock mica schist (QRMS), iron formation (IF), and amphibolites (AMP).

The GN is composed of alternating mafic and felsic bands consisting of biotite, quartz, feldspar, muscovite, hornblende, and variable amounts of garnet. The texture is variable as it switches randomly to banded gneiss to augen gneiss to a more granitic texture. It is coded as GN (gneiss), GNF (felsic gneiss), or GNM (mafic gneiss). The gneiss is either Archean in age or the equivalent of the Proterozoic Attikamagen Group.

The QR is the equivalent of the Wishart Formation. It is usually a hard, white, massive rock with variable amounts of muscovite, low amounts of garnet and biotite, and variable content of hematite as it approaches the upper contact with the Iron Formation. This lithology is coded as QR (quartz rock) or QRIF (quartz rock in Iron Formation).

The QRMS is composed of variable amounts of quartz and muscovite with traces of chlorite, tourmaline, and iron oxides. Composition varies from quartz rock to mica schist,

which is composed of more than 80% muscovite. The occurrence of QRMS throughout the sequence indicates that it is likely the equivalent of chert intervals in the Sokoman Formation. This lithology is coded QRMS (quartz rock mica schist) or QRMSIF (quartz rock mica schist in Iron Formation).

The IF at Mont-Wright is the equivalent of the Sokoman Formation and represents the main source of iron ore. The IF at Mont-Wright is not as detailed as it is in other areas of the Québec-Labrador Trough due to either local metamorphism, local variation in depositional setting, or both. However, recent work by AMMC enabled the recognition of three subdivisions in IF (i.e., the basal, middle, and top IF). The basal IF is composed of quartz, magnetite, iron silicates (grunerite), and minor hematite, and is coded SIF (silicates Iron Formation). The middle IF is composed of quartz and hematite with minor amounts of magnetite. This is the preferred ore and is coded either IF (Iron Formation) or HIF (hematite Iron Formation). The topmost IF is composed of quartz, hematite, magnetite, and silicates such as actinolite and diopside. Depending on the amount of silicates, this IF is coded either IF, HIF, or SIF. When the IF contains more magnetite than hematite, it is coded as MIF (magnetite Iron Formation). There is no specific stratigraphic position for the MIF, although it is likely located at the base of the Sokoman Group where silicates are scarce. Generally, the HIF is coarse grained while the MIF is almost cherty.

The AMP is very common at Mont-Wright and consists of medium-grained foliated rocks with dark green hornblende, black biotite, and feldspar, and is accompanied by small to medium-sized garnets. Locally, the AMP has similar texture to a coarse gabbro. Although it has been interpreted in the past as a metamorphosed sedimentary rock, recent study shows that the AMPs are actually metamorphosed gabbro sills. At the contact with the IF, the AMPs can be altered into an argillite (ARG) with thicknesses ranging from a few centimetres to 2m. Altered AMP contacts are soft and display a yellowish green colour. There is no detailed mineralogy for the ARG, but remnants of weathering-resistant minerals such as garnet can be observed. This condition has been associated with several slope instabilities in open pit areas in the Mont-Wright Mine (Piteau, 1998). The argillic alteration is not restricted to contacts with the IF; AMP can also show signs of alteration along contacts with the QR and QRMS. However, alteration along these contacts tends to be

less continuous and thinner than along contacts with the IF (Piteau, 2010). This lithology is coded AMP (amphibolite) and AMPIF (amphibolite in Iron Formation).

2.2 GEOTECHNICAL UNITS

At least 13 distinct lithologies have been recognized in the 2015 drill core logs. Some of these lithologies represent slight mineralogical gradations, and many are sufficiently similar to be considered as a single geotechnical unit (e.g., IF inclusions within other lithologies). For design purposes, five main geotechnical units, primarily differentiated on the basis of the block model lithology (AMMC, 2015d), have been identified and are summarized below in stratigraphic order.

Gneiss (GN): Consists of the GN, GNF, and GNM lithologies. Major occurrence is at depth but, due to folding, it is expected to be exposed in portions of the upper benches in the footwall.

Quartzite (QR): Consists of the QR and QRIF lithologies. Occurs as inclusions within IF and AMP and, depending on the location, as the first unit below the AMP. At depth, it occurs as large units interbedded with AMP. As a result of stratigraphic inversion, due to overturned tight folding, QR is expected to form extended portions of the hanging wall and east endwall.

Quartz Rock Mica Schist (QRMS): Consists of the QRMS lithology. Occurs as inclusions within IF and, depending on the location, as the first unit below the AMP. This unit is not expected to daylight along significant portions of the proposed pit, but might be present on the upper benches of the footwall.

Iron Formation (IF): This geotechnical unit is comprised of the ore-bearing IF lithology and might contain a number of smaller, continuous and discontinuous bands of QRMS/QRMSIF and AMP/AMPIF lithologies. Due to tight overturned folding, IF is expected to form the lower benches in the footwall and in the hanging wall.

Amphibolite (AMP): Consists of the AMP and AMPIF lithologies. Occurs interbedded with IF and, depending on the location, as the first unit below the IF. At depth, it occurs as large units interbedded with QR and QRMS. This unit is expected to form most of the benches in the footwall and the west and east endwalls, and the lower benches in the hanging wall.

2.3 STRUCTURAL GEOLOGY

2.3.1 Discontinuities

General geometric relationships between the joint sets observed at the mine, namely bedding joints and cross joints, are similar to conditions observed in folded sedimentary and low grade metasedimentary rocks in many other areas. That is, one main set of bedding joints and two main sets of cross joints seem to exist: one cross joint set strikes approximately perpendicular to bedding and dips steeply to subvertically, and a second cross joint set strikes essentially parallel to bedding and dips approximately normal to it. Additionally, weakly to strongly developed, random joint sets seem to occur locally within the proposed pit area. It should be noted, however, that due to the complex folding in Irène and the massive nature of some lithologies (e.g., QR), some of the main structural sets (i.e., bedding joints or cross joints) may be absent locally.

Discontinuities mapped on surface and logged in drillholes at Mont-Wright generally consist of joints, bedding joints, and faults. Most of the discontinuities mapped with photogrammetric techniques on surface and logged in drillholes were joints. Bedding joints were mostly mapped with AdamTech® photogrammetry carried out by Piteau, with a limited amount of bedding joints logged in drillholes. Other types of discontinuities, such as faults, were logged in drillholes only and not observed on surface.

Photogrammetric mapping carried out by AMMC with Sirovision® did not differentiate between structure types. Consequently, all structures mapped with Sirovision® were initially considered as joints and later categorized as joints or bedding joints based on association with peak concentrations determined from the AdamTech® database. The Sirovision® database was further filtered for persistence greater than 1m, and the resulting structures were compared, based on location, to the AdamTech® database, with potential duplicate structures (i.e., two or more similar measurements at the same location) being removed from the Sirovision® database. The remaining 154 Sirovision® structures were then incorporated with the AdamTech® database, with the resulting combined database used for structural analysis.

2.3.2 Faults and Contact Zones

Although no major faults parallel to bedding or lithologic contacts were observed in the pit area (Figs. 1 and 2), it is likely that some of the bedding joints and contact surfaces have undergone shearing during folding and deformation, particularly in the footwall (as suggested in the stereonets), based on the subparallelism between some faults and bedding joint sets. Moreover, the development of soft infilling material, including clay, micaceous minerals, and subsequent alteration products has been noted along contact zones. Where daylighted by mining, argillically-altered contacts have factored in slope instability on pit walls at Mont-Wright (e.g., the June 6, 1998 Pit B Ramp Instability (Piteau, 1998)).

Based on observation of core from the 2015 drilling program, a number of drillhole intercepts of contact zones were characterized as weak or altered. The altered contact zones were primarily observed in contacts involving AMP. These altered zones typically were composed of argillic clay and completely altered amphibolite, with an average thickness of about 20 cm. To develop an understanding of the extent of these weak zones and their potential implication on stability of the slopes in Pit Irène, each drillhole intercept was plotted on structural contour plans of each lithologic contact. Contact intercepts that were identified in core as weak or altered were then highlighted on these plans, and zones were outlined where numerous intercepts indicating weak material were adjacent. Finally, these altered contact zones were transferred to the appropriate contact on the 2015 geologic sections provided by AMMC (2015b), as shown on Figs. 3 through 9.

2.3.3 Structural Domains

Results of photogrammetry and drilling investigations indicate that the proposed Pit Irène Mine Plan (AMMC, 2016b) will be excavated in seven main structural domains. The boundaries between these domains were mainly delineated based on the orientation of bedding joints and interpretation of lithologic contacts projected to the mine plan. Therefore, these domain boundaries are not rigid (i.e., not associated with large, regional structures such as faults or shear zones), and should be re-evaluated as the pit walls are exposed. Moreover, due to the complex nature of folding in Irène, it is recognized that the

main discontinuity sets defined for each structural domain may rotate with depth, mirroring the folding and lithologic contacts.

The structural domains defined for the Pit Irène Mine Plan are included on Fig. 2 and summarized in the table below.

Structural Domain	Lithology	Pit Wall Area
Northwest	AMP and IF with minor occurrences of QR and QRMS	north wall (footwall)
North		
East		
Southeast	AMP, GN, IF, and QR	east wall (endwall) and south wall (hanging wall)
Central		
South		
West	AMP, IF, and QR with minor occurrences of QRMS	west wall (hanging wall)

2.3.4 Structural Analysis of Discontinuity Data

Structural analysis of discontinuity data was carried out to define the structural domains by categorizing joint sets relative to stratigraphy or bedding, as follows:

- Peak joint set subparallel to bedding (or lithologic contacts) – defined as Joint Set JS1; these are typically known as bedding joints.
- Peak joint set striking approximately perpendicular to bedding and dipping steeply to subvertically – defined as Joint Set JS2.
- Peak joint set striking essentially parallel to bedding and dipping approximately normal to bedding – defined as Joint Set JS3.
- All other peak concentrations were labelled in increasing numeric order representing the strongest to weakest sets[1] (i.e., JS4, JS5, JS6, etc.). Peak fault concentrations are also labelled in increasing numeric order representing the strongest to weakest sets (i.e., F1, F2, F3, etc.); no relation with bedding was incorporated in the naming scheme of faults.

[1] The strongest set refers to the most-developed peak concentration on a given stereonet, while the weakest set refers to the least-developed, identified peak.

If more than one pole concentration associated to Joint Sets JS1, JS2, or JS3 were identified, an extension was added to the name (i.e., JS1-1, JS3-2, etc.).

Figures A1 to A18, included in Appendix A, summarize the peak joint and fault orientations defined in the seven structural domains based on the photogrammetric[2] and oriented core databases. The relative weighting of each discontinuity set was determined by subdividing the peak population percentage into approximate thirds to characterize weak (i.e., lower one-third of contours), moderate (i.e., median one-third), and strong (i.e., upper one-third) sets. In the case of small datasets (i.e., less than about 50 poles), peaks that could have been categorized as strong were assigned reduced weighting. A summary of the peak orientations and weightings is included in Tables A1 and A2 presented in Appendix A.

Joint Set JS1 consists of joints developed subparallel to stratigraphy with continuity ranging from a few metres to greater than 20m. Spacing of JS1 was observed to be typically in the 1 to 6m range. The dip and dip direction of JS1 was observed to be highly variable within the pit area as a result of successive folding events. On the footwall (i.e., Northwest, North, and East domains), the orientation of JS1 varies from an east-southeast dip of about 45° in the Northwest Domain, to a south-southeast dip of about 85° in the North Domain, to a south-southwest dip of about 45° in the East Domain. On the hanging wall (i.e., Southeast, Central, South, and West domains), the orientation of JS1 varies even more significantly from one structural domain to another due to local folding and faulting.

It should be noted that in the South Domain, JS1 was mapped on surface (i.e., from photogrammetry) and at depth (i.e., from oriented core) to be dipping northwest at shallow to moderate dips (Figs. A15 and A16). This dip direction is in conflict with the main bedding orientation identified in the geologic model (as shown on Fig. 3), which indicates bedding dipping mainly towards the south-southeast. This northwest bedding dip could be the result of local folding, as seen on Fig. 3 (i.e., local north dipping of the AMP-IF contact), or a misinterpretation of persistent cleavage joints as bedding joints. In any

[2] Piteau AdamTech® and AMMC Sirovision® databases combined.

case, there are indications that these northwest-dipping structures are of limited continuity as they are most likely crosscut by the main structures subparallel to bedding.

The orientations of JS2 and JS3 were observed to be highly variable as well, as the orientation of these sets is related to the orientation of JS1.

2.3.5 Assessment of Structural Anisotropy

Where well-defined structural fabric exists, rock mass strength can be expected to vary depending on the orientation (i.e., strength anisotropy) and frequency of structural discontinuities with respect to the slope face.

An assessment of potential ranges of shear strength anisotropy was based on structural orientations defined from photogrammetric and oriented core data. The main discontinuity orientations for each structural domain were assessed to determine the potential for preferential shearing along discrete structural features such as faults, joints, or bedding joints, defining shear strength anisotropy within the slopes. Moderate and strong peak fault, joint, and bedding joint set orientations with dip directions within ±30° of the main slope orientations were included for anisotropy. The ranges of apparent structural dip in the anisotropic functions were specified as ±3° from the main peak orientation. Structural sets dipping 50° or more into the slopes (i.e., in-dipping discontinuities) were not included in the anisotropic assessments. Table I summarizes the fault, joint, and bedding joint dip ranges for each rock type on each analysis section (i.e., geologic section). Lower hemisphere equal area projections of the structural databases are included in Appendix A.

The effects of shear strength anisotropy were incorporated in deep-seated stability analyses of the hanging wall and endwalls, as discussed in Section 3.6 below, by applying the shear strengths of faults, joints, and bedding joints to any potential shear surfaces within the ranges of anisotropy determined above. Due to limited continuity of moderate and strong joint sets, as observed in exposed walls in the current Pit Irène, a rock bridge proportion of 20% was assumed to represent discontinuous joint shear strengths for anisotropic analysis. Faults and bedding joints were assumed to be more continuous and a 10% rock bridge proportion was assumed to represent these structures.

In the footwall, anisotropic effects were incorporated at the bench and multibench-scale by considering critical failure modes involving slab failures along JS1 (i.e., bedding joints) and shearing along pre-existing discontinuities at the toe. This particular failure mechanism is known as bilinear slab failure and consists of an active block (i.e., the slab) and a passive, resisting block (i.e., the toe block); the interface between the two blocks is assumed to be formed by JS3 (Fig. 10). At the interramp and overall scale, the effects of shear strength anisotropy were incorporated in deep-seated stability analysis of the footwall by considering lithologic contacts as discrete continuous shearing features. However, in order to investigate the possibility of shallower failure mechanisms, sensitivity analyses incorporating the effects of rock mass anisotropy were run for footwall sections in which lithologic contacts were identified to be widely spaced.

2.4 ROCK MASS STRENGTH ASSESSMENT

Assessment of the strength and competency of the rock mass is based on a number of things: the strength of the intact rock material, the general quality of the rock mass, and the condition and spacing of discontinuities. As summarized in Table II, an assessment of the relative strength of the various geotechnical units was made based on the results of geomechanical core logging, PLI testing, and a laboratory testing program comprised of UCS, TCS, and BTS testing of intact core, and DS testing of natural discontinuities.

2.4.1 Intact Rock Strength

A knowledge of the intact strength of the rock is necessary for basic rock mass classification and conventional assessments of rock mass shear strength. The methods used to evaluate intact rock strength were Hardness logging, and PLI, UCS, TCS, and BTS testing.

i) Hardness (H)

Estimates of Hardness were logged on a run-by-run basis according to International Society for Rock Mechanics (ISRM) Suggested Methods (ISRM, 1981), as illustrated graphically on the geomechanical core logs included in Appendix B. As summarized in Table II, the average H for the various geotechnical units range from 3.6 for GN to 4.0 for

IF and QRMS, indicating medium-strong to strong rock according to the ISRM strength classification system (ISRM, 1981).

ii) Degree of Alteration (DOA)

DOA is a simple visual and mechanical classification based on how altered or weathered the rock appears, relative to a fresh specimen. For example, a DOA of A corresponds to residual soil, with original fabric destroyed, while a DOA of F corresponds to fresh and unweathered rock, with possible improvement in rock competency due to alteration (e.g., silicification). As summarized in Table II, core logging data from 2015 indicate average ratings between E (slightly weathered/altered) and D (moderately weathered/altered). Results of DOA logging are graphically illustrated on geotechnical core logs included in Appendix B.

iii) Point Load Index (PLI) Testing

PLI testing was performed by Piteau personnel on core from the 2015 geotechnical drilling program in accordance with the ISRM testing procedures (ISRM, 1985). PLI tests were conducted at approximately 3m intervals, with additional PLI testing added within 5m on either side of UCS sample locations. In total, 1055 PLI tests were performed, of which 878 were considered valid (about 83%). Of the 878 valid tests, 856 (about 97%) were tested diametrically[3] and 22 (about 3%) axially[4]. In rock types that displayed visual indication of strength anisotropy (i.e., bedding), tests were conducted approximately parallel and perpendicular to the bedding plane. Valid individual diametral PLI results, normalized to an equivalent 50mm core diameter ($I_{S(50)}$), are shown on the geotechnical core logs included in Appendix B.

The Strength Anisotropy Index ($I_{a(50)}$) is the ratio of the $I_{S(50)}$ measured perpendicular or across bedding to the $I_{S(50)}$ measured parallel or along bedding. Values close to 1 are considered to be representative of isotropic rocks and higher values are representative of anisotropic rocks (ISRM, 1985). Strength Anisotropy Indices for each geotechnical units are summarized in the table below.

[3] PLI testing conducted across the axis of the core.
[4] PLI testing conducted parallel to the axis of the core.

Geotechnical Unit	Strength Anisotropy Index ($I_{a(50)}$)
AMP	1.1
IF	1.2
QRMS	1.3
QR	1.2
GN	1.2

Results indicate that QRMS is moderately anisotropic and that IF, AMP, QR, and GN are only slightly anisotropic.

iv) Uniaxial Compressive Strength (UCS) Testing

A total of 25 UCS test were conducted on core samples from the 2015 geotechnical drilling program. Five UCS tests were performed for each of the following geotechnical units: AMP, IF, QRMS, QR, and GN. The UCS test results are summarized in the table below. Individual test results are presented in Table C1 included in Appendix C.

Geotechnical Unit	Number of Tests	UCS (MPa)	
		Average	Standard Deviation
AMP	5	132	49
IF	5	209	64
QRMS	5	188	44
QR	5	291	96
GN	5	91	36

The UCS test results indicate strong to extremely strong rock according to the ISRM strength classification system. The results, in addition to providing values of UCS for intact rock, were used to provide calibration of Hardness estimates and to develop UCS-PLI correlation coefficients.

v) Development of PLI-UCS Correlation Factors

Correlation factors are required to estimate the UCS from a particular PLI ($I_{S(50)}$) value. ISRM (1985) suggests that, on average, UCS is 20 to 25 times PLI, but that this ratio can vary between 15 and 50. To determine a correlation factor specific to a given site or rock

type, UCS test results for a given specimen must be correlated with PLI test results for the same specimen, or for specimens very close to the UCS sample location. ISRM recommends using a suite of 10 PLI tests and discarding the two highest and two lowest values to derive an average of six tests (ISRM, 1985). For this study, all valid diametral PLI tests within 5m of the UCS sample and of the same lithology were selected. From this grouping, equal numbers of highest and lowest tests were removed until there were six or seven tests remaining (depending on whether there was an even or an odd number of tests in the initial group). The mean $I_{S(50)}$ value of each suite of tests was correlated to the corresponding UCS test value to determine the correlation factor (K). Separate correlations were developed for each geotechnical unit as shown on Figs. C1 to C5 and summarized in the table below.

Geotechnical Unit	PLI Coefficient of Correlation, K
AMP	23
IF	29
QRMS	25
QR	32
GN	19

These correlation factors were subsequently applied to all valid PLI test results for estimation of UCS from PLI (UCS_{PLI}). As indicated in Table II, average UCS_{PLI} ranges from about 69 MPa for GN to about 284 MPa for QR, indicating strong to extremely strong rock according to the ISRM strength classification system.

vi) Assessment of UCS-Hardness Relationships

Logged Hardness (H) was used to provide site-specific estimates of UCS. Correlations were developed between UCS values estimated from PLI tests (as determined above) and corresponding average H values as illustrated on Fig. 11. Figures C6 to C10, included in Appendix C, are site-specific individual plots of UCS (derived from PLI) versus the estimated H values for each geotechnical unit. Mean UCS values above and below the ISRM mean curve indicate underestimation or overestimation of the H value, respectively. Where there were limited data points (i.e., less than 10), correlations between Hardness estimates and UCS incorporated mean ISRM (1981) values. These correlations were used to develop the weighted-average UCS based on Hardness for

each geotechnical unit (UCS_{PLI}-H). As summarized in Table II, average UCS_{PLI}-H ranges from about 73 MPa for GN to about 286 MPa for QR, indicating strong to extremely strong rock.

vii) Triaxial Compressive Strength (TCS) Testing

A total of 27 TCS tests, with confining pressures of 10, 20, and 32 MPa, were carried out on representative samples of IF, AMP, and QR. The TCS test results are summarized in the table below. Individual test results are presented in Table C2 included in Appendix C. TCS tests were not completed on samples from the QRMS and GN geotechnical units.

Geotechnical Unit	Number of Tests	Confining Pressure (MPa)	Failure Pressure (MPa)	
			Average	Standard Deviation
AMP	3	10	163	5
	3	20	285	41
	3	32	320	49
IF	3	10	425	61
	3	20	499	84
	3	32	676	77
QR	3	10	607	45
	3	20	584	101
	3	32	803	88

viii) Brazilian Indirect Tensile Strength (BTS) Testing

Fifteen samples, collected from the 2015 geotechnical drillholes, were used for laboratory BTS testing. The BTS test results are summarized in the table below. Individual test results are presented in Table C3 included in Appendix C. BTS tests were not completed on samples from the QRMS and GN geotechnical units.

Geotechnical Unit	Number of Tests	Tensile Strength[1] (MPa)	
		Average	Standard Deviation
AMP	5	13	3
IF	5	11	2
QR	5	11	2

Note: In the current report, tensile strength is stated as a negative value.

ix) Determination of Hoek-Brown Material Constant m_i

The Hoek-Brown material constant m_i (Hoek et al., 2002) was derived for the various geotechnical units expected to be encountered in Pit Irène based on assessments of valid UCS, TCS, and BTS test results. This was accomplished by fitting an intact strength envelope curve, using the computer program RocLab® from Rocscience, to the laboratory testing data (i.e., Mohr circle plots), as indicated on Figs. C11 to C13 included in Appendix C. The resulting m_i parameters are summarized in the table below and are included in Table III. Hoek-Brown m_i material constants for the QRMS and GN geotechnical units were estimated from charts published by Hoek et al. (2002), as TCS and BTS testing were not carried out for these units.

Geotechnical Unit	Hoek-Brown Constant, m_i
AMP	11
IF	25
QRMS[1]	12
QR	33
GN[2]	23

Notes: 1. Assumed value corresponding to the average of tabulated values for schist (Hoek et al., 2002);
2. Assumed value corresponding to the lower-bound of tabulated values for gneiss (Hoek et al., 2002).

2.4.2 Shear Strength of Discontinuities and Lithologic Contacts

Direct shear strength testing of natural discontinuities was conducted on 15 representative joint specimens obtained from the 2015 geotechnical drilling program. The results of the DS testing are summarized below. Individual test results are presented in Table C4 and on Figs. C14 to C28 included in Appendix C.

Geotechnical Unit	Average JRC Friction Angle[1]	Number of Tests	Average Shear Strength				35th Percentile Shear Strength			
			Peak		Residual		Peak		Residual	
			ϕ_p'	c_p' (kPa)	ϕ_r'	c_r' (kPa)	ϕ_p'	c_p' (kPa)	ϕ_r'	c_r' (kPa)
AMP	34°	5	34.0°	78	28.7°	0	29.8	69	26.0	0
IF	38°	5	39.8°	90	36.2°	5	39.4	85	35.4	0
QR	37°	5	40.6°	78	30.4°	10	40.4	68	30.8	0
All Units Combined	37°	15	38.1°	82	31.8°	5	38.5°	75	32°	0

Note: After Barton and Choubey (1977) assuming a basic friction angle of 25° and a normal stress of 1 MPa.

Additionally, Barton and Choubey (1977) Joint Roughness Coefficient (JRC) and Joint Compressive Strength (JCS) data from the 2015 core samples were reviewed to empirically assess joint shear strength. The empirical assessment of JRC friction angles generally agrees with the range of DS testing results summarized in the table above.

For bench-scale kinematic assessments, a ϕ' of 38° was selected for joints, with no cohesion. When accounting for the effects of blasting, sensitivity analyses were carried out to assess the improvements on bench-scale stability considering a range of cohesion from 0 to 75 kPa for double, 28 m-high, benches. The selected ϕ' of 38° for joints corresponds approximately to the 35th percentile of all ϕ_p values and assumes that significant movement has not occurred along joints. Faults were not considered for bench-scale stability analyses as these structures are widely spaced and do not occur frequently enough to control bench-scale stability.

At the interramp and overall scale, shear strengths of joints, bedding joints, and faults were calculated incorporating the effects of rock bridging, assuming that blasting effects have less impact deeper behind the wall. A rock bridge proportion of 20% was considered for joints, and shear strengths were calculated from the peak 35th percentile ϕ_p' of 38° assuming a basic cohesion of 50 kPa. For faults and continuous bedding joints, a rock bridge proportion of 10% was considered. Bedding joint shear strengths were calculated from the residual 35th percentile ϕ_r' of 32° assuming a basic cohesion of 50 kPa. Fault shear strengths were calculated assuming nominal cohesion and friction values of 50 kPa and 20°, respectively.

Shear strength of altered contact zones were estimated to be c' of 75 kPa and ϕ' of 28°, based on previous experience at Mont-Wright and on consolidated undrained (CU) triaxial testing conducted on three samples, two involving material from the QRMS-AMP contact and one of sandy, altered IF. Details of the CU triaxial testing can be found in Piteau (2010).

Shear strengths of discontinuities and lithologic contacts are graphically illustrated on Fig. 12.

2.4.3 Rock Mass Classification

Rock mass classification of geotechnical units within Pit Irène was carried out according to the Bieniawski (1976) RMR system. This system requires evaluation of five interrelated rock mass parameters: intact rock strength (or UCS), RQD, joint spacing (or its inverse, fracture frequency), JC, and groundwater conditions[5]. Each parameter is assigned a weighted numerical value and the sum of these values determines the RMR. RMRs between 8 and 100 are possible. For RMRs greater than 25, RMR is considered equivalent to the Geological Strength Index (GSI) (Hoek et al., 2002). Values of RMR derived from geomechanical core logging from the 2015 geotechnical drillholes are included in Table II.

As summarized in Table II, RMR was calculated for every geotechnical unit based on intact rock strength derived from UCS_{PLI}-H relations, UCS_{PLI}, and UCS tests. Average RMR values ranged from 74 to 85 for RMR based on UCS_{PLI}-H relations, from 74 to 84 for RMR based on UCS_{PLI}, and from 76 to 85 for RMR derived from UCS testing, indicating good agreement between the various approaches. Based on this range of average RMR values, the rock mass composing the walls of Pit Irène is classified as Good to Very Good rock according to Bieniawski (1976) classification system. In terms of individual geotechnical units, the GN is the weakest with the average RMR ranging between 74 and 76 depending on the intact rock strength used for the RMR calculation. The strongest geotechnical unit is the QR with the average RMR ranging between 84 and 85, again depending on the intact rock strength used for the RMR calculation. As illustrated in the graphical logs included in Appendix B, zones characterized by broken rock or fault zones were encountered in all units, but a distinct zone characterized by altered or weaker rock mass was not identified.

Failure mechanisms in rock slopes generally tend to exploit weak zones; therefore, average or median rock mass parameters can potentially be too high for stability assessments. Back analyses carried out by Piteau (2010) as part of the South Wall Pit Slope Design for the Paul's Peak Pit indicate that more representative rock mass values correspond to the 35th percentile range. Therefore, as shown in Appendix E and in

[5] Groundwater condition are typically assumed to be dry for calculating RMR; piezometric conditions are modeled explicitly in limit equilibrium analyses, as described in Section 3.6.1

Table III, design values for the current assessments were selected using the 35th percentiles of RMR and UCS_{PLI}. UCS-PLI (UCS_{PLI}) correlations were selected to define the design parameters because i) PLI testing is more objective than Hardness assessments, and ii) the PLI database is much larger than the more reliable UCS testing database.

2.4.4 Isotropic Rock Mass Strength

i) Non-Linear Rock Mass Strength

As reported in Table III and graphically illustrated on Fig. 12, isotropic Hoek-Brown rock mass strengths were derived using RMR and UCS values based on the 35th percentile. These design rock mass strengths assume a Disturbance (D) of 0.85, signifying partially disturbed conditions, up to 50m behind the pit wall (measured perpendicular to the slope face from bench toes). This D value corresponds to a moderate level of disturbance that would be consistent with stress relief induced by mining and the implementation of controlled blasting measures adjacent to the pit walls, as is currently implemented at Mont-Wright. Beyond this depth limit, a D of 0.7 was assumed.

ii) Linear Rock Mass Strength

Linear Mohr-Coulomb rock mass strengths were derived from the Hoek-Brown Failure Criterion (Hoek et al., 2002) assuming a σ'_{3max} of 1 MPa. This stress level is considered representative of average conditions along potential failure surfaces at the scale of interramp and overall slopes in Pit Irène. Linear rock mass strength envelopes of geotechnical units are graphically illustrated on Fig. 12 and summarized in Table III.

2.4.5 Anisotropic Rock Mass Strength

Linear anisotropic shear strengths used in limit equilibrium stability analyses for moderate and strong discontinuities were estimated assuming 10% rock bridging for faults and bedding joints and 20% rock bridging for joints. Table IV summarize calculated anisotropic shear strengths for faults, joints, and bedding joints for rock bridging ranging from 5 to 20%.

2.5 HYDROGEOLOGY

Water level data were collected from four VWPs (AMMC, 2015e) installed in two of the 2015 geotechnical drillholes (i.e., drillholes GT15-I003 and GT15-I007). The vibrating wires were completed as deep and shallow piezometers, located at the bottom and at about half the length of each drillhole. The water level data collected from the piezometers were reviewed and used to interpret preliminary phreatic surfaces on representative geologic sections (i.e., Sections I-SE1, I-SE2, I-NE1, I-SW1, 100, -1750, and -1900). Depths to water were in the 7 to 20m range in the piezometers in both geotechnical drillholes (i.e., drillholes GT15-I003 and GT15-I007), and interpreted preliminary piezometric surfaces were below the current pit floor on all the analyzed sections.

Due to the limited groundwater monitoring points and hydrogeological information available for Pit Irène, and considering the proximity of Paul's Peak Pit, which is located in a similar geologic setting, the hydrogeological model for Irène was developed in analogy to the one developed for Paul's Peak. Two cases were considered for the prediction. The first case predicted groundwater responses to mining only without considerations of dewatering wells or horizontal drains. The second case considered a series of 150m-long horizontal drains, installed upwards at a 5° angle along the face of the bench. The drains were designed to be staggered on two benches with a lateral distance of 150m between drains. The drains were assumed to drain up to about half of their installed lengths.

It is recommended that VWPs or standpipes be installed in additional drillholes and that water levels be measured on a regular basis. The preliminary phreatic surfaces on the sections should be reinterpreted and updated as additional water level data becomes available.

3. SLOPE STABILITY ANALYSIS AND DESIGN

3.1 BASIC SLOPE DESIGN CONSIDERATIONS

In rock slopes, instability may occur as a result of sliding or separation along geologic structural discontinuities, such as joints, faults, bedding, contacts, etc. In fractured, weak, or altered rock, slopes may be subject to degradation, ravelling, and rockfall generation, which could result in unsafe working conditions. In very high slopes, or slopes containing very fractured or weak rock, instability may also occur as a result of failure through the rock mass. Various combinations of failure along discontinuities and through the rock mass may also be possible.

Risk assessment for open pit slope design involves evaluation of the likelihood of failure occurring combined with the potential consequence of the failure. In such assessments, the size of the potential instability plays a key role. For example, a bench failure may have a relatively low consequence as compared to an overall slope failure. With increasing size of the potential failure, there is commonly an increase in consequence; therefore, risk tolerance generally decreases as failure size increases.

The optimum open pit slope design is one that maximizes overall slope angles, minimizes the risk of overall slope instability, and provides for safe and efficient movement of personnel, equipment, and materials during mining operations. In most cases, it is impractical (and usually uneconomical) to design the slope such that no failures occur. A more pragmatic approach is to design the pit with benches and excavate the slope under controlled conditions such that any failures that do occur are anticipated and effectively controlled on benches. This approach provides for adequate safety at minimal cost, although special design or remedial measures may be required to ensure the stability of haulroads and critical infrastructure.

Slope stability analyses for the proposed Pit Irène Mine Plan involved assessment of kinematically possible failure modes exploiting geologic structural discontinuities that could result in shallow failure of individual benches and deeper failure of multibench and interramp slopes. Results of these assessments were used to develop recommendations for preliminary interramp slope angles (IRAs). Analyses were then conducted, in conjunction with assessments of rock mass quality, to assess the potential for deep-seated, structurally controlled or non-circular,

rotational rock mass failure of interramp and overall slopes. The IRAs were adjusted where necessary to reflect the recommended slope designs assuming a minimum required Factor of Safety (FoS) of 1.2 for interramp and overall slopes.

3.2 BASIC SLOPE GEOMETRY

The basic parameters that are used to describe the geometry of a benched mine slope are shown on Fig. 13 and summarized in the following table.

Design Bench Face Angle (BFA)	Design BFA, incorporating allotment for expected breakback.
Bench Height (BH)	Single-bench height of 14m; 28m double benches on hanging wall and endwalls; ranges from single to quintuple benches (i.e., 70m) on footwall, depending on the design BFA.
Effective Catch Bench Width (w_{eff})	Minimum effective catch bench width for rockfall protection.
Interramp Slope Angle (IRA)	Maximum allowable bench toe-to-toe or crest-to-crest slope angle.
Interramp Slope Height (IRH)	Maximum allowable IRH determined from kinematic and rock mass stability analyses.
Ramp/Stepout Width	Haul ramp widths are usually dependent on mining equipment specifications; stepout or geotechnical berm widths can vary and are dependent on operational considerations, slope access requirements, stability assessments, etc.
Overall Slope Angle	Angle from the crest to the toe of the pit.
Kinematic Sector	Areas of the pit with consistent geologic structural conditions (i.e., structural domains) and pit slope orientation (within about 15°).
Design Sector	Slope areas that combine two or more kinematic sectors, have in common geologic structural conditions and rock mass properties, and ultimately have commonality in recommended bench and interramp design criteria.

3.2.1 Documentation of Achieved Bench Geometry

Documentation of bench performance (e.g., BFA, filled and unfilled catch bench width, etc.) is required in order to evaluate the success of slope designs that have been or are currently being mined, and to provide calibration for future mining. Documentation of achieved bench geometry was obtained using DTMs created from photogrammetric surveys performed by Piteau on the hanging wall.

Bench face angles were measured using plane approximations over the bench face in 3DM Analyst® (from AdamTech®). Cumulative frequency plots of documented BFAs are included in Appendix F. Achieved BFAs were selected for 70% reliability (or 30% cumulative frequency), and range from 66.4 to 66.8° in the Southeast Domain, 71.4 to 71.7° in the Central Domain, 62.8 to 74.9° in the South Domain, and 72.8 to 75.2° in the West Domain (i.e., the hanging wall domains), as summarized in Tables F1 and F2 included in Appendix F. Bench loss was back-calculated based on the difference between a presplit design BFA of 80° and the achieved measured BFA. Bench losses based on the 30% cumulative frequency (or 70% reliability) for documented achieved BFAs are summarized in Tables F1 and F2, and range from 7.1 to 7.3m for the Southeast Domain, 4.3 to 4.5m for the Central Domain, 2.6 to 9.5m for the South Domain, and 2.5 to 3.8m for the West Domain.

As there were no benches established on the footwall at the time of the field investigations, no documentation was performed for the Northwest, North, and East domains.

3.2.2 Empirical Assessment of Required Catch Berm Width for Rockfall Protection

In the absence of field-calibrated rockfall testing and analysis, an empirical assessment of required catch bench widths can be based on the following empirical Modified Ritchie Criteria (Call, 1992) for rockfall catchment:

$$w_{eff}\ (m) = 0.2 \times BH + 4.6$$

Based on the above, and allowing for about 3m of additional breakback at the crest of the bench, a minimum effective catch bench width of 13m is specified for 28m-high benches. For higher benches in the footwall, the same minimum effective catch bench width is specified, as the footwall designs assume that the BFA is excavated to the average dip of Set JS1 (i.e., bedding joints) in any given area. Because this footwall design assumption means that JS1 should not be undercut, rockfall generation in the footwall is expected to be minimal and relatively narrow berms are considered adequate.

3.3 FOOTWALL AND HANGING WALL DESIGN APPROACHES

The designing process of bench, multibench, and interramp slopes in stratigraphically controlled deposits involves different stability analysis approaches for slopes on the footwall versus slopes on the hanging wall (and endwalls), as the failure mechanisms associated with these distinct slope classifications are different.

Failure mechanisms on the footwall usually involve planar or complex planar failures (e.g., planar, bilinear slab, ploughing, buckling, etc.) and are sensitive to the dip, spacing, shape and planarity of the structures involved. In this geologic environment, BFAs are typically determined based on the average dip of bedding in the design sector, and allowable bench stack heights between catchment berms are determined by bilinear analyses. On the hanging wall (and endwalls), as non-stratigraphically related structures (i.e., JS2, JS3, etc.) are more susceptible to be undercut, bench face and interramp designs are usually based on kinematic assessments of critical failure mechanisms.

As a general rule, if the relative difference of the wall orientation and the dip direction of Set JS1 is less than 30°, footwall designs should be adopted. However, footwall designs perform best when the wall orientation matches the orientation of JS1 exactly, or is at most no more than 5 or 10° oblique to JS1. Slope orientations within the range of 10 to 30° oblique to JS1 constitute a transition zone between footwall and hanging wall designs, and should be avoided as much as possible; footwall designs may be conservative and practically difficult to mine within this transition zone, and bench-scale failures are highly probable if hanging wall designs are adopted.

3.4 STABILITY ASSESSMENTS FOR FOOTWALL SLOPES

3.4.1 Bilinear Slab Analysis Methodology and Assumptions

Limit equilibrium analyses were conducted for the footwall slopes to assess potential failure modes affecting individual bench slopes, whether single or multiple bench heights. The objective of the analyses was to determine allowable bench heights between catchment berms. Based on the geologic structural conditions and previous experience with footwall slopes at Mont-Wright, the critical failure mode with respect to the footwall slope design involves slab failures along JS1, either due to undercutting of this set or

shearing through weak toe materials. The latter condition constitutes a failure mechanism known as bilinear slab failure.

The bilinear slab-type failure mechanism consists of an active driving block and a passive resisting block. The back plane of the driving block is assumed to be formed by structures of JS1, the interface between the two blocks is assumed to be formed by structures belonging to JS3, and the breakout plane is assumed to develop through the rock mass in the toe, or possibly along a pre-existing structure. The bilinear slab-type failure mechanism is illustrated on Fig. 10.

Based on results of DS testing, analysis of the slab failure mechanism was carried out using a ϕ' of 32° with no cohesion for the back plane (i.e., JS1). This friction angle corresponds to the 35th percentile residual shear strength determined based on DS testing of joints. For the interface structure (i.e., JS3), a ϕ' of 38° with no cohesion was used. For the breakout plane, both shear failure through intact rock mass and failure along a pre-existing discontinuity were considered. Failure along a discontinuity was found to be more conservative and was therefore used for design. A ϕ' of 38.5° and a c' of 75 kPa, which correspond to the 35th percentile peak shear strength determined based on DS testing of joints, were selected as discontinuity shear strengths for the breakout plane along an existing discontinuity.

The selected shear strength parameters represent a conservative but practical approach for footwall bench and multibench design for Pit Irène.

3.4.2 Bilinear Slab Analysis Results

A detailed assessment of potential bilinear failure mechanisms was carried out by assessing the potential for slab instability to occur for varying slope heights, bedding dip angles, and spacing of JS1 (i.e., slab thickness). Based on field observations and measurements obtained from the AdamTech® photogrammetric models, spacing between continuous JS1 structures is expected to be in the range of 1 to 5m. Spacing of less than 1m for JS1 was considered to be infrequent on continuous structures. Moreover, potential slabs with thickness less than 2m will have a lower consequence of failure (relative to

thicker slabs) and should be readily accommodated through the use of adequate catchment berms. Also, analyses indicate that increasing thickness of potential failure slab corresponds to increasing stability. Consequently, a slab thickness of 2m was identified as the critical design condition.

Bilinear slab analyses were based on a 2D limit equilibrium approach assuming dry conditions. For the 2m-thick potential slab, a minimum FoS of 1.2 was selected as the design criteria (see discussion below in Section 3.6.1 on acceptability criteria). This approach yielded a range of design bench heights for the footwall, and provided general bench design criteria for the range of structural conditions anticipated based on a review of the geologic sections. Bilinear slab analysis results for a 2m-thick potential slab are summarized on Fig. 14. The bench design criteria developed based on the bilinear limit equilibrium analyses are summarized in Table V.

For the purposes of preparing the slope designs, the average dip of JS1 in any given area should be considered as being representative of the BFA in that portion of the pit slope. In other words, bench faces should be excavated at the dip angle of JS1. Transitions in slope design between steeper and flatter areas of average dip, either laterally along slope or vertically down slope, should be conducted in the area of steeper dip (i.e., where the maximum bench stack height will be lower). In areas where the design would leave thin, unstable slivers of rock adjacent to a major contact, a wider berm than recommended in the design criteria should be planned to remove the thin slab and excavate back to the contact.

3.5 KINEMATIC ASSESSMENTS FOR HANGING WALL SLOPES

To assess potential failure mechanisms involving discontinuities (i.e., plane, wedge, or toppling failures involving joints, faults, etc.), it is first necessary to divide the pit into areas wherein both the orientation and characteristics of the discontinuities and the orientation of the slope are expected to be consistent. Slopes with different geologic structure would be expected to behave differently. Likewise, different failure modes may occur in slopes with different orientations.

3.5.1 Kinematic Sectors

Areas of the pit with consistent geologic structure and pit slope orientation are referred to as *kinematic sectors*. Based on the 2015 Pit Irène Mine Plan (v7.0), 11 kinematic sectors, designated by structural domain and approximate pit slope orientation (i.e., dip direction), were delineated in the hanging wall and endwalls of the proposed pit (i.e., in the Southeast, Central, South, and West domains). Figure 2 shows the various kinematic sectors on the proposed Pit Irène Mine Plan. Tables F1 and F2, included in Appendix F, summarize the kinematic analysis results described in Sections 3.5.5 and 3.5.6 below for each kinematic sector assessed. Note that additional kinematic sectors (i.e., slope orientations), other than those observed on the proposed Pit Irène Mine Plan (v7.0), are included in Tables F1 and F2 to accommodate potential, small changes between design sectors in the mine plan.

Within each kinematic sector, bench and interramp kinematic assessments were conducted using geologic structural data from their respective structural domains. Bench geometry assessments were conducted first to determine the expected, or effective, BFA. Interramp slope angles were subsequently calculated based on 28m-high bench heights (i.e., double benches), minimum catch berm widths, and expected BFAs. Additional assessments were conducted to determine kinematic controls of interramp slopes.

3.5.2 Identification of Kinematically Possible Failures

Kinematic assessments for the hanging wall were conducted by considering the effects of faults, joints, and bedding joints on stability. It was assumed (based on observations at Pit Irène, photogrammetric data, and experience elsewhere) that joints could be continuous for up to the height of a double bench and that faults and bedding joints could be continuous to the interramp scale; joints (with the exception of bedding joints) are generally discontinuous structures and failure through rock bridges would be required to reach the interramp scale. Faults, however, are widely spaced and do not occur frequently enough to control bench-scale stability, and bedding joints are not adversely oriented relatively to the hanging wall and endwall slopes. Thus, only failures involving joints were considered valid for bench kinematic assessments and only failures involving faults and bedding joints were considered valid for interramp kinematic assessments.

Three basic types of kinematically possible failure modes (i.e., wedge, planar, and toppling) were identified using the proprietary kinematic and slope stability analysis software, KinStabl version 2.9, developed by Piteau. In particular:

- Wedge failures can occur where the apparent plunge of the line of intersection of two discontinuities daylights on a slope.
- Planar failures can occur where the apparent dip of a plane daylights on a slope, and a suitable lateral release feature exists (or is assumed to exist).
- Toppling failures can occur where a well-defined, closely spaced set of discontinuities, or more widely spaced major discontinuities such as faults, dips steeply into the slope and strikes subparallel to the slope.

A typical lower hemisphere equal area projection, or stereonet, illustrating the different failure modes is shown on Fig. 15. For each kinematic sector, stereonets of planes of the various discontinuity sets were used to identify kinematically possible failure modes. Wedge, planar, and toppling failure modes are identified on lower hemisphere equal area projections included in Appendix F for each kinematic sector on the proposed Pit Irène Mine Plan.

3.5.3 Stability Analysis of Kinematically Possible Failures

Simplified limit equilibrium stability analyses were conducted, using KinStabl, for each kinematically possible plane and wedge failure to evaluate their potential impact on bench and interramp stability. Discontinuity shear strengths used for stability analyses assumed a loss of cohesion and reduction in strength as a result of blast damage on near-surface structures. Shear strengths used for bench, interramp, and overall assessments were as follows:

- Faults:
  - c'=0, ϕ'=20° (typical production blasting conditions at bench scale)
  - c'=110 kPa, ϕ'=25.2° (good presplit blasting conditions and 10% rock bridge at interramp scale)
- Bedding Joints:

  - c'=0, ϕ'=32º (typical production blasting conditions at bench scale)
  - c'=110 kPa, ϕ'=35.2º (good presplit blasting conditions and 10% rock bridge at interramp scale)
- Joints:
  - c'=0, ϕ'=38º (typical production blasting conditions at bench scale)
  - c'=75 kPa, ϕ'=38º (good presplit blasting conditions at bench scale)

Dry or depressurized conditions were assumed for each failure mode, which is practical at the bench and near-interramp scale, where the rock mass is expected to be drained. Analyses for bench geometries and interramp slopes were conducted to determine which failure modes are likely to fail under static loading conditions (i.e., due to gravity). An FoS was calculated for each kinematically possible failure using both peak discontinuity orientations and individual discontinuities in each structural domain, as determined from photogrammetric and oriented core data. Sensitivity analyses of variations in cohesion were also carried out to assess the potential improvements in slope angle with good controlled blasting measures and the effects of slope angle on interramp stability.

3.5.4 Determination of Critical Failure Modes

Not all kinematically possible failure modes have the same impact on bench design. The FoS of some modes may be such that failure is unlikely. Other failure modes may be too oblique to the slope to be of practical importance. Still others may be formed on discontinuities that are only weakly developed and, hence, are unlikely to occur. Therefore, it is necessary to evaluate which kinematically possible failure modes are critical to bench design.

Critical failure modes for bench and interramp stability assessments are defined as follows:

- The calculated FoS of kinematically possible wedge or plane failures, resulting from joint or fault combinations, is less than or equal to 1.0 for bench-scale failures and less than or equal to 1.2 for interramp-scale failures;

- The true dip direction of plane failures must be less than 30° oblique to the dip direction of the slope;
- The azimuth of the line of intersection of wedge failures must be less than 45° oblique to the dip direction of the slope; and
- Toppling modes are possible if the strike of the discontinuity set is less than 30° oblique to the strike of the slope and the discontinuity dip is steeper than 65° into the slope.

3.5.5 Effect of Critical Failure Modes on Bench Stability

Determination of bench-scale critical failure modes involved a statistical assessment, referred to as cumulative frequency analysis (CFA), of all kinematically possible combinations (i.e., plane and wedge failures) of individual joint measurements from photogrammetric and oriented core data within each domain. Faults were excluded from bench-scale assessments, and bedding joints were assigned joint strengths. For each kinematic sector, the relative frequency of all critical failures was cumulated on the basis of apparent plunge (wedge failures) or apparent dip (plane failures). The resulting cumulative frequency was expressed as a percentage of all critical failures and plotted against an increasing apparent plunge or dip angle; an example of this is shown on Fig. 16.

Calibration of kinematic CFA curves involved comparison with the equivalent cumulative frequency plot of documented BFAs for the same kinematic sector. In other words, the theoretical bench face angles from the kinematic analyses were compared to the actual bench face angles attained in the field. To achieve reasonable calibration between the two required consideration of a compound-angle bench face model; based on field observations of bench performance in Pit Irène, benches appear to be generally controlled by the design presplit angle of 80° for the lower two-thirds of the bench (where presplit half barrels are often clearly visible), while the upper one-third of the bench is impacted by breakback. Thus, the theoretical BFAs from kinematics were adjusted to account for the steeper lower part of the bench. This approach is consistent with the results of calibration of CFA curves at other operating mines using presplit blasting techniques.

Using this approach, the kinematic CFA results yielded preliminary calibrated CFA curves that were considered to compare reasonably well with the corresponding CFA curves for documented BFAs. Preliminary calibrated CFA plots for each wall orientation are provided in Appendix F. Where available, documented BFAs are also included on the CFA plots in Appendix F. As mining advances and benches are exposed, bench breakback should continue to be documented to improve calibration of the kinematic CFA curves and allow for bench design optimization.

The expected breakback angle (β_{exp}), or expected BFA, is defined as the angle to which the bench face is expected to break back, on average, due to the occurrence of plane and wedge failures. Based on the preliminary calibration of the kinematic CFA curves for 28m-high benches, as described above, β_{exp} was determined based on a 30% CFA angle ($\beta_{30\%}$), defining a 70% bench reliability considering all kinematically possible wedge and plane failures with an FoS less than or equal to 1.0. Values of $\beta_{50\%}$, which represent bench reliabilities of 50%, are also shown on the CFA plots for comparison purposes.

3.5.6 Effect of Critical Failure Modes on Interramp and Overall Slope Stability

Assessment of kinematically possible failure modes that could control interramp slope designs included consideration of plane, wedge, and toppling failures involving faults and bedding joints. As compared to bench stability, which can be controlled by less continuous features (i.e., joints), instability of interramp and overall slopes requires undercutting of more continuous features such as faults or continuous bedding joints. Potentially critical failure modes are summarized in Tables F1 and F2, and are identified on the stereonets included in Appendix F. A discussion for each failure mechanism is presented below.

i) Planar Failure Potential

Planar failure potential is indicated in the South Domain by bedding joints of Joint Sets JS1-1 and JS1-2 (Table F2). These sets dip northwest at moderate angles, which are flatter than the anticipated range of allowable slope angles in the 2015 Pit Irène Mine Plan, potentially limiting IRH in this structural domain. However, reconciliation of the photogrammetric structural database in the South Domain with the geologic model indicates that the dip direction of JS1-1 and JS1-2 is oblique to the general bedding trend,

defined by the orientation of lithologic contacts (see discussion in Section 2.3.4). This fact suggests that JS1-1 and JS1-2 may be associated with local folding or cleavage joints oblique to bedding. In any case, continuity of JS1-1 and JS1-2 in the South Domain is expected to be limited and should not affect interramp slope stability. As mining advances in this structural domain, additional geotechnical data collection and evaluation is recommended to document and verify the structural model. Should these joint sets have significant continuity on the order of 100m or more, a detailed review and update of the geotechnical design criteria should be considered.

Planar failure potential is not indicated in any other structural domain on the hanging wall (i.e., Southeast, Central, and West domains).

ii) Wedge Failure Potential

Wedge failure potential is not indicated in any structural domain on the hanging wall (i.e., Southeast, Central, South, and West domains).

iii) Deep-Seated Toppling Potential

The potential for deep-seated toppling in the hanging wall was determined to be low and should not affect the performance of the hanging wall.

3.5.7 Determination of Kinematically Allowable Interramp Slope Angles and Heights

As summarized in Tables F1 and F2, IRAs of slopes in the various kinematic sectors of the hanging wall of the proposed Pit Irène Mine Plan are controlled by bench geometries determined from kinematic analyses. At the interramp scale, kinematic controls involving faults or bedding joints were not identified, assuming that 10% rock bridging for faults and bedding joints is preserved with good controlled blasting measures.

The following maximum allowable IRAs are specified based on bench geometries determined from kinematic analyses:

- 46° IRA in Kinematic Sectors 340° to 360° of the South Domain, defined by a 30th percentile BFA of about 63°;
- 53° IRA in Kinematic Sectors 360° to 030° of the South Domain, defined by 30th percentile BFAs in the range of 74 to 75°.
- 48° IRA in Kinematic Sectors 265 to 360° of the Southeast Domain, defined by 30th percentile BFAs in the range of 66 to 67°;
- 51° IRA in Kinematic Sectors 305 to 330° of the Central Domain, defined by 30th percentile BFAs in the range of 71 to 72°;
- 52° IRA in Kinematic Sectors 005 to 060° of the West Domain, defined by 30th percentile BFAs in the range of 72 to 75°.

3.6 DEEP-SEATED 2D LIMIT EQUILIBRIUM ANALYSES

Two-dimensional limit equilibrium analysis of slopes using the method of slices is an established and accepted analysis methodology for stability assessment of slopes in both soil and rock. While it is often the only methodology used on many mining projects due to its relative simplicity, cost effectiveness, and widespread acceptance, it is most justified for slopes that are relatively straight in plan view (i.e., slopes that do not have a significant radius of curvature), as the 2D method assumes a section of unit thickness with no lateral effects or hoop stresses that may be present in circular or tight corners. This might imply, in some cases, the requirement for adequate lateral release to allow freedom of movement in the downslope direction. Due to the long and mostly linear configuration of the slopes forming the hanging wall and footwall of the Pit Irène Mine Plan, 2D limit equilibrium analyses were judged appropriate. It is recognized that lateral effects or hoop stresses might be present on the east endwall due to the small radius of curvature in this area of the proposed pit. However, due to the small extent of this wall and flat interramp and overall slope angles, the complexity of creating a representative 3D model for this section of the pit was not deemed necessary.

3.6.1 2D Limit Equilibrium Analysis Methodology and Acceptability Criteria

i) Limit Equilibrium Analysis Methodology

Deep-seated limit equilibrium stability analyses were carried out with Slide® (Rocscience, version 6.0), using the Generalized Limit Equilibrium (GLE) method of slices (Fredlund

and Krahn, 1977) to determine the minimum static FoS for the slope. The GLE method is a rigorous analysis approach that accounts for both force and moment equilibria. Non-circular searches were conducted to identify the critical shear path (i.e., the potential failure path with the lowest FoS) in all cases. Non-circular searches are well-suited for modeling specific geologic structures or structural fabric trends along the failure path to simulate shear strength anisotropy. For all critical analysis cases, block search analyses were used to refine the shape of the critical non-circular shear surface initially determined using the path search optimizer function in Slide®. This was done through a process of placing block search boxes around each inflection point of the minimum FoS shear path defined with the optimizer function turned on, then running the block search analysis with the optimizer turned off. This approach is considered appropriate to determine repeatable analysis results.

For this study, analyses were carried out on ten representative geologic sections (five on the footwall, four on the hanging wall, and one on the east endwall) constructed based on the 2015 geologic sections provided by AMMC (2015b). Cross section locations are shown on Fig. 2 and presented on Figs. 3 to 9. The slope geometry is based on the proposed Pit Irène Mine Plan (v7.0) (AMMC, 2016b). Design rock mass shear strength parameters were assigned to each geotechnical unit included in the stability models. Contacts were modeled using altered contact zone shear strengths. Design rock mass and discontinuity shear strengths are presented in Table III.

Since the thickness of the geologic units (i.e., the contact spacing) is relatively thin when compared to the slope height, deep-seated stability analysis of the footwall of Pit Irène assumed the rock mass to be isotropic and investigated failure mechanisms involving shearing along the lithologic contacts. However, where massive geotechnical units were encountered in the footwall, sensitivity analysis on rock mass anisotropy were carried out to investigate the influence of adverse discontinuities on slope stability. In the hanging wall and endwalls, the effects of shear strength anisotropy were incorporated in deep-seated stability analyses by applying the shear strengths of faults, joints, and bedding joints to the shear surfaces defined by the ranges of anisotropy determined in Section 2.3.5 and assuming a rock bridging component (10% rock bridging for faults and bedding joints and 20% for joints, assuming good controlled blasting measures).

Anisotropic shear strengths of faults, joints, and bedding joints with the assumed rock bridge percentages are presented in Table IV.

ii) Assessment of Shear Strength Anisotropy

In rock masses where a well-defined structural fabric exists, rock mass strength can be expected to vary depending on the orientation of structural discontinuities (i.e., faults, joints, and bedding joints) with respect to the slope face. Shearing in a direction parallel to these discontinuities, even if they are discontinuous, would be expected to mobilize a lower overall shear strength than shearing in a direction normal to them. The combined influence of geologic structure and the rock mass can be analyzed with Slide® using the Generalized Anisotropy strength function, as illustrated on Fig. 17. This feature in Slide® allows the input of non-linear Hoek-Brown shear strength parameters for the rock mass and linear Mohr-Coulomb strength parameters for discontinuities. Shear strength anisotropy was applied along well-defined (i.e., moderate and strong) geologic structural discontinuity orientations with dip directions within ±30° of the azimuth of each analysis cross section.

Anisotropic analyses were performed to investigate the potential for instability related to the combined influence of discontinuities (i.e., faults, joints, and bedding joints) and the intact rock mass on the hanging wall of Pit Irène. Dip ranges representing moderate and strong peak discontinuity set orientations are included in Table I. The range of dips in the anisotropic functions was specified as ±3° from peak orientations of moderate and strong discontinuity sets (Figs. A1 to A18, and Tables A1 and A2 included in Appendix A). The shear strengths for fault, joint, and bedding joint anisotropy ranges are presented and discussed in Section 2.4.2.

iii) Acceptability Criteria

Industry standards for acceptable levels of safety (i.e., minimum FoS values) are not clearly established in the literature, as a single value usually does not reflect all risks, consequences, and uncertainties associated with slope design. Historically, the most frequently used values range from 1.1 to 1.5 depending on the scale of the slope being

analyzed (i.e., bench, interramp, overall) and the criticality of the slope design (i.e., consequence of failure) (Read and Stacey, 2009).

From a geotechnical perspective, the choice of a minimum FoS to be used in a specific project generally involves technical aspects such as: the level of confidence in the geotechnical and hydrogeological databases; data coverage; complexity of the geomechanical, geologic, structural, and hydrogeological models; previous experience on site; etc. Nonetheless, the selection of minimum acceptability criteria is also a management decision which is likely to be governed by a complex mixture of company culture, risk acceptance, legislative requirements, economics, and social views.

Based on Piteau's experience on open pits at Mont-Wright Mine, acquired through annual site inspections being conducted since 1988, the high level of confidence in the geomechanical database, and the fact that an FoS of 1.2 has historically been successfully incorporated in all pit designs at Mont-Wright, an acceptability criteria using an FoS of 1.2 was deemed appropriated for deep-seated limit equilibrium analyses for the present geotechnical assessment.

iv) Limit Equilibrium Analysis Approach

Stability analyses were initially run assuming slopes with augmented depressurization; that is, levels of depressurization that could likely be achieved with the installation of 150m-long horizontal drainholes during mining of the Pit Irène slopes (as discussed in Section 2.5). Sensitivity analyses were run to assess the adverse effect of water pressures on slope stability assuming passive depressurization only (i.e., slopes subject to depressurization due to mining alone, with no augmented depressurization system). For analysis results with a minimum FoS greater than 1.2 for augmented depressurization conditions (i.e., assuming the installation of 150m-long horizontal drainholes), additional sensitivity analyses were run to assess the minimum level of depressurization required to achieve an FoS of 1.2.

3.6.2 2D Limit Equilibrium Stability Analysis Results

i) Analysis of the Proposed Pit Irène Mine Plan

Analyses of the proposed Pit Irène Mine Plan were carried out to determine the minimum FoS values for each stability analysis section prior to investigating the maximum allowable IRAs specified by the kinematic assessments for the hanging wall (as discussed in Section 3.5). Selected limit equilibrium analysis results are shown on Figs. G1 to G27 included in Appendix G. The minimum FoS for each analyzed section is summarized below.

Section	IRA / Pit Wall	Minimum FoS		Approximate Depth of Depressurization for FoS = 1.2	Figure
		Augmented Depressurization[2]	Passive Depressurization		
-1900 (N)	50° / footwall	n/a	2.79	n/a	G1
-1750 (N)	48° / footwall	n/a	2.02	n/a	G5
NE1	variable / footwall	n/a	1.58[3]	n/a	G9
100 (E)	variable / footwall	n/a	1.46[3]	n/a	G13
I-SE1	50° / hanging wall	n/a	2.59	n/a	G17
I-SE2 (SE)	50° / hanging wall	1.66	1.12	12m	G18 to G20
-1900 (S)	50° / hanging wall	1.62[4]	1.16[4]	13m[4]	G21 to G23
I-SW1	50° / hanging wall	n/a	2.27	n/a	G24
100 (W)	variable / footwall	n/a	4.53	n/a	G26
I-SE2 (NW)	49° / footwall	n/a	2.91	n/a	G27

Note
1. FoS values less than 1.2 are shown in red font.
2. This level of depressurization corresponds to lowering the water table approximately 40 to 70m, measured horizontally behind the pit face, with the use of 150m-long horizontal drainholes.
3. Sensitivity analysis on rock mass anisotropy assuming rock bridge proportion to investigate the influence of adverse discontinuities on slope stability.
4. Sensitivity analysis assuming bedding joint anisotropy.

For the IRAs indicated on the proposed Pit Irène Mine Plan, and for the passive depressurization case, Slide® analysis results indicate minimum FoS values greater than

1.2 for all cross sections except sections I-SE2 (SE) and -1900 (S). In this case, passive depressurization means slopes subject to depressurization due to mining alone, without the installation of any augmented depressurization system. For these two sections, sensitivity analyses on the level of depressurization of the slope indicate that an FoS of 1.2 could be achieved provided that the slope is depressurized to a minimum horizontal depth of about 13m (measured horizontally behind the pit face). Assuming drainholes will effectively drain up to about half of their length, which is a reasonable assumption based on experience at Mont-Wright, this level of depressurization could be achieved with the installation of about 26m-long horizontal drainholes drilled from successive benches as the slope is mined down.

It is important to note that limit equilibrium analyses also indicate that stability of the footwall is strongly controlled by the orientation, location, and nature[6] of the lithologic contacts. Undulated and kinked (or closely folded) contacts could force potential shear surfaces to cross the stronger rock mass in order to bridge the gap between two adjacent weak contact zones along the failure surface, increasing stability. Conversely, smooth contacts would maximize the potential for the shear surface to follow the weak contact as much as possible, reducing stability. All being equal, a critical shear surface following a lithologic contact closer to the slope face would tend to result in a lower FoS as compared to a critical shear surface following a lithologic contact located deeper in the slope (assuming that the lithologic contact does not daylight). In other words, the stability models and analysis results are only as good as the available geologic model, and it is recommended that the geologic model be updated as Pit Irène is mined down. If significant deviation from the current geologic interpretation is recognized, slope designs should be reviewed and adjusted accordingly.

ii) *Analysis of the Optimized Slopes for Pit Irène*

Stability analyses were carried out for the maximum kinematically allowable IRAs as summarized in Tables F1 and F2 included in Appendix F. The analyses results are shown on Figs. G28 to G34 included in Appendix G, and summarized in the following table.

[6] Unaltered contacts versus weak contacts characterized by argillic alteration.

Section	Maximum IRA	Pit Wall	Minimum FoS		Approximate Depth of Depressurization for FoS = 1.2	Figure
			Augmented Depressurization[2]	Passive Depressurization		
I-SE2 (SE)	51°	hanging wall	1.65	1.11	12m	G28 to G30
-1900 (S)	53°	hanging wall	1.48[3]	1.07[3]	31m[3]	G31 to G33
I-SW1	52°	hanging wall	n/a	2.28	n/a	G34

Note
1. FoS values less than 1.2 are shown in red font.
2. This level of depressurization corresponds to lowering the water table approximately 40 to 70m, measured horizontally behind the pit face, with the use of 150m-long horizontal drainholes.
3. Sensitivity analysis assuming bedding joint anisotropy.

Slide® analysis results for the maximum allowable IRAs based on kinematic assessments for the hanging wall (as discussed in Section 3.5), indicate that 31m of horizontal depressurization is required to achieve minimum FoS values greater than 1.2. This level of depressurization could be achieved with the installation of about 62m-long horizontal drainholes drilled from successive benches as the slope is mined down. Based on the predicted post-mining water table, as shown on the geologic sections (Figs. 3 to 9), the initial elevation for the installation of drainholes varies depending on the location in the slope, ranging from as high as the 672m level in the east (Section I-SE1) to about the 644m level in the west (Sections -1750 (S), -1900 (S), and I-SW1). Based on previous experience at Mont-Wright, it is recommended to install the drainholes on a staggered (i.e., diamond) pattern with vertical and lateral spacing of 28m and 150m, respectively. Moreover, to maximize drainage potential, drainhole pattern and orientation should be locally modified, on the basis of the geologic model, and designed to intersect potential draining structures such as faults, shear zones, and bedding planes.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

4.1.1 Engineering Geology

i) Structural Geology and Rock Mass Anisotropy

The structural geology at the Mont-Wright area is complex due to tight folding caused by at least two major orogeny events. The end result of this complex folding at Pit Irène is the creation of tight folds with limbs generally dipping southeast, with local variations including overturned sections on the hanging wall of the pit. As an example, north-south sections through the pit indicate steep lithologic contacts close to surface on the footwall, gradually flattening towards the south and at depth resulting in generally horizontal to gently south-dipping lithologic contacts on the hanging wall.

Although no major faults parallel to bedding and lithologic contacts were observed in the pit area, it is likely that some bedding joints and contact surfaces have undergone shearing during folding and deformation, as indicated in some geomechanical logs. This assumption was incorporated in the analyses by assuming residual shear strengths for bedding joints and shear strengths determined for altered contact zones applied to all lithologic contacts.

Geometric relationships between the joint sets observed at Mont-Wright, namely bedding joints (JS1) and cross joints (JS2 and JS3), are similar to conditions observed in folded sedimentary and metasedimentary rocks in many other areas. That is, one main set of bedding joints and two main sets of cross joints seem to exist: one cross joint set that strikes approximately perpendicular to the bedding joint set and dips steeply to subvertically (i.e., JS2), and a second cross joint set that strikes essentially parallel to the bedding joint set and dips approximately normal to it (i.e., JS3).

Faults, joints, and bedding joints were recognized as preferential shear orientations characterizing shear strength anisotropy within the slopes. The effects of shear strength

anisotropy were incorporated in deep-seated stability analyses of the hanging wall (and endwalls) by applying the shear strengths of faults, joints, and bedding joints to the shear surfaces defined by the ranges of anisotropy determined based on the structural database. Due to observed limited continuity of moderate and strong joint sets, a rock bridge proportion of 20% was assumed to represent discontinuous joint shear strengths for anisotropic analysis. For faults and bedding joints, a 10% rock bridge proportion was assumed. In the footwall, anisotropic effects were incorporated at the bench- and multibench-scale by considering critical failure modes involving slab failures along JS1 and shearing along pre-existing discontinuities at the toe (i.e., bilinear slab failure). At the interramp and overall scale, the effects of shear strength anisotropy were incorporated in deep-seated stability analysis of the footwall by considering lithologic contacts as discrete continuous shearing features while the rock mass was assumed to be isotropic. However, to investigate possible failure mechanisms between lithologic contacts, sensitivity analyses incorporating the effects of rock mass anisotropy were run for footwall sections in which lithologic contacts were identified to be widely spaced.

ii) Geotechnical Units and Rock Mass Strength

For design purposes, the following five main geotechnical units have been identified: Gneiss (GN), Quartzite (QR), Quartz Rock Mica Schist (QRMS), Iron Formation (IF), and Amphibolite (AMP). The major occurrence of GN is at depth, but as result of stratigraphic inversion, due to overturned tight folding, it is expected to be exposed in portions of the upper benches in the footwall. QR occurs as inclusions within the IF and AMP units, and, depending on the location, as the first unit below the AMP. However, as a result of stratigraphic inversion, QR is expected to form extended portions of the hanging wall and east endwall. The QRMS unit is not expected to daylight along significant portions of the pit but might be present in the upper benches in the footwall. The IF unit, which is comprised of the ore-bearing IF lithology, might contain a number of smaller continuous and discontinuous bands of QRMS and AMP. Due to tight overturned folding, IF is expected to form the lower benches in the footwall and hanging wall. The AMP unit is expected to form most of the benches in the footwall and the west and east endwalls, and the lower benches in the hanging wall. However, at depth it occurs as large units interbedded with the QR and QRMS units.

In terms of rock mass quality, the geotechnical units expected to form the walls of Pit Irène can be classified as competent. Average RMRs range from 74 to 84 with the 35th percentile values ranging between 65 and 78, indicating good quality rock for both statistical descriptions. The GN is the least-competent geotechnical unit with 35th percentile and average RMR values of about 65 and 74, respectively. The QR is the most-competent geotechnical unit with 35th percentile and average RMR values of about 78 and 84, respectively.

iii) Hydrogeology

Piezometric data from 2015 were collected and reviewed. Due to the limited groundwater monitoring points and hydrogeological information available for Pit Irène, and considering the proximity of Paul's Peak Pit, which is located in a similar geologic setting, the hydrogeological model for Irène was developed in analogy to the one developed for Paul's Peak.

Two cases were considered for the prediction of phreatic surfaces. The first case predicted groundwater responses to mining only (i.e., passive depressurization), while the second case simulated a series of 150m-long horizontal drains installed along bench faces and were assumed to drain up to about half of their total length (i.e., augmented depressurization condition).

4.1.2 Open Pit Stability Analysis Results and Open Pit Slope Designs

Slope design criteria for Pit Irène were developed based on kinematic assessments of allowable bench and interramp slope geometries in the hanging wall, bilinear failure mechanisms involving slab failures in the footwall, and assessments of deep-seated limit equilibrium stability analyses for both hanging wall and footwall.

i) Assessment of Maximum Allowable Bench Stack Height in the Footwall

Sensitivity analyses on the thickness of slabs defining the bilinear failure mechanism indicate a 2 m-thick slab as the critical design condition. Failures involving slabs with thickness less than 2m should be readily accommodated through the use of 13 m-wide

catchment benches and would have a lower consequence of failure relative to a thicker slab. Sensitivity analyses also indicate that increasing thickness of the potential failure slab correlate to increasing stability.

The bilinear analysis approach yielded a range of design bench heights for the footwall corresponding to the dip of bedding (JS1), and provided a general bench design criteria for the range of anticipated geologic structural conditions. The recommended bench design criteria for the footwall of Pit Irène are summarized in Table V.

ii) Analysis of Bench Breakback Potential in the Hanging Wall

The expected breakback angle of benches in the hanging wall of the proposed Pit Irène is based on a 30% CFA angle (or 70% reliability) defined by all kinematically possible wedge and plane failures involving joints with an FoS less than or equal to 1.0. Documented breakback angles ranged from 62.8° in Kinematic Sector 350° in the South Domain to 75.2° in Kinematic Sector 025° in the West Domain. For kinematic sectors where bench documentation is not available, the expected breakback angle of benches was predicted based on preliminary calibration of kinematic CFA curves for 28 m-high benches assuming a compound-angle breakback. Predicted breakback angles based on compound-angle kinematic assessments ranged from 67.4 to 75.4°. Manhattan diagrams showing the predicted and the documented breakback angles for the various kinematic sectors are shown on Fig. 18.

iii) Assessment of Maximum Allowable IRAs in the Hanging Wall Based on Kinematic Analysis Results

Based on the results of kinematic assessments involving discontinuity populations determined from photogrammetry and core orientation, maximum allowable IRAs are not defined by kinematic controls involving faults and bedding joints. Instead, the following maximum allowable IRAs are specified based on bench geometries determined from kinematic analyses:

- 46° IRA in Kinematic Sectors 340° to 360° of the South Domain, defined by a 30th percentile BFA of about 63°;

- 48° IRA in Kinematic Sectors 265 to 360° of the Southeast Domain, defined by 30th percentile BFAs in the range of 66 to 67°;
- 51° IRA in Kinematic Sectors 305 to 330° of the Central Domain, defined by 30th percentile BFAs in the range of 71 to 72°;
- 52° IRA in Kinematic Sectors 005 to 060° of the West Domain, defined by 30th percentile BFAs in the range of 72 to 75°;
- 53° IRA in Kinematic Sectors 360° to 030° of the South Domain, defined by 30th percentile BFAs in the range of 74 to 75°.

iv) Deep-Seated Limit Equilibrium Stability Analysis Results

Results of limit equilibrium analyses indicate minimum FoS values greater than 1.2 for slopes in the footwall (of the proposed mine plan) without the installation of any depressurization system (i.e., passive depressurization). In the hanging wall, minimum FoS values greater than 1.2 can be achieved for the proposed mine plan provided that the hanging wall is depressurized to a minimum horizontal depth of about 26m (measured horizontally behind the pit face).

For slopes in the hanging wall with optimized IRAs of 51°, 52°, and 53° in the Central, West, and South domains, respectively, a minimum horizontal depressurization depth of 31m is required to achieve minimum FoS values of 1.2. Assuming drainholes will effectively drain up to about half of their length, which is a reasonable assumption based on experience at Mont-Wright and elsewhere, this level of depressurization could be achieved with the installation of about 62 m-long horizontal drainholes.

v) Opportunities for Slope Steepening in the Hanging Wall

As indicated in Tables F1 and F2 included in Appendix F, predicted breakback angles based on compound-angle kinematic assessments indicate potential for interramp slope steepening in Kinematic Sectors 325° to 355° in the Southeast Domain and in Kinematic Sectors 340° to 360° in the South Domain. Successful bench trials with 80° presplit angle could allow the following increase in the design IRA:

- Kinematic Sectors 325° to 355° in the Southeast Domain:
    - Potential increase in the design IRA to 53°, from proposed 48°, provided that effective BFAs of 74° can be achieved at a 70% reliability (30% cumulative frequency).
- Kinematic Sectors 340 to 360° in the South Domain:
    - Potential increase in the design IRA to 52°, from proposed 46°, provided that effective BFAs of 72° can be achieved at a 70% reliability (30% cumulative frequency).

4.1.3 Slope Design Recommendations

Recommended slope designs for the Pit Irène Mine Plan consist of six design sectors, as summarized in Tables V and VI and shown on Figs. 18 and 19. The basic slope geometry parameters for the recommended slope designs are described in Section 3.2 and illustrated on Fig. 13.

Results of limit equilibrium analyses of the footwall and hanging wall discussed below are valid for the proposed 2015 Pit Irène Mine Plan (v7.0); any modification to the mine plan resulting in higher slopes should be validated based on additional limit equilibrium analyses.

i) Bench Slope Designs

Recommended bench designs consist of a BFA of 80° for presplit blasting and a double bench height of 28m in all design sectors in the hanging wall (Design Sectors II to VI on Fig. 19). This design BFA, which is based on current practice at Mont-Wright, is several degrees steeper than the expected breakback angles to allow for improvements in effective BFA with optimization of controlled blasting measures. Design bench widths for the various design sectors in the hanging wall are calculated based on the design BFA, bench heights, and IRAs in Table VI. Design bench widths, with allotment for crest breakback, range from 13m in Design Sector I to 22.1m in Design Sector IV.

In the footwall (Design Sector I on Fig. 19), the average dip of JS1 in any given area is considered as the BFA in that portion of the slope.

ii) Interramp Slope Designs

Recommended bench stack heights for the footwall (Design Sector I on Fig. 19) are specified based on the average dip of JS1 as summarized in Table V. The recommended IRAs for Design Sectors II to VI, in the hanging wall, are summarized in Table VI and described as follows.

In Design Sector II, the recommended IRA is 48° based on the performance of documented bench breakback. A potential increase in the recommended design to 53°, from the proposed 48°, was identified, based on compound-angle kinematic assessments, provided that effective BFAs of 74° can be achieved at a 70% reliability (30% cumulative frequency).

In Design Sector III, the recommended IRA is 51°, based on the performance of documented bench breakback.

In Design Sector IV, a 46° IRA is recommended based on the performance of documented bench breakback. A potential increase in the design IRA to 52°, from the proposed 46°, was identified, based on a compound-angle kinematic assessments, provided that effective BFAs of 72° can be achieved at a 70% reliability (30% cumulative frequency). Alternatively, wall orientation 005°, from Design Sector V, could be extended further east to connect, at a sharp angle, with wall orientation 320° from Design Sector III. This would avoid unfavourable structures associated with wall orientations ranging from 340° to 360° in the South Domain and would allow for the recommended IRA for Design Sector V (i.e., IRA of 53°) to be applied all the way to the boundary with Design Sector III (thus eliminating Design Sector IV).

In Design Sector V, the recommended IRA is 53°, based on the performance of documented bench breakback.

In Design Sector VI, the recommended IRA is 52°, based on the performance of documented bench breakback.

iii) Footwall Overall Slope Designs

Results of limit equilibrium analyses on sections through the footwall indicate FoS values greater than 1.2 for the passive depressurization condition; that is, groundwater responses to mining only without the need for the installation of any augmented depressurization system.

It is important to note that limit equilibrium analysis results indicate that stability of the footwall is strongly controlled by the orientation, location, and nature of the lithologic contacts. It is recommended that the geologic model be updated as the footwall is mined down and if significant deviation from the current geologic interpretation is recognized, including identification of extensive weak contact zones characterized by argillic alteration, slope designs should be reviewed and adjusted.

A review of the proposed Pit Irène Mine Plan (v7.0) on the basis of the geotechnical footwall design criteria summarized in Table V is recommended. For the purposes of reviewing and preparing the mine plan, the average dip of JS1 or of lithologic contacts in any given area should be considered as being representative of the BFA in that portion of the pit slope. Where contacts occur in the vicinity of the final footwall, it is recommended that the mine plan be locally modified to mine back to the contact or, alternatively, stepped away from the contact, in order to avoid the potential for localized and shallow failures of weak contact zones involving single or multiple benches. Because this process is highly dependent on the geologic interpretation, it is recommended that mine plan be continually reviewed during the short-range design process and during mining, and any changes to the geologic interpretation be incorporated into the mine plan. The objective of the proposed design process is to avoid undercutting bedding, or lithologic contacts, at the bench scale while maintaining the IRA as parallel as possible to the lithologic contacts.

To improve slope stability and performance, consideration should be given to removing or altering slope convexities (i.e., noses) whenever possible, such as the one indicated in the East Domain (Figs. 2 and 19).

iv) Hanging Wall Overall Slope Designs

Results of limit equilibrium analyses on sections through the hanging wall indicate FoS values of 1.2 or greater can be achieved provided that portions of the hanging wall, as indicated in Table VI, are depressurized to a minimum horizontal depth of 31m. Assuming drainholes will effectively drain up to about half of their length, which is a reasonable assumption based on experience at Mont-Wright and elsewhere, this level of depressurization could be achieved with the installation of about 62 m-long horizontal drainholes. The initial elevation required for the installation of drainholes varies depending on the location on the slope, ranging from about the 672m level in the east portion of the hanging wall to about the 644m level in the west. Based on previous experience at Mont-Wright, it is recommended that drainholes be installed on a staggered (i.e., diamond) pattern with vertical and lateral spacing of 28m and 150m, respectively. Moreover, to maximize drainage potential, drainhole pattern and orientation should be locally modified, on the basis of the geologic model, and designed to intersect potential draining structures such as faults, shear zones, and bedding planes.

Based on the indicated lack of kinematic controls involving faults and bedding joints at the interramp scale, the following overall IRH limits were specified for design sectors in the hanging wall, based on results of limit equilibrium analyses of the proposed 2015 Pit Irène Mine Plan (v7.0):

- IRH of 210m in Design Sector II (Southeast Domain);
- IRH of 210m in Design Sector III (Central Domain);
- IRH of 196m in Design Sectors IV and V (South Domain);
- IRH of 140m in Design Sector VI (West Domain).

Higher slopes could potentially be achieved (if changes to the mine plan necessitate higher slopes), but would need to be validated based additional on limit equilibrium analyses.

v) Blending and Finalizing Designs

Where recommended IRAs differ between adjacent design sectors, blending should occur within the design sector with the greater IRA, or where the maximum bench stack height will be lower (for footwall designs). Similarly, blending from weaker to stronger materials should occur in the stronger or better quality rock mass materials. In footwall areas where the design would potentially leave thin, unstable slivers of rock above a major contact, a wider berm than recommended in the design criteria should be planned to mine back to the contact and remove the thin slab.

As a general rule, if the relative difference of the wall orientation and the dip direction of Set JS1 is less than 30°, footwall designs should be adopted. However, footwall designs perform best when the wall orientation matches the orientation of JS1 exactly, or is at most no more than 5 or 10° oblique to JS1. Slope orientations within the range of 10 to 30° oblique to JS1 constitute a transition zone between footwall and hanging wall designs, and should be avoided as much as possible; footwall designs may be conservative and practically difficult to mine within this transition zone, and bench-scale failures are highly probable if hanging wall designs are adopted.

4.2 GENERAL RECOMMENDATIONS

4.2.1 Bench Trials

Bench trials in Kinematic Sectors 325° to 355° in the Southeast Domain (Design Sector II) and in Kinematic Sectors 340 to 360° in the South Domain (Design Sector IV) should be considered to test the possibility of improving slope angles, as proposed above. These trials should be planned in areas where bench performance is expected to have the least impact on the stability of haulroads or other critical slope areas. Bench designs should be updated based on ongoing evaluation of bench performance.

4.2.2 Slope Monitoring

The ongoing development of Pit Irène will require regular monitoring using survey prisms in combination with an observational approach to access slope stability and performance.

Depending on the performance of the slopes at Pit Irène, monitoring with a Slope Stability Radar (SSR) unit may be required.

4.4.3 Visual Inspection Monitoring

Regular inspections of the crest and exposed benches in Pit Irène should be carried out to identify any signs of tension cracking, increased ravelling, or other signs of instability. The locations of observed tension cracks should be surveyed and added to geotechnical plans to allow assessment of slope deformation with respect to slope monitoring data and any potential mechanism(s) of instability. Any unusual signs of slope ravelling or distress should be communicated to the Mine Geotechnical Department and assessed accordingly.

4.4.4 Hydrogeological Monitoring

Regular reviews of piezometric data should be conducted to confirm that adequate depressurization is being achieved. Depending on the number and location of existing VWPs remaining on the pit walls during and after mining, the installation of additional piezometers, either behind the final pit crest or installed from benches on the slope, could be required.

4.4.5 Controlled Blasting

Controlled blasting techniques are recommended on all final walls to minimize disturbance to the rock mass and preserve cohesion on discontinuity surfaces, in particular along JS1 in the footwall. For the hanging wall, the recommended BFA and expected bench breakback assume that benches will be excavated using 80° angled presplit blast holes (based on positive experience in Pit Irène). Blast monitoring and pre- and post-blast inspections should be conducted to continually assess potential blast damage and improve blast performance.

4.4.6 Bench Scaling and Cleaning Catch Berms

As is normal practice at Mont-Wright, bench faces should be thoroughly scaled and bench toes and berms cleaned following excavation. This is particularly important on final slopes where access may be limited once mining progresses. The need for additional scaling

and periodic cleaning of berms to minimize potential for rockfall hazards and maintain the berms for effective rockfall catchment and monitoring instrumentation should be assessed by mine personnel on an ongoing basis.

4.4.7 Ongoing Data Acquisition, Verification, and Updating Design Criteria

Optimization of slope designs requires an iterative approach, whereby designs are implemented, results are evaluated, and the design criteria are updated or modified based on experience. To achieve optimum interramp and overall slopes, an ongoing program of geotechnical data collection and evaluation is recommended during mining operations to document rock mass behaviour and verify or modify the design criteria as the mine is developed. This could consist of systematic bench face mapping and photogrammetric surveys. Furthermore, any future drainholes or exploration drillholes should be geomechanically logged (to obtain all parameters to assess RMR according to Bieniawski, 1976) to provide updates to the geologic and geomechanical models. If any significant variation in bedding or lithologic contact location is noticed, slope designs should be adjusted accordingly.

4.4.8 Surface Water Control

Surface water control in Pit Irène should incorporate well-maintained perimeter ditches behind the pit crest, adequate grading and ditching of haulroads, and collection and pumping of surface water in appropriately placed sumps.

5. LIMITATIONS AND CLOSURE

In preparing the stability assessments, conclusions, and recommendations contained herein, Piteau Associates Engineering Ltd. has relied on information and interpretations provided by others. Piteau is not responsible for any errors or omissions in this information. This report is comprised of text, tables, figures, and appendices, and all components must be read and interpreted in the context of the whole report. This report has been prepared for the sole use of ArcelorMittal Mines Canada and no representation of any kind is made to any other party.

Conclusions and recommendations made in this report are based on information available prior to March 31, 2016.

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We trust the above is adequate for your present needs. Please contact us if you have any questions, comments or concerns.

Respectfully submitted,

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7. REFERENCES

ArcelorMittal, 2015a. "mont_wright_current_topography20150528.dxf". Mont-Wright Current Topography. Electronic file provided by ArcelorMittal by file transfer protocol, May 29.

ArcelorMittal, 2015b. "section_irene_utm_b-1750.str, section_irene_utm_b-1900.str, sec_long_utm_b_100.str, section_se2.dxf, section_sw1.dxf, section_se1.dxf, and section_ne1.dxf". Seven cross sections through Pit Irène provided by ArcelorMittal in four electronic mails, October 26, 27, 30, and 31.

ArcelorMittal, 2015c. "Geology_MW.doc". Summary of geologic setting at Mont-Wright. Electronic file provided by ArcelorMittal by electronic mail, November 19.

ArcelorMittal, 2015d. "bmb_mwh_i_20150325.mdl". Pit Irène block model. Electronic file provided by ArcelorMittal by file transfer protocol, November 27.

ArcelorMittal, 2015e. "PZ-Irène-2015_Dec7.xlsx". Piezometer data for Pit Irène. Electronic file provided by ArcelorMittal by electronic mail, December 7.

ArcelorMittal, 2016a. "faille _irene_20160111.dtm". Fault Interpretation. Electronic file provided by ArcelorMittal by electronic mail, January 15.

ArcelorMittal, 2016b. "DE_IR_v7.0_Ligne.dxf". Pit Irène Mine Plan. Electronic file provided by ArcelorMittal by electronic mail, January 22.

Barton, N., and Choubey, V., 1977. "The Shear Strength of Rock Joints in Theory and Practice." Rock Mechanics, Vol. 10, pp. 1-54.

Bieniawski, Z.T., 1976. "Rock Mass Classification in Rock Engineering." Proceedings of the Symposium on Exploration for Rock Engineering, ed. Z.T. Bieniawski, Balkema, Rotterdam, pp. 97-106.

Bourassa, P.J., 1977. "The Mont-Wright Story – History and Development of Mont-Wright." CIM Bulletin, April, pp. 75-82.

Call, R.D., 1992. "Slope Stability." In SME Mining Engineering Handbook, ed. H.L. Hartman, 2nd ed., Chapter 10.4, Littleton, Colorado: SME.

Deere, D.U., Hendron, A.J., Patton, F.D., and Cording, E.J., 1967. "Design of Surface and Near Surface Construction in Rock." Procs. 8th U.S. Symposium on Rock Mechanics, AIME, New York, pp. 237-302.

Fredlund, D.G. and Krahn, J., 1977. "Comparison of Slope Stability Methods of Analysis." Canadian Geotechnical Journal, Volume 14, pp. 429-439.

Hawley, P.M., Gilmore, B.W., and Newcomen, H.W., 1994. "Application of Rock Mass Classification to Open Pit Slope Design." Integral Approach to Applied Rock Mechanics, Volume II, 1994 ISRM International Symposium. Santiago, Chile. M. Van Sint Jan, ed., pp 727-738.

Hoek, E., Carranza-Torres, C., and Corkum, B., 2002. "Hoek-Brown Failure Criterion – 2002 Edition." Proc. North American Rock Mechanics Society Meeting, Toronto, July.

ISRM, 1981. "Rock Characterization Testing and Monitoring: ISRM Suggested Methods", ed. E.T. Brown, Pergamon Press.

ISRM, 1985. "Suggested Methods for Determining Point Load Strength." International Society for Rock Mechanics, Lisbon. 8p.

Piteau, 1998. "Slope Instability in Pit B and at the Mont-Wright Mine." Letter report to: Pierre Casagrain, Compagnie Minière Québec Cartier, December.

Piteau, 2010. "South Wall Pit Slope Design for the Paul's Peak Pit." Report to ArcelorMittal Mine Canada, July.

Piteau, 2015. "Pit Irène – Scope and Estimated Costs for Pit Slope Design Update." Proposal to ArcelorMittal Mines Canada, July 14.

Piteau, 2016. "Geotechnical Stability Assessments for Continued Mining of the South Wall in Paul's Peak." Report to ArcelorMittal Mine Canada, January, 39p.

Read and Stacey, 2009. "Guidelines for Open Pit Slope Design." CRC Press, 496p.

TABLES

TABLE I
RANGES OF STRUCTURAL ANISOTROPY USED IN SLIDE LIMIT EQUILIBRIUM MODELS FOR THE HANGING WALL OF THE PIT IRÈNE MINE PLAN (V7.0)[1]

Geologic Section/ (Dip Dir)[2]	Structural Domain	Plane Shear Structural Sets				Orientation	Anisotropy Dip Range (°)[4]		
		Set	Weight[3]	Database	Dip/Dip Dir (°)		Faults	Bedding	Joints
I-NE1 (208°)	East	F2	M	ORIENTED	36/201	Pitward	33-39	31-33	53-59
		F1	M	ORIENTED	72/215	Pitward	69-75	39-49	82-90
		JS1-3 (bedding)	M	ORIENTED	34/180	Pitward			
		JS1-2 (bedding)	S	ORIENTED	41/223	Pitward			
		JS1-1 (bedding)	S	ORIENTED	46/193	Pitward			
		JS4	M	ADAM/SIRO	56/195	Pitward			
		JS2-2	M	ADAM/SIRO	85/221	Pitward			
		JS2-1	S	ADAM/SIRO	87/238	Pitward			
I-SE1 (345°)	Southeast	JS6	M	ADAM/SIRO	50/348	Pitward			47-55
		JS5	M	ADAM/SIRO	52/336	Pitward			71-77
		JS4	S	ADAM/SIRO	74/339	Pitward			
	East	JS1-3 (bedding)	M	ORIENTED	34/180	Indipping		*31-37*	
		JS1-1 (bedding)	S	ORIENTED	46/193	Indipping		*43-49*	
I-SE2/SE (311°)	Central	JS10	M	ORIENTED	15/298	Pitward			12-25
		JS9	S	ORIENTED	22/334	Pitward			42-48
		JS5	S	ADAM	45/333	Pitward			59-65
		JS4	S	ADAM	62/338	Pitward			
		JS1 (bedding)	M	ADAM	27/104	Indipping		*24-30*	
	West	JS5	M	ADAM/SIRO	86/337	Pitward			83-89
I-SE2/NW (131°)	North	JS6	M	ORIENTED	42/126	Pitward			39-45
		JS5	M	ORIENTED	70/137	Pitward			67-73
		JS3	M	ADAM	15/297	Indipping			*12-24*
		JS7	M	ORIENTED	21/302	Indipping			
I-SW1 (022°)	South	JS1 (bedding)	S	ORIENTED	30/013	Pitward		27-40	9-15
		JS1-1 (bedding)	M	ADAM/SIRO	37/024	Pitward			
		JS4	M	ORIENTED	12/043	Pitward			
	West	JS1 (bedding)	M	ADAM/SIRO	53/003	Pitward		50-56	
100/W (085°)	Northwest	F1	M	ORIENTED	56/080	Pitward	53-59	48-53	
		JS1-1 (bedding)	S	ORIENTED	51/100	Pitward			
		JS3	M	ORIENTED	17/292	Indipping			*14-20*
100/E (265°)	Southeast	JS7	M	ADAM/SIRO	16/115	Indipping			*13-19*
	Central	JS3	S	ADAM	81/270	Pitward			78-84
		JS1 (bedding)	M	ADAM	27/104	Indipping		*24-30*	
-1750/N (175°)	North	F1	M	ORIENTED	36/201	Pitward	33-39	74-80	
		JS1 (bedding)	S	ORIENTED	77/185	Pitward		83-89	
		JS1 (bedding)	S	ADAM	86/163	Pitward			
		JS4	M	ADAM	33/009	Indipping			*30-36*
	East	F2	M	ORIENTED	36/201	Pitward	33-39	31-33	53-59
		JS1-3 (bedding)	M	ORIENTED	34/180	Pitward		43-49	
		JS1-1 (bedding)	S	ORIENTED	46/193	Pitward			
		JS4	M	ADAM/SIRO	56/195	Pitward			
-1900/N (175°)	North	F1	M	ORIENTED	36/201	Pitward	33-39	74-80	
		JS1 (bedding)	S	ORIENTED	77/185	Pitward		83-89	
		JS1 (bedding)	S	ADAM	86/163	Pitward			
		JS4	M	ADAM	33/009	Indipping			*30-36*
-1900/S (355°)	South	F2	M	ORIENTED	14/344	Pitward	11-17	27-40	
		JS1 (bedding)	S	ORIENTED	30/013	Pitward		42-48	
		JS1-1 (bedding)	M	ADAM/SIRO	37/024	Pitward			
		JS1-2 (bedding)	M	ADAM/SIRO	45/347	Pitward			
	West	JS1 (bedding)	M	ADAM/SIRO	53/003	Pitward		50-56	83-89
		JS5	M	ADAM/SIRO	86/337	Pitward			

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Notes:
1. Ranges of shear strength anisotropy defined by peak set structural orientations defined from Adamtech and Sirovision photogrammetry, and CorientR oriented core data (Appendix A).
2. Refer to Fig. 2 for geologic section locations.
3. Only Moderate (M) and Strong (S) fault, bedding joint, and joint sets were considered for anisotropic analyses.
4. The range of structural dips in the anisotropic functions were assumed to be defined by a ±3° dip from the peak set orientation. Indipping ranges are shown in italics.
5. Refer to Table III for rock mass shear strength and Table IV for anisotropic shear strength of faults, bedding joints, and joints based on rock bridge percentage.
6. This table is an integral part of Piteau's report dated May 2016 (file:1846-16_R02), and must be read and interpreted in the context of that report. Provided for the exclusive use of ArcelorMittal Mines Canada and Mont-Wright Mine, and may not be modified or used for any other party without the expressed approval from Piteau Associates Engineering Ltd.

TABLE II
WEIGHTED-AVERAGED GEOMECHANICAL PARAMETERS
FROM THE 2015 GEOTECHNICAL DRILLHOLES FOR THE PIT IRÈNE AREA [1, 2]

GEOTECHNICAL UNIT	LITHOLOGY TYPES	LENGTH DRILLED (m)	RECOVERY (%)	RQD (%)	FF [3] (#/m)	DOB [4]	JC [5]	DOA [6]	H (R) [7]	UCS_{PLI} (MPa) [8]	Site-Specific UCS_{PLI}-H [9] (MPa)	UCS Testing (MPa) [10]	RMR - UCS_{PLI} [11,12]	RMR - Site Specific H [11,13]	RMR - UCS [11,14]
AMP	AMP	691.47	99.0	96.6	1.8	E	16.7	E	3.9	116.2	117.2	-	78.2	78.6	-
			(3.3)	*(8.4)*	*(2.3)*		*(7.7)*		*(0.8)*	*(47.1)*	*(29.6)*	-	*(14.3)*	*(14.3)*	-
	AMPIF	24.36	99.4	96.1	2.5	E-	12.4	D	3.4	74.6	100.6	-	68.1	70.1	-
			(1.4)	*(5.6)*	*(2.0)*		*(6.3)*		*(0.7)*	*(49.7)*	*(47.8)*	-	*(12.4)*	*(12.1)*	-
	COMBINED	**715.83**	**99.0**	**96.6**	**1.8**	**E**	**16.5**	**E**	**3.9**	**114.8**	**116.6**	**132.0**	**77.9**	**78.3**	**79.6**
			(3.2)	***(8.3)***	***(2.3)***		***(7.7)***		***(0.8)***	***(47.8)***	***(30.5)***	***(49.0)***	***(14.3)***	***(14.3)***	***(13.6)***
IF	IF	**725.83**	**98.3**	**94.7**	**2.4**	**E-**	**17.3**	**E-**	**4.0**	**183.2**	**173.6**	**208.9**	**79.6**	**79.9**	**81.6**
			(1.9)	***(11.7)***	***(2.9)***		***(7.0)***		***(0.8)***	***(78.6)***	***(50.4)***	***(63.6)***	***(15.3)***	***(15.4)***	***(13.9)***
QRMS	QRMS	63.00	99.3	96.7	2.2	E-	15.8	D+	4.1	171.6	155.2	-	78.1	77.4	-
			(1.4)	*(5.7)*	*(2.1)*		*(6.1)*		*(0.9)*	*(68.9)*	*(66.5)*	-	*(13.2)*	*(13.5)*	-
	QRMSIF	70.50	99.4	96.8	1.9	E	14.8	D+	3.9	141.0	137.0	-	76.9	76.9	-
			(1.3)	*(7.1)*	*(2.1)*		*(7.0)*		*(0.7)*	*(64.3)*	*(53.7)*	-	*(13.2)*	*(13.8)*	-
	COMBINED	**133.50**	**99.4**	**96.7**	**2.0**	**E-**	**15.3**	**D+**	**4.0**	**155.4**	**145.6**	**188.2**	**77.4**	**77.2**	**79.3**
			(1.3)	***(6.5)***	***(2.1)***		***(6.6)***		***(0.8)***	***(68.3)***	***(60.8)***	***(44.2)***	***(13.2)***	***(13.7)***	***(12.3)***
QR	QR	695.84	98.5	96.8	1.7	D+	17.8	E-	3.6	288.4	287.4	-	84.3	84.8	-
			(4.9)	*(6.5)*	*(1.9)*		*(6.5)*		*(0.5)*	*(81.5)*	*(35.4)*	-	*(12.4)*	*(12.4)*	-
	QRIF	73.50	98.0	95.1	2.4	E-	17.1	E-	4.1	240.1	273.8	-	79.8	81.6	-
			(3.7)	*(10.7)*	*(2.9)*		*(5.8)*		*(0.9)*	*(113.5)*	*(50.0)*	-	*(13.4)*	*(12.3)*	-
	COMBINED	**769.34**	**98.5**	**96.6**	**1.7**	**D+**	**17.7**	**E-**	**3.7**	**283.8**	**286.1**	**291.5**	**83.9**	**84.5**	**84.7**
			(4.8)	***(7.1)***	***(2.0)***		***(6.4)***		***(0.6)***	***(86.3)***	***(37.3)***	***(96.0)***	***(12.6)***	***(12.4)***	***(12.1)***
GN	GN	91.50	98.4	97.3	1.3	E	16.3	E-	3.7	71.2	72.8	-	76.4	76.7	-
			(3.1)	*(4.9)*	*(1.6)*		*(7.8)*		*(0.5)*	*(34.1)*	*(13.4)*	-	*(13.5)*	*(13.4)*	-
	GNF	9.00	94.9	88.4	3.6	E	10.7	D+	3.8	40.6	75.2	-	60.7	63.7	-
			(7.8)	*(13.9)*	*(3.2)*		*(2.6)*		*(0.5)*	*(25.4)*	*(13.4)*	-	*(11.7)*	*(9.8)*	-
	GNM	44.50	98.2	96.6	1.6	E-	17.3	D+	3.7	75.9	77.4	-	76.7	76.5	-
			(2.7)	*(3.8)*	*(1.7)*		*(7.2)*		*(0.3)*	*(25.4)*	*(13.5)*	-	*(14.4)*	*(14.2)*	-
	GNIF	15.00	94.1	91.5	3.6	E-	8.9	D+	3.1	50.4	55.6	-	59.0	59.6	-
			(9.0)	*(11.4)*	*(2.7)*		*(5.6)*		*(0.6)*	*(22.7)*	*(21.7)*	-	*(9.2)*	*(9.4)*	-
	COMBINED	**160.00**	**97.8**	**96.1**	**1.8**	**E**	**15.6**	**D+**	**3.6**	**68.9**	**72.6**	**90.9**	**73.9**	**74.3**	**75.5**
			(4.5)	***(6.9)***	***(2.0)***		***(7.7)***		***(0.5)***	***(32.0)***	***(15.5)***	***(35.6)***	***(14.6)***	***(14.3)***	***(13.9)***

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Notes:
1. Includes data from geotechnical drillholes GT15-I001, GT15-I002, GT15-I002a, and GT15-I003 to GT15–I015.
2. Values reported in parentheses are standard deviations corresponding to weighted average values based on interval length.
3. Fracture Frequency (FF): number of natural fractures per metre. A default value of 20 is assigned for FF for core runs with Hardness values less than R1.0 to coincide with a default RQD value of 0%.
4. Degree of Breakage (DOB): total number of all fractures per metre (includes both natural and mechanical breaks prior to core handling). DOB ratings: A = fault gouge, B = crushed and broken rock (no fault gouge), C = mean fracture spacing 5 to 10 cm, D = mean fracture spacing 10 to 20 cm, E = mean fracture spacing greater than 20 cm.
5. Joint Condition (JC), after Bieniawski (1976).
6. Degree of Alteration (DOA). DOA ratings: A = residual soil, B = completely altered, C = highly altered, D = moderately altered, E = slightly altered, F = fresh and unweathered.
7. Hardness (H), as per ISRM (1981) field Hardness scale.
8. Unconfined compressive strength (UCS) estimated from drill run PLI value averaged by lithotypes and correlated to UCS strength based on the correlation factor (K). Minor lithctypes were assigned K values corresponding to the major geotechnical unit.
9. Unconfined compressive strength (UCS) estimated from field specific Hardness curves developed based on correlations with field PLI and laboratory UCS tests.
10. Unconfined compressive strength (UCS) estimated from UCS laboratory test results averaged by lithotypes.
11. Rock Mass Rating (RMR) as per Bieniawski (1976).
12. RMR calculated based on UCS_{PLI} strength.
13. RMR calculated based on UCS_{PLI}-H strength.
14. RMR calculated based on UCS Testing strength.
15. This table is an integral part of Piteau's report dated May 2016 (file:1846-16_R02), and must be read and interpreted in the context of that report. Provided for the exclusive use of ArcelorMittal Mines Canada and Mont-Wright Mine, and may not be modified or used for any other party without the expressed approval from Piteau Associates Engineering Ltd.

TABLE III

SUMMARY OF ROCK MASS STRENGTH PARAMETERS USED IN SLIDE LIMIT EQUILIBRIUM MODELS FOR PIT IRÈNE[1]

Geotechnical Unit	Unit Weight (kg/m^3)	Strength Condition	Hoek-Brown (2002) Rock Mass Strength Parameters									
			Intact Rock Strength[2] (MPa)	RMR_{76}[3]/ GSI	Non-Linear[4]						Linear[5]	
					m_i	Depth of Disturbance	Disturbance (D)	mb	s	a	Friction Angle, ϕ' (°)	Cohesion, c' (kPa)
AMP	3066	35th Percentile	93	70.6	11	0-50m	0.85	1.771	1.05E-02	0.501	53.5	1441
						>50m	0.7	2.187	1.41E-02	0.501	54.9	1608
IF	3583	35th Percentile	150	72.6	25	0-50m	0.85	4.559	1.43E-02	0.501	63.6	1932
						>50m	0.7	5.548	1.89E-02	0.501	64.6	2132
QRMS	2674	35th Percentile	113	70.4	12	0-50m	0.85	1.909	1.02E-02	0.501	55.3	1636
						>50m	0.7	2.360	1.37E-02	0.501	56.6	1829
QR	2651	35th Percentile	258	78.3	33	0-50m	0.85	8.574	3.46E-02	0.501	68.3	4327
						>50m	0.7	10.016	4.31E-02	0.501	69.0	4705
GN	2835	35th Percentile	56	64.6	23	0-50m	0.85	2.552	4.13E-03	0.502	55.1	647
						>50m	0.7	3.289	5.91E-03	0.502	56.9	712
Faults	-	-	-	-	-	-	-	-	-	-	20	50
Joints	-	-	-	-	-	-	-	-	-	-	38	50
Bedding Joints (JS1)	-	-	-	-	-	-	-	-	-	-	32	50
Altered Contact Zones	-	-	-	-	-	-	-	-	-	-	28	75

H:\Project\1846\2015-06 slope design updates\SLIDE\[Slide_Strengths_Irene.xlsx]Table III

Notes:
1. Based on weighted average geomechanical core logging results from 2015 drillholes (Table II).
2. Intact rock strength estimated from 35th Percentile UCS_{PLI}. (Appendix E)
3. RMR calculated as per Bieniawski (1976). For RMR_{76} greater than 25, RMR_{76} is equivalent to GSI (Hoek et al., 2002).
4. Non-linear strengths derived from 2002 Hoek-Brown Strength Criterion (Hoek et al., 2002) assuming D=0.85 for 0-50m depth and D=0.70 for >50m depth.
5. Linear Mohr-Coulomb strengths calculated from 2002 Hoek-Brown Strength Criterion at σ'_{3max} of 1 MPa.
6. This table is an integral part of Piteau's report dated May 2016 (file:1846-16_R02), and must be read and interpreted in the context of that report. Provided for the exclusive use of ArcelorMittal Mines Canada and Mont-Wright Mine, and may not be modified or used for any other party without the expressed approval from Piteau Associates Engineering Ltd.

TABLE IV
ANISOTROPIC SHEAR STRENGTHS OF FAULTS, BEDDING JOINTS, AND JOINTS BASED ON ROCK BRIDGE PERCENTAGE

Structure Type	Disturbance (D)	Rock Bridge Percent							
		5%		10%		15%		20%	
		Cohesion, c′ (kPa)	Friction Angle, ϕ′ (°)	Cohesion, c′ (kPa)	Friction Angle, ϕ′ (°)	Cohesion, c′ (kPa)	Friction Angle, ϕ′ (°)	Cohesion, c′ (kPa)	Friction Angle, ϕ′ (°)
Faults in AMP[1]	0.85	120	22.5	189	24.8	259	27.1	328	29.3
	0.7	128	22.6	206	25.2	284	27.6	362	29.9
Bedding in AMP[2]	0.85	120	33.5	189	34.9	259	36.3	328	37.6
	0.7	128	33.6	206	35.2	284	36.7	362	38.1
Joints in AMP[3]	0.85	120	39.0	189	40.0	259	40.9	328	41.9
	0.7	128	39.1	206	40.2	284	41.3	362	42.3
Faults in IF[1]	0.85	144	24.1	238	27.9	332	31.5	426	34.8
	0.7	154	24.3	258	28.3	362	32.0	466	35.5
Bedding in IF[2]	0.85	144	34.8	238	37.4	332	39.8	426	42.1
	0.7	154	35.0	258	37.7	362	40.3	466	42.7
Joints in IF[3]	0.85	144	40.1	238	42.1	332	44.0	426	45.8
	0.7	154	40.3	258	42.4	362	44.4	466	46.3
Faults in QRMS[1]	0.85	129	22.7	209	25.3	288	27.7	367	30.1
	0.7	139	22.9	228	25.6	317	28.2	406	30.7
Bedding in QRMS[2]	0.85	129	33.7	209	35.3	288	36.8	367	38.3
	0.7	139	33.8	228	35.5	317	37.2	406	38.8
Joints in QRMS[3]	0.85	129	39.2	209	40.3	288	41.4	367	42.4
	0.7	139	39.3	228	40.5	317	41.7	406	42.9
Faults in QR[1]	0.85	264	25.2	478	30.1	692	34.5	905	38.5
	0.7	283	25.4	515	30.4	748	35.0	981	39.0
Bedding in QR[2]	0.85	264	35.7	478	39.1	692	42.3	905	45.1
	0.7	283	35.9	515	39.4	748	42.6	981	45.6
Joints in QR[3]	0.85	264	41.0	478	43.7	692	46.2	905	48.5
	0.7	283	41.1	515	43.9	748	46.5	981	48.9
Faults in GN[1]	0.85	80	22.7	110	25.2	140	27.7	169	30.0
	0.7	83	22.9	116	25.7	149	28.3	182	30.9
Bedding in GN[2]	0.85	80	33.6	110	35.2	140	36.7	169	38.2
	0.7	83	33.8	116	35.6	149	37.3	182	38.9
Joints in GN[3]	0.85	80	39.1	110	40.2	140	41.3	169	42.4
	0.7	83	39.3	116	40.6	149	41.8	182	43.0

H:\Project\1846\2015-06 slope design updates\SLIDE\[Slide_Strengths_Irene.xlsx]Table IV

Notes:
1. Shear strengths for discontinuous anisotropic fault orientations were estimated based on a weighted average of the Mohr-Coulomb rock mass shear strengths reported in Table III (representing the rock bridge) and a fault shear strength of ϕ'=20° and c'=50 kPa.
2. Shear strengths for discontinuous anisotropic bedding joint orientations were estimated based on a weighted average of the Mohr-Coulomb rock mass shear strengths reported in Table III (representing the rock bridge) and a bedding joint shear strength of ϕ'=32° and c'=50 kPa.
3. Shear strengths for discontinuous anisotropic joint orientations were estimated based on a weighted average of the Mohr-Coulomb rock mass shear strengths reported in Table III (representing the rock bridge) and a joint shear strength of ϕ'=38° and c'=50 kPa.
4. This table is an integral part of Piteau's report dated May 2016 (file:1846-16_R02), and must be read and interpreted in the context of that report. Provided for the exclusive use of ArcelorMittal Mines Canada and Mont-Wright Mine, and may not be modified or used for any other party without the expressed approval from Piteau Associates Engineering Ltd.

TABLE V

RECOMMENDED FEASIBILITY-LEVEL BENCH SLOPE DESIGN CRITERIA FOR THE FOOTWALL OF THE PIT IRÈNE MINE PLAN (V7.0)

Bench Face Angle (average dip of the JS1 Set)	Maximum Bench Stack Height	Bench Width
<32°	Unbenched	-
32° to 46°	70m (5 benches)	13m
46° to 50°	56m (4 benches)	13m
50° to 60°	42m (3 benches)	13m
60° to 80°	28m (2 benches)	13m

H:\Project\1846\2015-06 slope design updates\Excel\[Irene_2015 Feasibility Bench Slope Designs Footwall_Final.xls]TABLE V

Note: 1. This table is an integral part of Piteau's report dated May 2016 (file: 1846-16_R02), and must be read and interpreted in the context of that report. Provided for exclusive use of ArcelorMittal Mines Canada and Mont Wright-Mine, and may not be modified or used for any other party without the expressed approval from Piteau Associates Engineering Ltd.

TABLE VI
RECOMMENDED FEASIBILITY-LEVEL INTERRAMP AND OVERALL SLOPE DESIGNS FOR THE HANGING WALL OF THE PIT IRÈNE MINE PLAN (V7.0)[1]

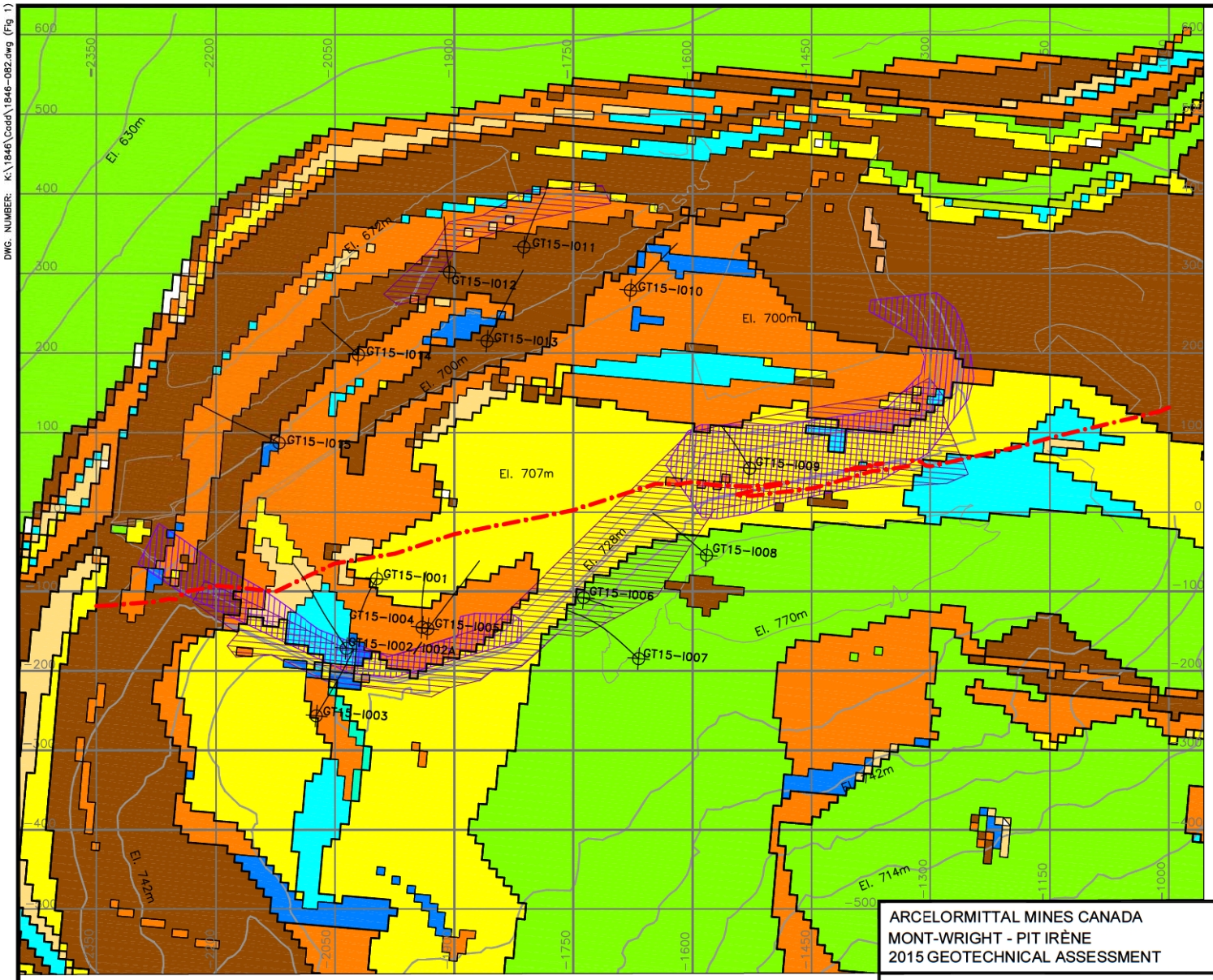
Design Sector[2]	Cross-Sections[3]	Structural Domains	Wall Type	Dip Direction (°)	Main Design Control	Bench Design[4]				Interramp/ Overall Slope Design[4]		
						Bench Height (m)	Catch Berm Width (m)	Expected Breakback Angle[5] (°)	Bench Face Angle[6] (°)	Interramp Slope Angle (°)	Maximum Interramp Slope Height (m)	Approximate Required Depth of Depressurization[7] (m)
I[8]	I-SE2/NW, -1900/N, -1750/N, I-NE1	Nortwest, North, East	Footwall[8]	100 to 270	Bilinear Failure Mechanism	Variable	13.0	n/a	Variable	Variable	Variable	0
II	I-SE1	Southeast	Hanging Wall	265 to 360	Bench Kinematics	28	20.3	66 to 67	80	48	210	0
III	I-SE2/SE	Central		305 to 330			17.7	71 to 72		51	210	31
IV	-1900/S	South		340 to 360			22.1	63		46	196	
V				360 to 030			16.2	74 to 75		53	196	
VI	I-SW1	West		005 to 060			16.9	72 to 75		52	140	0

H:\Project\1846\2015-06 slope design updates\Excel\[Irene_2015_Feasibility_Designs - FINAL.xls]Table VI

Notes:
1. Recommended slope designs based on the Irène Mine Plan (DE_IR_v7.0_Ligne.dxf) provided by AMMC on May 29, 2015 (Figs. 2 and 19).
2. See Fig. 19 for design sector locations.
3. See Fig. 2 for cross-section locations.
4. Assumes best practice controlled blasting to minimize disturbance to the rock mass and potential loss of cohesion on structural discontinuities.
5. Expected breakback angle in bedrock estimated based on 30% cumulative frequency analysis (CFA) of bench documentation. For slope orientations where bench documentation is not available expected breakback angle of benches was predicted based on the calibration of the kinematic CFA curves for 28m high benches assuming a compound angle breakback; where breakback is assumed to occur on the upper one-third of the bench height and 80° presplit in the lower portion of the bench. Bench breakback kinematic assessments for a 28m bench height assume a joint friction angle (ϕ') of 38° and a cohesion of 75 kPa and is based on all kinematically possible planar and wedge failure combinations defined from photogrammetry and core orientation data.
6. A design bench face angle (BFA) of 80° is assumed for prepsplit controlled blasting.
7. A horizontal depth of depressurization behind the pit wall of 31m is assumed with 62m-long horizontal drainholes. Design will be optimized based on piezometer monitoring data.
8. Recommended bench slope design criteria for the footwall is presented in Table V.
9. This table is an integral part of Piteau's report dated May 2016 (file: 1846-16_R02), and must be read and interpreted in the context of that report. Provided for the exclusive use of ArcelorMittal Mines Canada and Mont-Wright Mine, and may not be modified or used for any other party without the expressed approval from Piteau Associates Engineering Ltd.

FIGURES

DWG. NUMBER: K:\1846\Cadd\1846-082.dwg (Fig 1)



TRUE NORTH

LEGEND

- INTERPRETED FAULT
- GT15-I001 2015 GEOTECHNICAL DRILLHOLE
- ADAMTECH PHOTOGRAMMETRY AREA
- SIROVISION PHOTOGRAMMETRY AREA
- AMPHIBOLITE
- IRON FORMATION
- CONTAMINATED IRON FORMATION – Al–Ti
- CONTAMINATED IRON FORMATION – Mn
- IRON FORMATION – NON–ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
- MICA SCHIST
- GNEISS
- UNKNOWN
- OVERBURDEN

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. BLOCK MODEL (bmb_mwh_i_20150325.mdl) PROVIDED BY AMMC ON NOVEMBER 27, 2015.
3. INTERPRETED FAULT (faille_irene_20160111.dtm) PROVIDED BY AMMC ON JANUARY 15, 2016.
4. MINE GRID SHOWN.

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0 50 100 150 200 250m

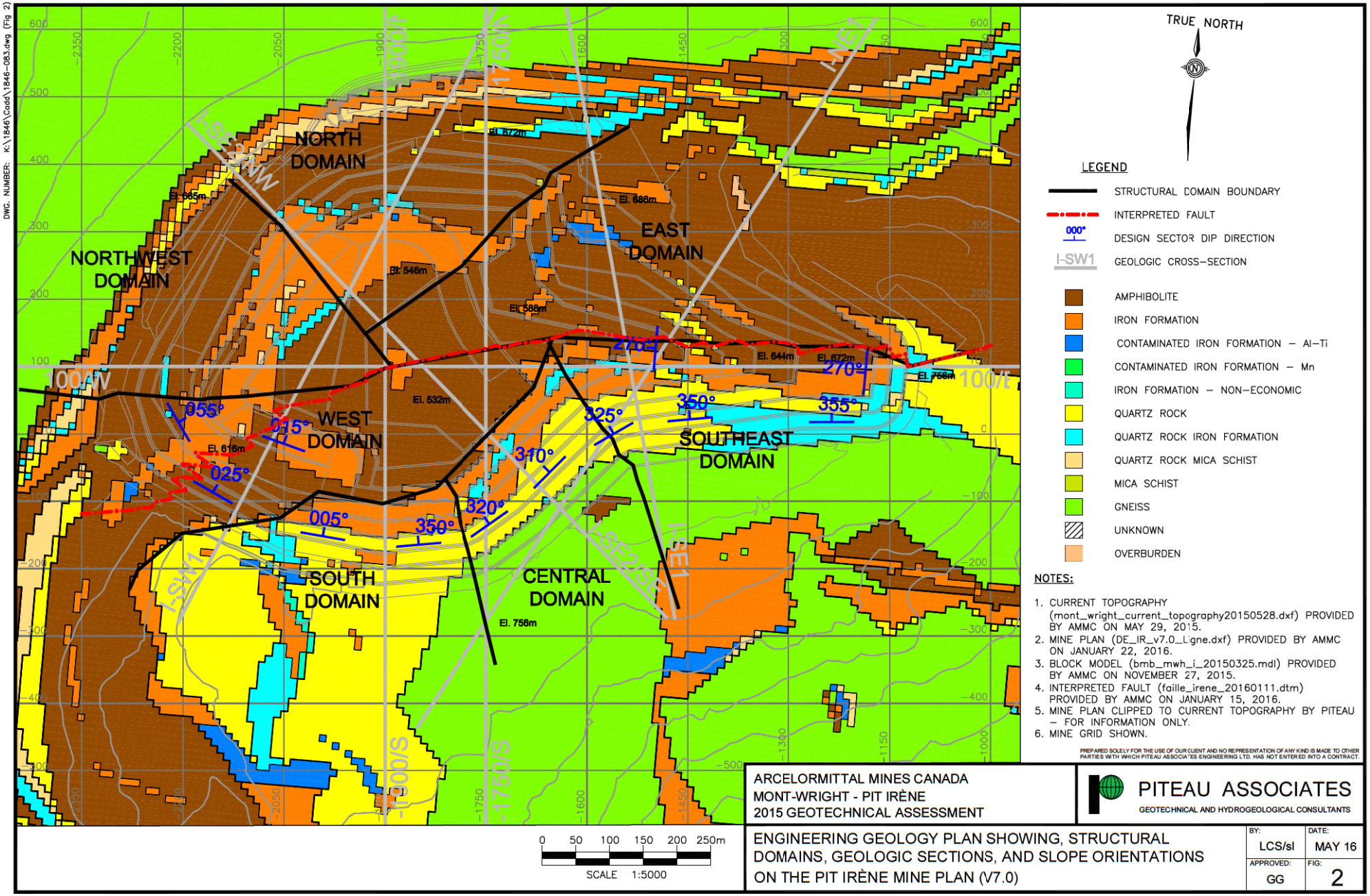
SCALE 1:5000

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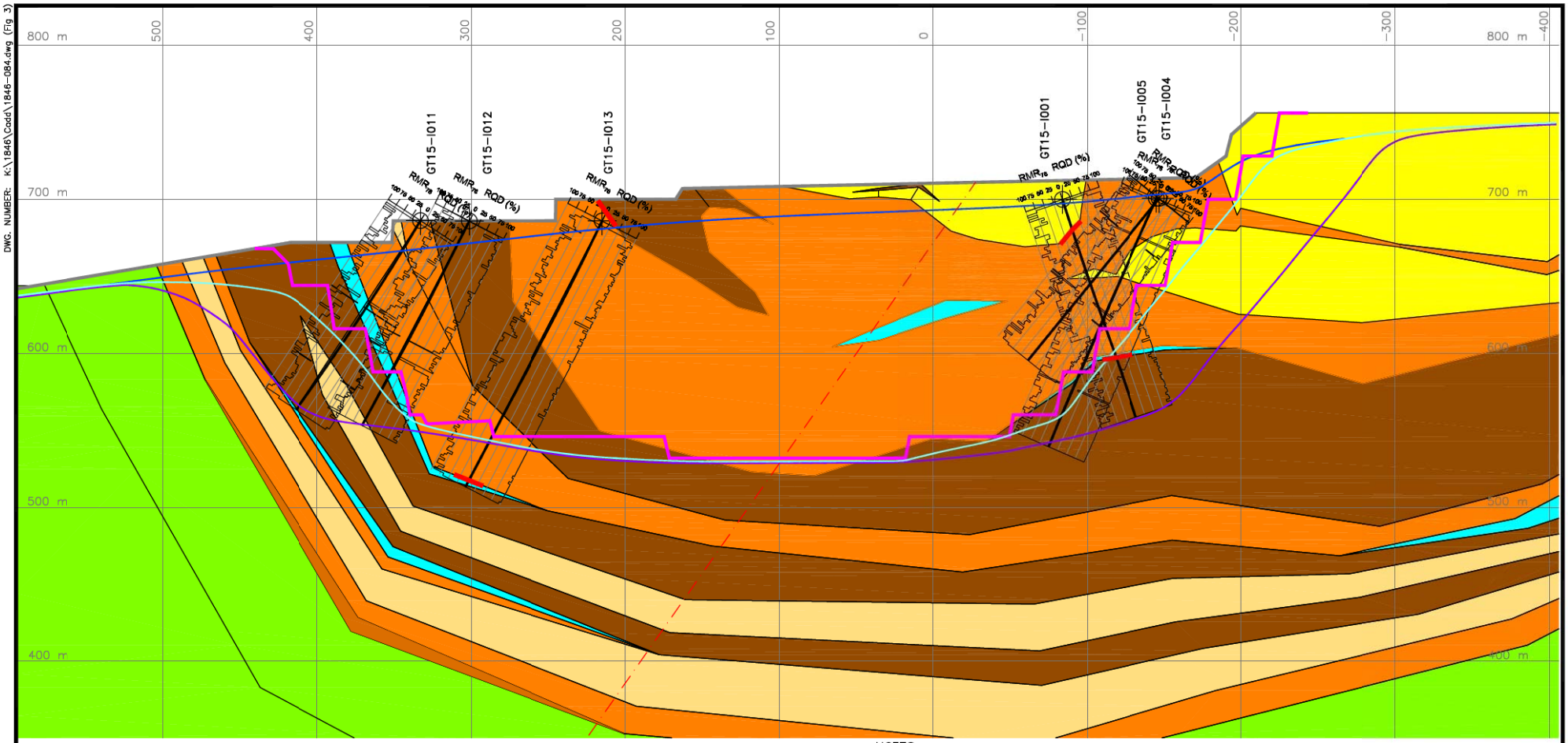
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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

ENGINEERING GEOLOGY PLAN SHOWING GEOTECHNICAL DRILLHOLES AND PHOTOGRAMMETRICALLY-MAPPED AREAS ON THE CURRENT PIT

BY:	DATE:
LCS/sl	MAY 16
APPROVED:	FIG:
GG	1


DWG. NUMBER: K:\1846\Cadd\1846-083.dwg (Fig 2)
TRUE NORTH
NORTH DOMAIN
NORTHWEST DOMAIN
EAST DOMAIN
WEST DOMAIN
SOUTHEAST DOMAIN
SOUTH DOMAIN
CENTRAL DOMAIN
I-SW1
I-SE1
I-SE2
I-NE1
1900/W
1750/W
1900/E
1750/E
100/W
100/E
1900/S
1750/S
El. 672m
El. 686m
El. 546m
El. 588m
El. 644m
El. 672m
El. 768m
El. 532m
El. 616m
El. 758m
055°
015°
025°
005°
350°
320°
310°
325°
350°
355°
270°
270°
LEGEND
STRUCTURAL DOMAIN BOUNDARY
INTERPRETED FAULT
000° DESIGN SECTOR DIP DIRECTION
I-SW1 GEOLOGIC CROSS-SECTION
AMPHIBOLITE
IRON FORMATION
CONTAMINATED IRON FORMATION – Al–Ti
CONTAMINATED IRON FORMATION – Mn
IRON FORMATION – NON–ECONOMIC
QUARTZ ROCK
QUARTZ ROCK IRON FORMATION
QUARTZ ROCK MICA SCHIST
MICA SCHIST
GNEISS
UNKNOWN
OVERBURDEN
NOTES:
1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
3. BLOCK MODEL (bmb_mwh_i_20150325.mdl) PROVIDED BY AMMC ON NOVEMBER 27, 2015.
4. INTERPRETED FAULT (faille_irene_20160111.dtm) PROVIDED BY AMMC ON JANUARY 15, 2016.
5. MINE PLAN CLIPPED TO CURRENT TOPOGRAPHY BY PITEAU – FOR INFORMATION ONLY.
6. MINE GRID SHOWN.
PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.
0 50 100 150 200 250m
SCALE 1:5000
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT
PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS
ENGINEERING GEOLOGY PLAN SHOWING, STRUCTURAL DOMAINS, GEOLOGIC SECTIONS, AND SLOPE ORIENTATIONS ON THE PIT IRÈNE MINE PLAN (V7.0)
BY: LCS/sl
DATE: MAY 16
APPROVED: GG
FIG: 2

DWG. NUMBER: K:\1846\Cadd\1846-084.dwg (Fig 3)



LEGEND

- AMPHIBOLITE
- AMPHIBOLITE IRON FORMATION
- IRON FORMATION
- IRON FORMATION – NON-ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
- MICA SCHIST
- GNEISS
- MAFIC GNEISS
- INTERPRETED FAULT LOCATION

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 150m LONG HORIZONTAL DRAINHOLES
- GT15-I001 693.3m P1 — PIEZOMETER WITH RECENT HEAD POSTED
- GT15-I001 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- RMR76 ROD (%) — GRAPHIC GEOTECHNICAL LOG OF RMR AND ROD (APPENDIX B)

- MAY 29, 2015 TOPOGRAPHY
- 2015 IRÈNE v7.0 MINE PLAN
- LOCATION OF INTERPRETED WEAK OR ALTERED CONTACT ZONE – NOMINAL LENGTH INDICATED

0 25 50 75 100 250m

SCALE 1:2500

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
3. INTERPRETED GEOLOGY (section_irene_utm_b-1900.str) PROVIDED BY AMMC ON OCTOBER 26, 2015.
4. INTERPRETED GEOLOGY CLIPPED TO CURRENT TOPOGRAPHY BY PITEAU – FOR INFORMATION ONLY.
5. INTERPRETED FAULT (faille_irene_20160111.dtm) PROVIDED BY AMMC ON JANUARY 15, 2016.
6. MINE GRID SHOWN.
7. SEE FIG. 2 FOR PLAN LOCATION OF GEOLOGIC SECTION.

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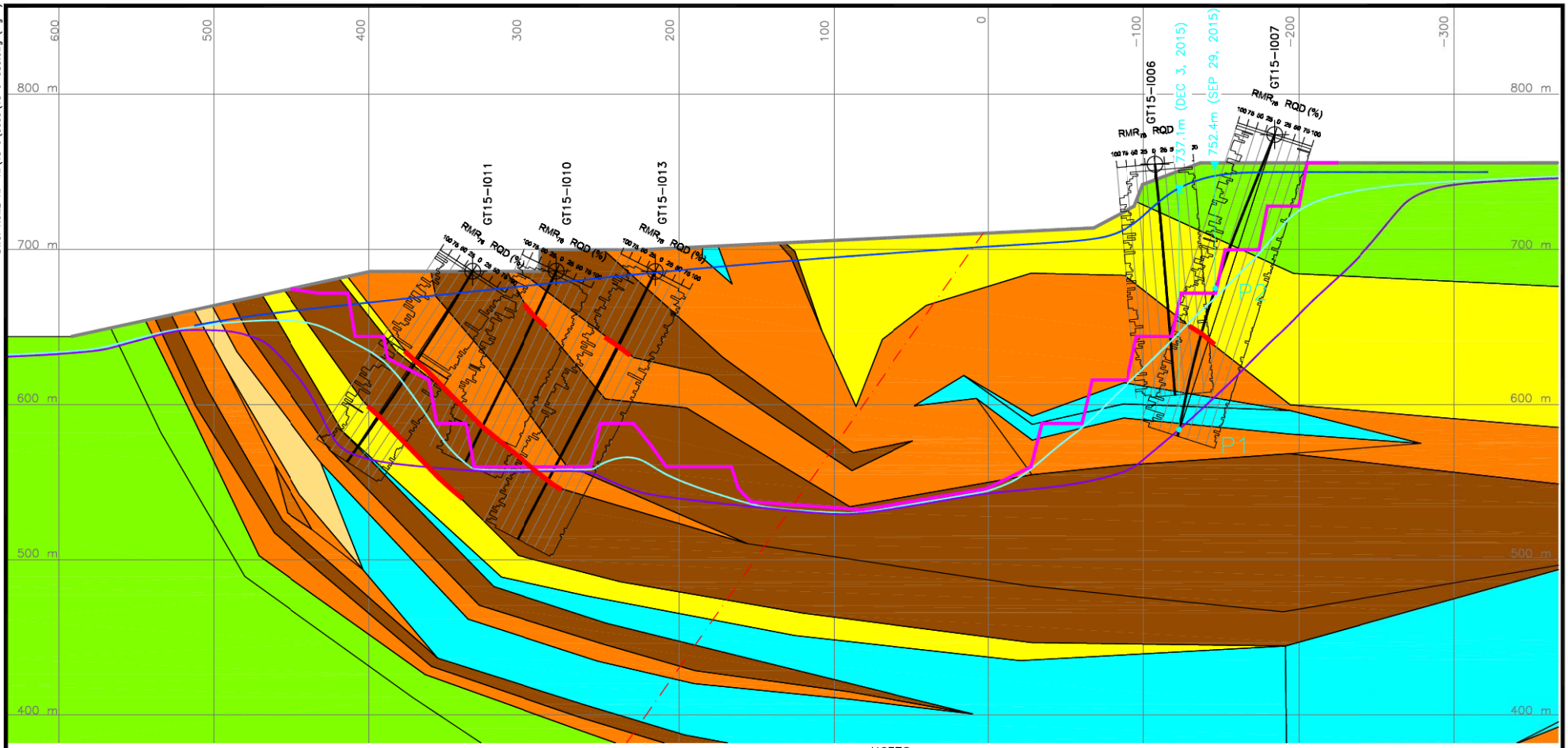
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2015 GEOTECHNICAL ASSESSMENT

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GEOLOGIC SECTION -1900

BY:	DATE:
LCS/sl	MAY 16
APPROVED:	FIG:
GG	3

DWG. NUMBER: K:\1846\Cadd\1846-085.dwg (Fig 4)



LEGEND

- AMPHIBOLITE
- AMPHIBOLITE IRON FORMATION
- IRON FORMATION
- IRON FORMATION – NON-ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
- MICA SCHIST
- GNEISS
- MAFIC GNEISS
- INTERPRETED FAULT LOCATION

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 150m LONG HORIZONTAL DRAINHOLES
- GT15-I001 693.3m P1 — PIEZOMETER WITH RECENT HEAD POSTED
- GT15-I001 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- RMR76 RQD (%) — GRAPHIC GEOTECHNICAL LOG OF RMR AND RQD (APPENDIX B)

- MAY 29, 2015 TOPOGRAPHY
- 2015 IRÈNE v7.0 MINE PLAN
- LOCATION OF INTERPRETED WEAK OR ALTERED CONTACT ZONE – NOMINAL LENGTH INDICATED

0 25 50 75 100 250m

SCALE 1:2500

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
3. INTERPRETED GEOLOGY (section_irene_utm_b-1750.str) PROVIDED BY AMMC ON OCTOBER 26, 2015.
4. INTERPRETED GEOLOGY CLIPPED TO CURRENT TOPOGRAPHY BY PITEAU – FOR INFORMATION ONLY.
5. INTERPRETED FAULT (faille_irene_20160111.dtm) PROVIDED BY AMMC ON JANUARY 15, 2016.
6. MINE GRID SHOWN.
7. SEE FIG. 2 FOR PLAN LOCATION OF GEOLOGIC SECTION.

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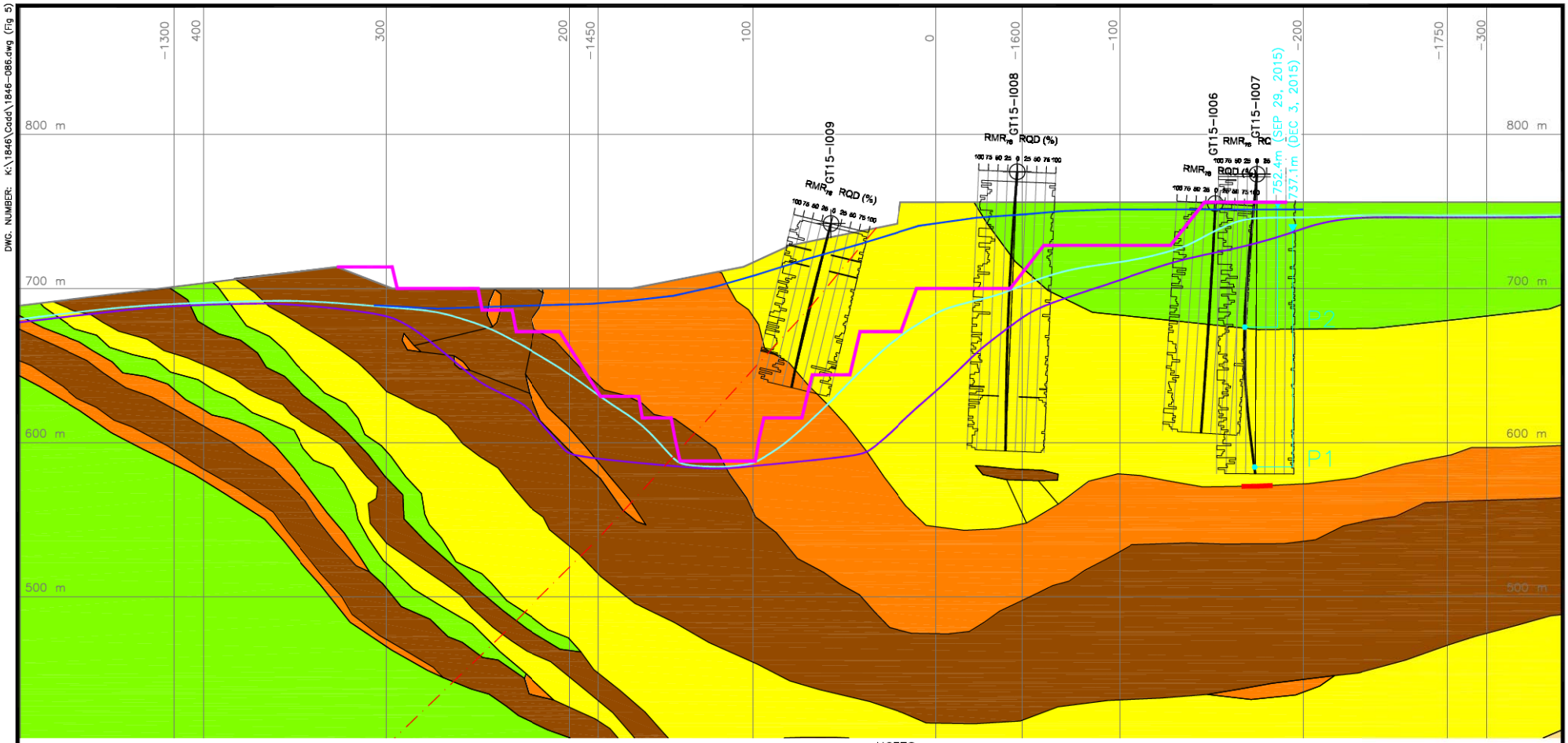
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GEOLOGIC SECTION -1750

BY:	DATE:
LCS/sl	MAY 16
APPROVED:	FIG:
GG	4

DWG. NUMBER: K:\1846\Cadd\1846-086.dwg (Fig 5)



LEGEND

- AMPHIBOLITE
- AMPHIBOLITE IRON FORMATION
- RON FORMATION
- RON FORMATION – NON-ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
- MICA SCHIST
- GNEISS
- MAFIC GNEISS
- NTERPRETED FAULT LOCATION

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
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- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 150m LONG HORIZONTAL DRAINHOLES
- GT15-I001 693.3m P1 — PIEZOMETER WITH RECENT HEAD POSTED
- GT15-I001 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- RMR76 RQD (%) — GRAPHIC GEOTECHNICAL LOG OF RMR AND RQD (APPENDIX B)

- MAY 29, 2015 TOPOGRAPHY
- 2015 IRÈNE v7.0 MINE PLAN
- LOCATION OF INTERPRETED WEAK OR ALTERED CONTACT ZONE – NOMINAL LENGTH INDICATED

0 25 50 75 100 125m

SCALE 1:2500

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
3. INTERPRETED GEOLOGY (section_ne1.dxf) PROVIDED BY AMMC ON OCTOBER 30, 2015.
4. INTERPRETED GEOLOGY CLIPPED TO CURRENT TOPOGRAPHY BY PITEAU – FOR INFORMATION ONLY.
5. INTERPRETED FAULT (faille_irene_20160111.dtm) PROVIDED BY AMMC ON JANUARY 15, 2016.
6. MINE GRID SHOWN.
7. SEE FIG. 2 FOR PLAN LOCATION OF GEOLOGIC SECTION.

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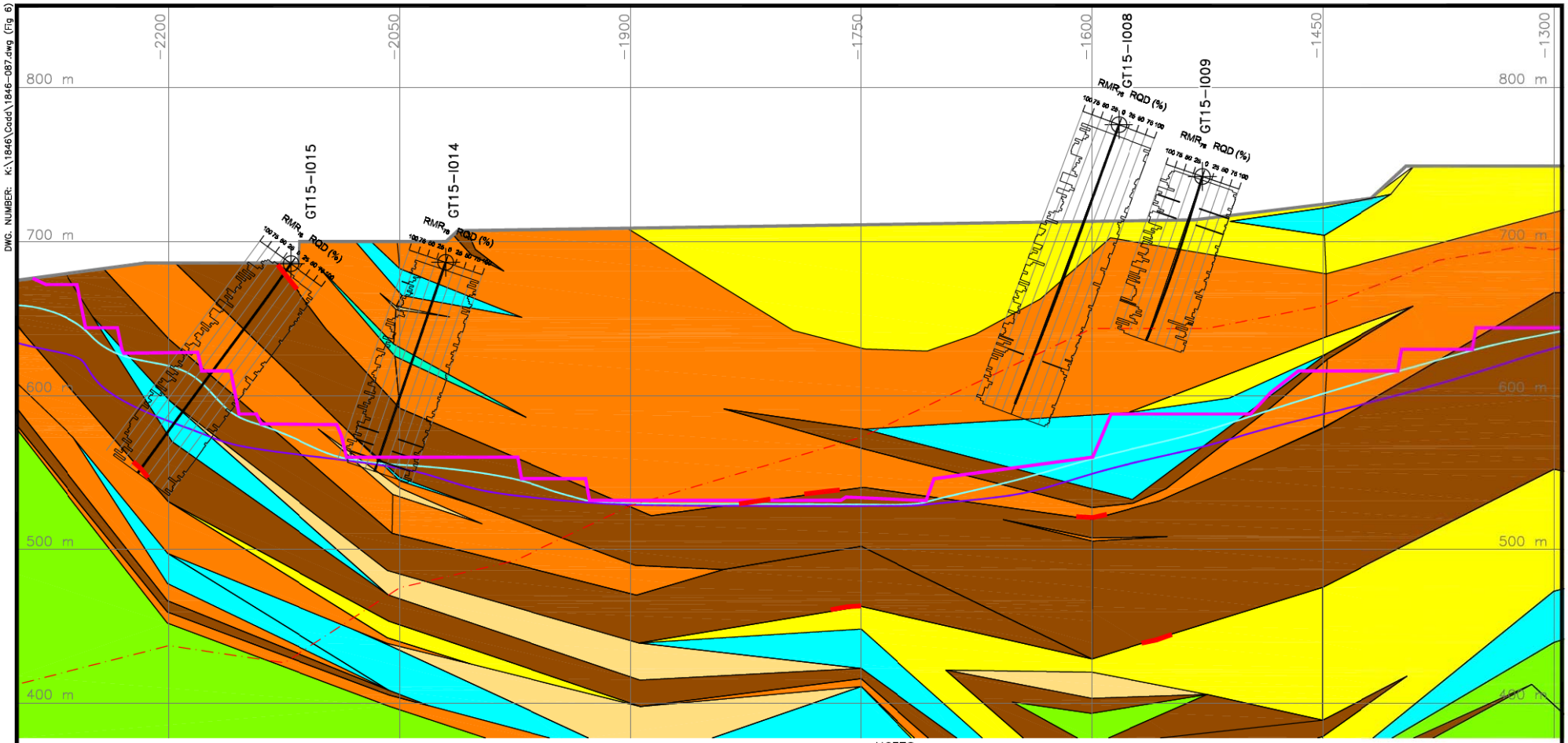
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

GEOLOGIC SECTION I-NE1

BY:	DATE:
LCS/sl	MAY 16
APPROVED:	FIG:
GG	5

DWG. NUMBER: K:\1846\Cadd\1846-087.dwg (Fig 6)



LEGEND

- AMPHIBOLITE
- AMPHIBOLITE IRON FORMATION
- IRON FORMATION
- IRON FORMATION – NON-ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
- MICA SCHIST
- GNEISS
- MAFIC GNEISS
- INTERPRETED FAULT LOCATION

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 150m LONG HORIZONTAL DRAINHOLES
- GT15-I001 — 693.3m — P1: PIEZOMETER WITH RECENT HEAD POSTED
- GT15-I001: COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- RMR76 RQD (%): GRAPHIC GEOTECHNICAL LOG OF RMR AND RQD (APPENDIX B)

- MAY 29, 2015 TOPOGRAPHY
- 2015 IRÈNE v7.0 MINE PLAN
- LOCATION OF INTERPRETED WEAK OR ALTERED CONTACT ZONE – NOMINAL LENGTH INDICATED

0 25 50 75 100 250 m

SCALE 1:2500

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
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5. INTERPRETED FAULT (faille_irene_20160111.dtm) PROVIDED BY AMMC ON JANUARY 15, 2016.
6. MINE GRID SHOWN.
7. SEE FIG. 2 FOR PLAN LOCATION OF GEOLOGIC SECTION.

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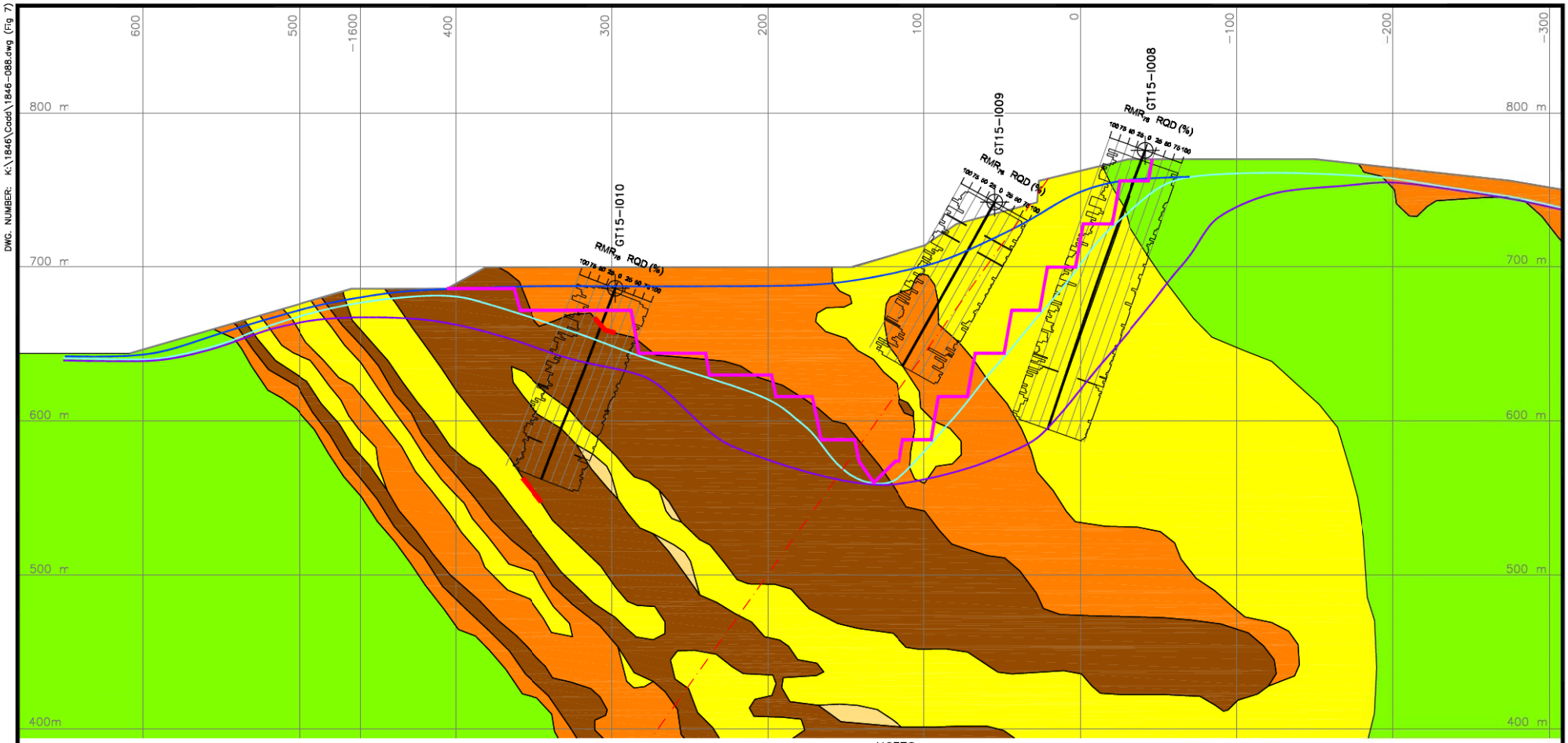
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GEOLOGIC SECTION 100

BY:	DATE:
LCS/sl	MAY 16
APPROVED:	FIG:
GG	6

DWG. NUMBER: K:\1846\Cadd\1846-088.dwg (Fig 7)



LEGEND

- AMPHIBOLITE
- AMPHIBOLITE IRON FORMATION
- RON FORMATION
- RON FORMATION – NON-ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
- MICA SCHIST
- GNEISS
- MAFIC GNEISS
- NTERPRETED FAULT LOCATION

- CURRENT INTERPRETATION OF PIEZOMETRIC SURFACE
- PREDICTED POST MINING WATER TABLE
- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 150m LONG HORIZONTAL DRAINHOLES
- GT15-I001 693.3m P1 — PIEZOMETER WITH RECENT HEAD POSTED
- GT15-I001 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- RMR76 RQD (%) — GRAPHIC GEOTECHNICAL LOG OF RMR AND RQD (APPENDIX B)

- MAY 29, 2015 TOPOGRAPHY
- 2015 IRÈNE v7.0 MINE PLAN
- LOCATION OF INTERPRETED WEAK OR ALTERED CONTACT ZONE – NOMINAL LENGTH INDICATED

0 25 50 75 100 250m

SCALE 1:2500

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
3. INTERPRETED GEOLOGY (section_se1.dxf) PROVIDED BY AMMC ON OCTOBER 30, 2015.
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7. SEE FIG. 2 FOR PLAN LOCATION OF GEOLOGIC SECTION.

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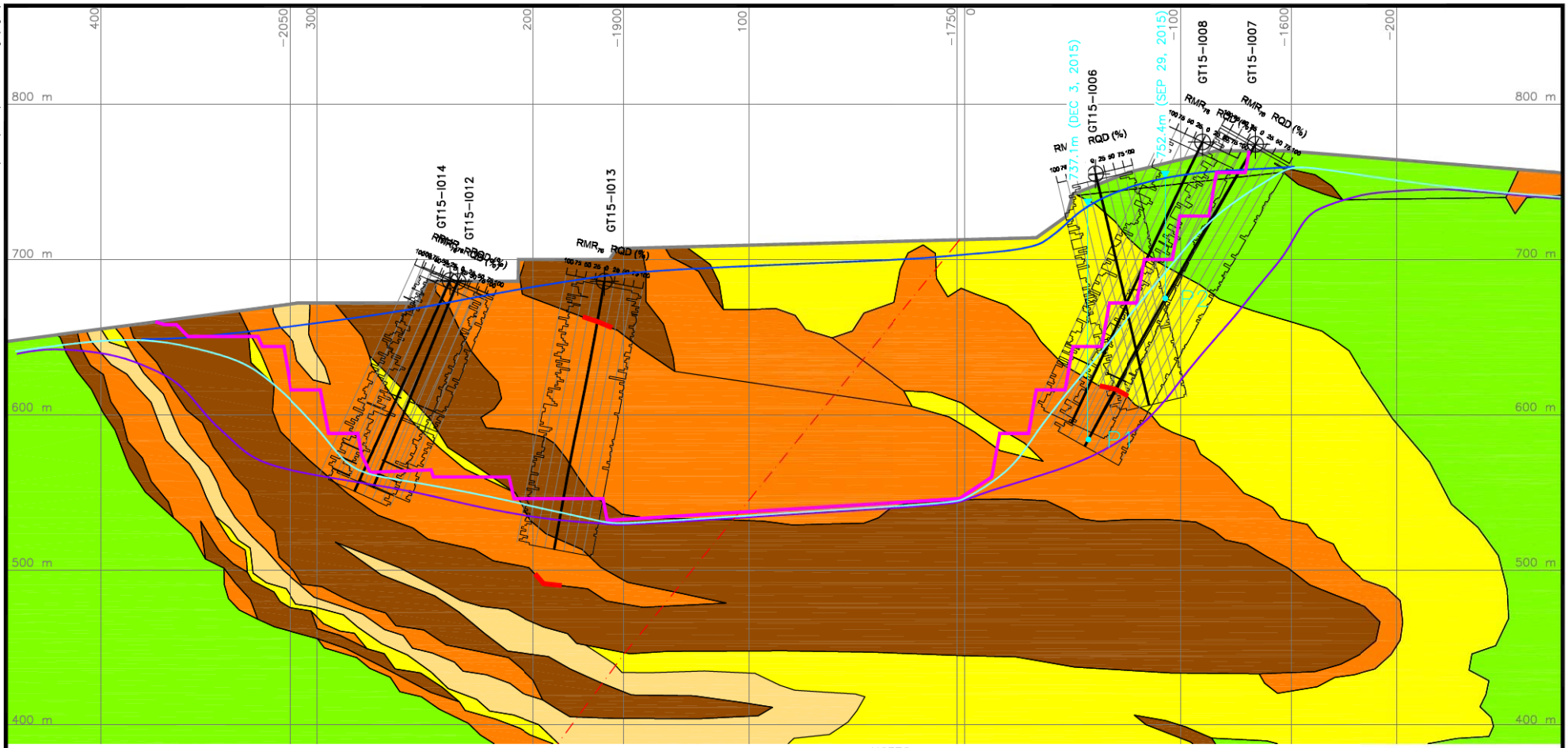
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GEOLOGIC SECTION I-SE1

BY:	DATE:
LCS/sl	MAY 16
APPROVED:	FIG:
GG	7

DWG. NUMBER: K:\1846\Cadd\1846-089.dwg (Fig 8)



LEGEND

- AMPHIBOLITE
- AMPHIBOLITE IRON FORMATION
- RON FORMATION
- RON FORMATION – NON–ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
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- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 150m LONG HORIZONTAL DRAINHOLES
- GT15-I001 693.3m P1 — PIEZOMETER WITH RECENT HEAD POSTED
- GT15-I001 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- RMR76 RQD (%) — GRAPHIC GEOTECHNICAL LOG OF RMR AND RQD (APPENDIX B)
- MAY 29, 2015 TOPOGRAPHY
- 2015 IRÈNE v7.0 MINE PLAN
- LOCATION OF INTERPRETED WEAK OR ALTERED CONTACT ZONE – NOMINAL LENGTH INDICATED

0 25 50 75 100 250m

SCALE 1:2500

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
3. INTERPRETED GEOLOGY (section_se2.dxf) PROVIDED BY AMMC ON OCTOBER 31, 2015.
4. INTERPRETED GEOLOGY CLIPPED TO CURRENT TOPOGRAPHY BY PITEAU – FOR INFORMATION ONLY.
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6. MINE GRID SHOWN.
7. SEE FIG. 2 FOR PLAN LOCATION OF GEOLOGIC SECTION.

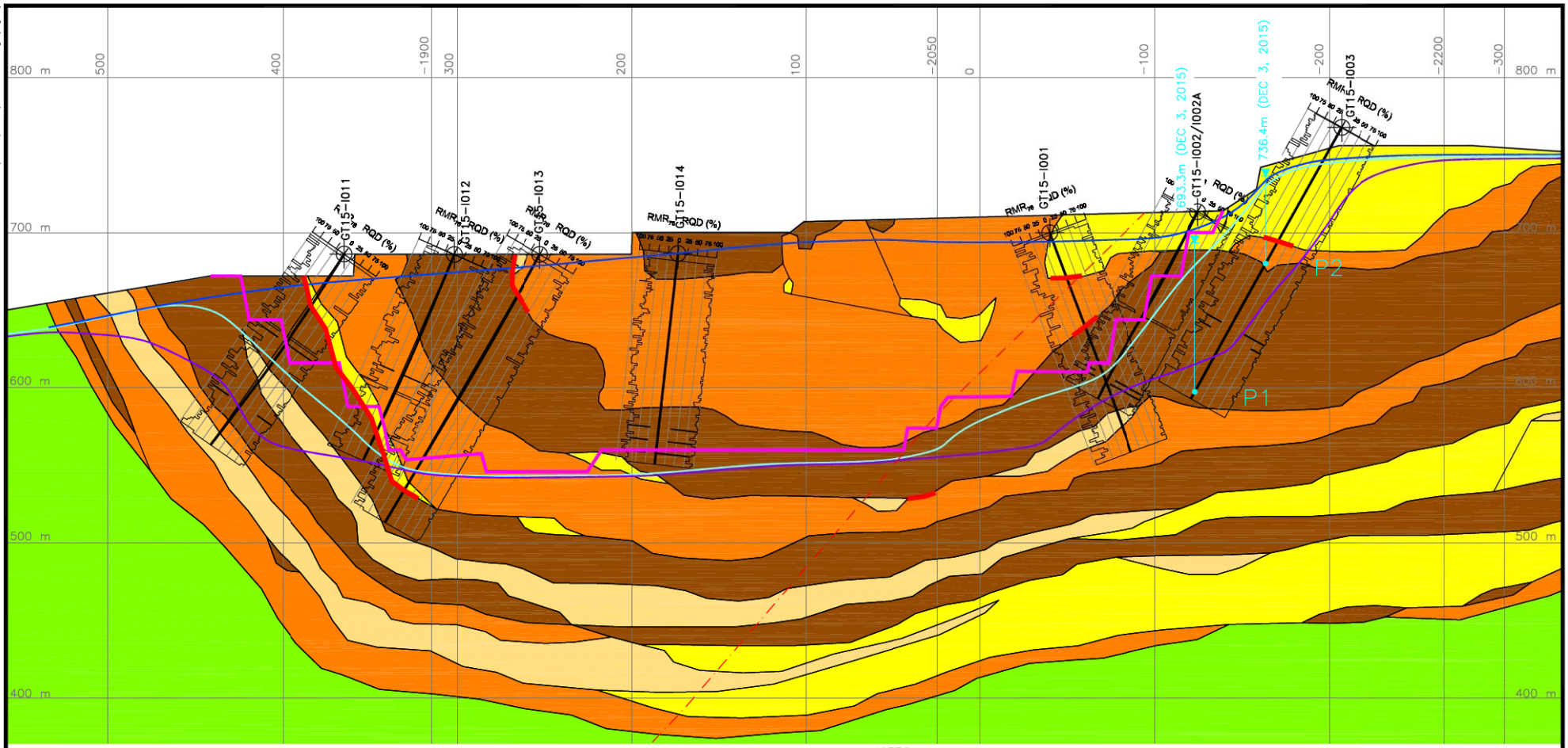
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GEOLOGIC SECTION I-SE2

BY:	DATE:
LCS/sl	MAY 16
APPROVED:	FIG:
GG	8



LEGEND

- AMPHIBOLITE
- AMPHIBOLITE IRON FORMATION
- RON FORMATION
- RON FORMATION – NON–ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
- MICA SCHIST
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- NTERPRETED FAULT LOCATION

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- PREDICTED WATER TABLE ASSUMING THE INSTALLATION OF 150m LONG HORIZONTAL DRAINHOLES
- GT15–I001 693.3m P1 — PIEZOMETER WITH RECENT HEAD POSTED
- GT15–I001 — COLLAR LOCATION
- SURVEYED ORIENTATION PROJECTED ONTO SECTION
- RMR76 RQD (%) — GRAPHIC GEOTECHNICAL LOG OF RMR AND RQD (APPENDIX B)

- MAY 29, 2015 TOPOGRAPHY
- 2015 IRÈNE v7.0 MINE PLAN
- LOCATION OF INTERPRETED WEAK OR ALTERED CONTACT ZONE – NOMINAL LENGTH INDICATED

0 25 50 75 100 250m

SCALE 1:2500

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
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6. MINE GRID SHOWN.
7. SEE FIG. 2 FOR PLAN LOCATION OF GEOLOGIC SECTION.

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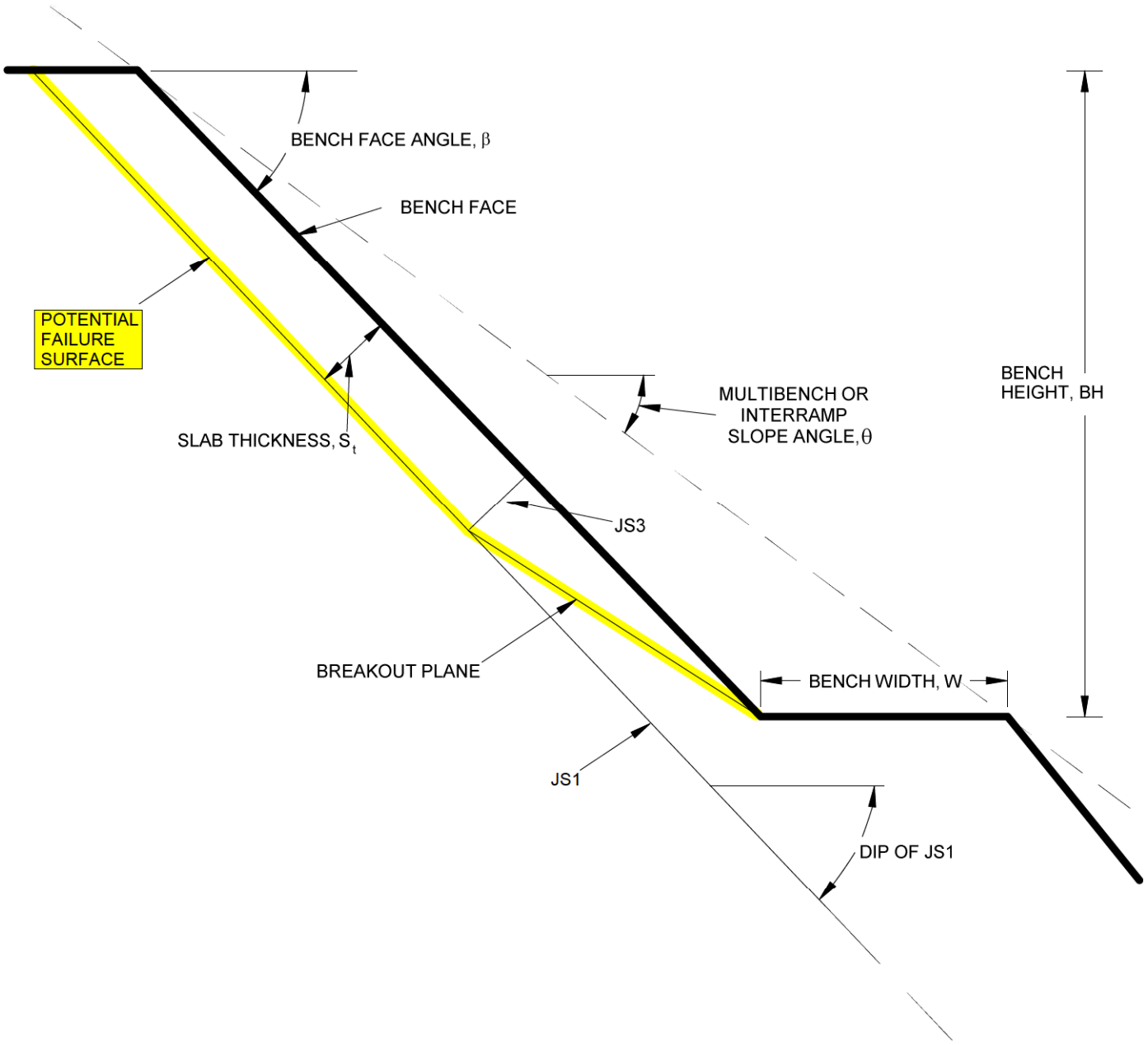
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GEOLOGIC SECTION I-SW1

BY:	DATE:
LCS/sl	MAY 16
APPROVED:	FIG:
GG	9

H:\Project\1846\2015-06 slope design updates\Kinematics\Bilinear_Slab\bilinear_slab_geometry.grf



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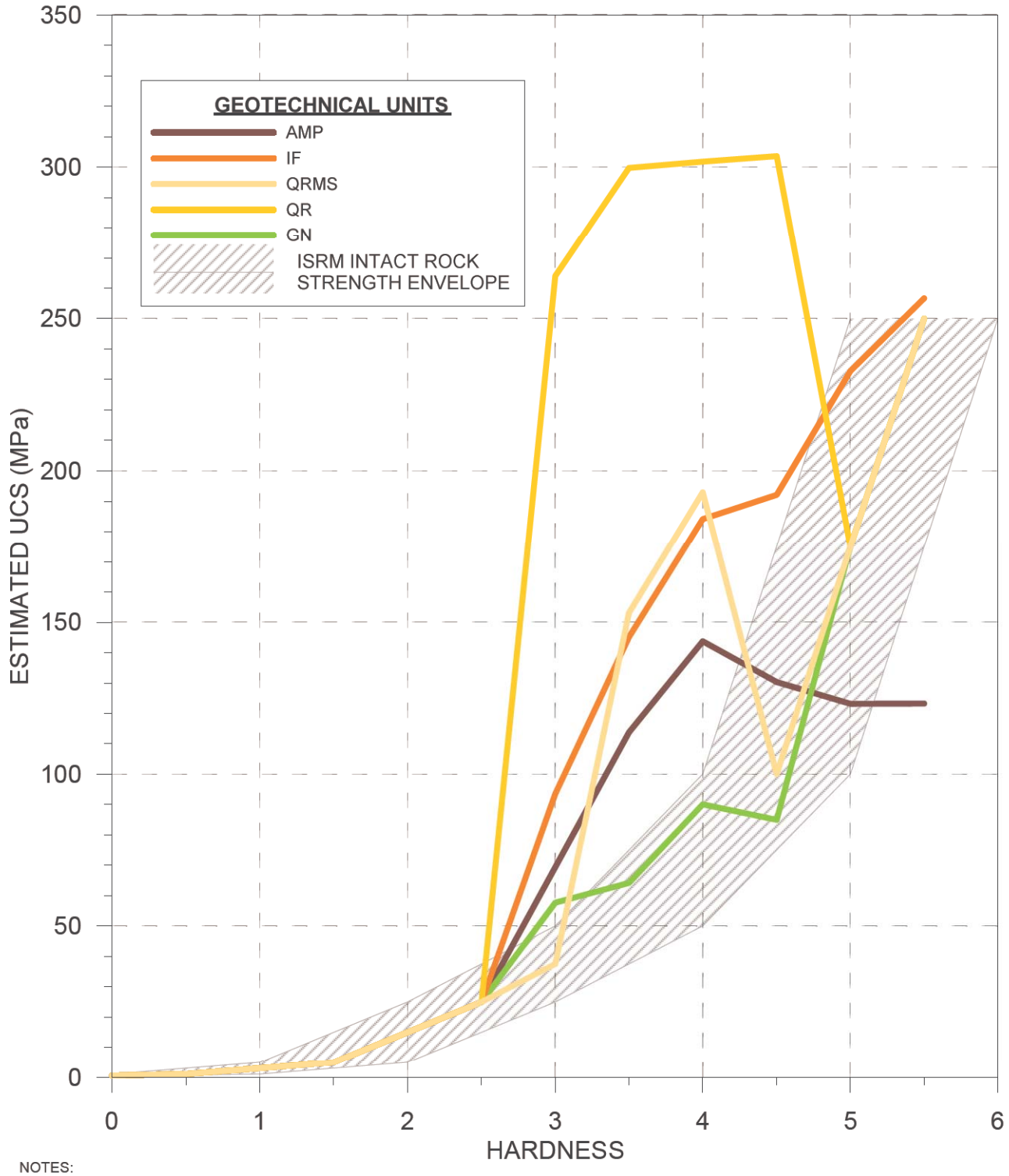
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BILINEAR SLAB GEOMETRY

BY:	DATE:
LCS	JAN 16
APPROVED:	FIG:
GG	10

H:\Project\18462\2015-06 slope design updates\Testing\PLTH_vs_UCS_SUMMARY_figure.grf



NOTES:
1. Only valid point load tests were used in derivation of curves.
2. Correlation Coefficients derived by Piteau are as follows:
   AMP: K = 23 IF: K = 29 QRMS: K = 25 QR: K = 32 GN: K = 19
3. Correlation coefficient K used to convert Point Load $I_{s(50)}$ to estimated UCS: $UCS_{estimated} = I_{s(50)} \times K$
4. Hardness was estimated on a run-by-run basis according to ISRM (1981).

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2015 GEOTECHNICAL ASSESSMENT

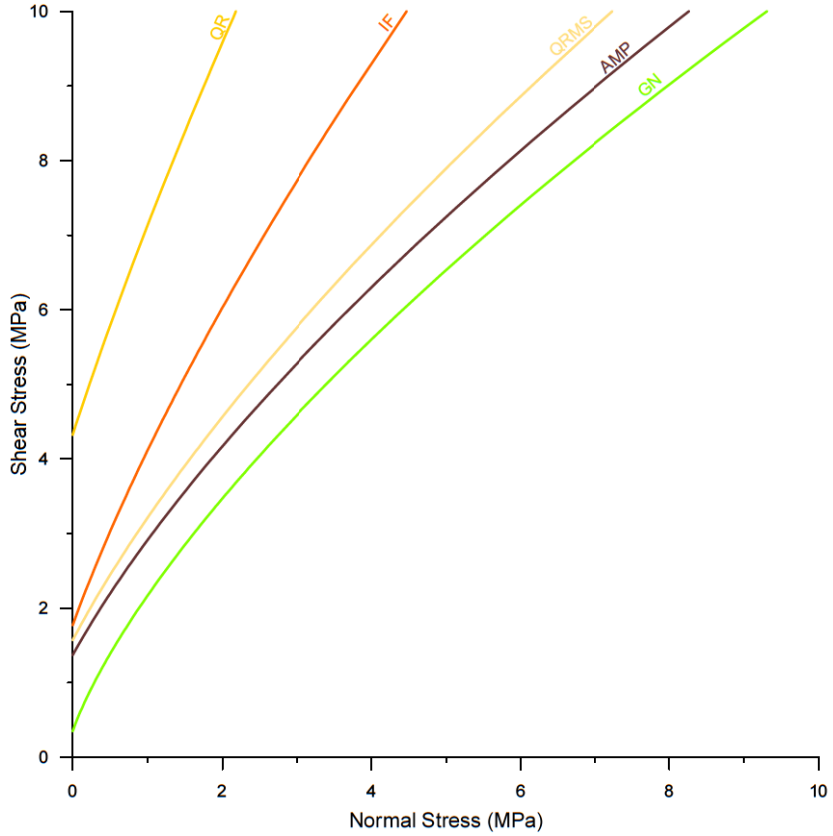
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RELATIONSHIP BETWEEN UNCONFINED COMPRESSIVE STRENGTH (ESTIMATED FROM UCS LABORATORY TEST RESULTS AND PLI TESTING) AND HARDNESS FOR THE AMP, IF, QRMS, QR, AND GN GEOTECHNICAL UNITS

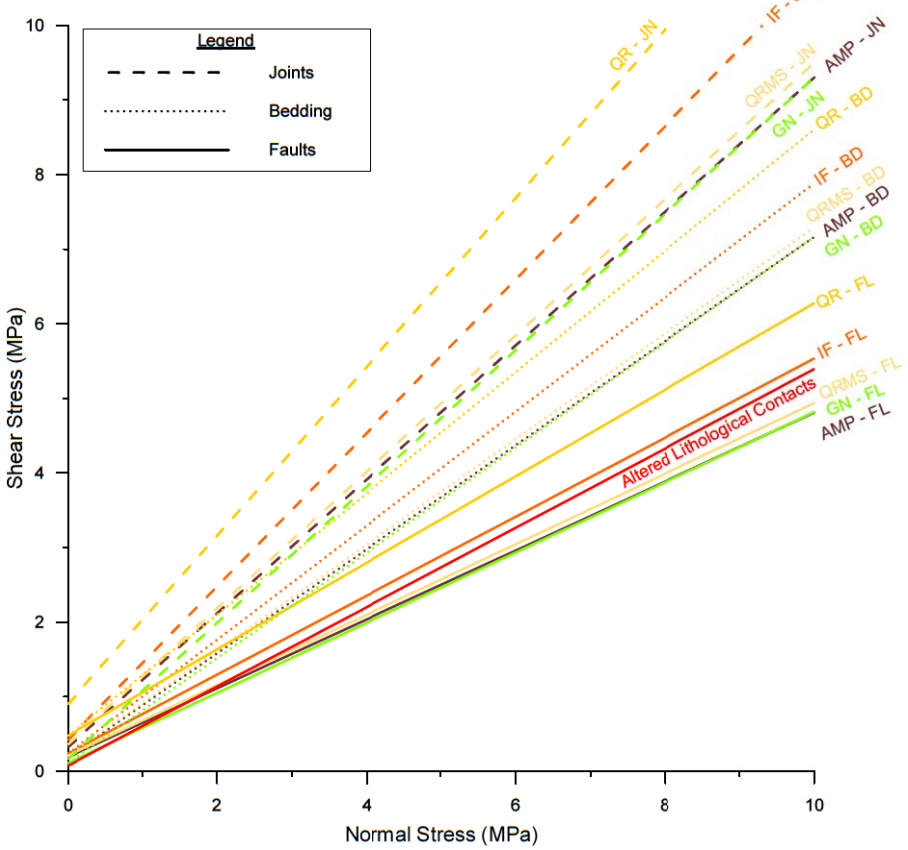
BY:	DATE:
LCS	JAN 16
APPROVED:	FIG:
GG	11

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NON-LINEAR[1,2]



LINEAR[1,3]



Notes:
1. Refer to Tables III and IV for summary of rock mass and material strength parameters.
2. Rock mass strength curves developed using the 35th percentile values for intact rock strength and RMR, and a Disturbance Factor (D) of 0.85.
3. Discontinuity shear strengths assume a 10% rock bridge proportion for faults and continuous bedding joints, and a 20% rock bridge proportion for joints related to limited structural continuity. Shear strengths for discontinuous features were estimated based on weighted average Mohr-Coulomb rock mass strengths (representing the rock bridge) and a discontinuity shear strength of $\phi' = 20°$ and $c' = 50$ kPa for faults, $\phi' = 38°$ and $c' = 50$ kPa for cross-joints, and $\phi' = 32°$ and $c' = 50$ kPa for continuous bedding-joints.

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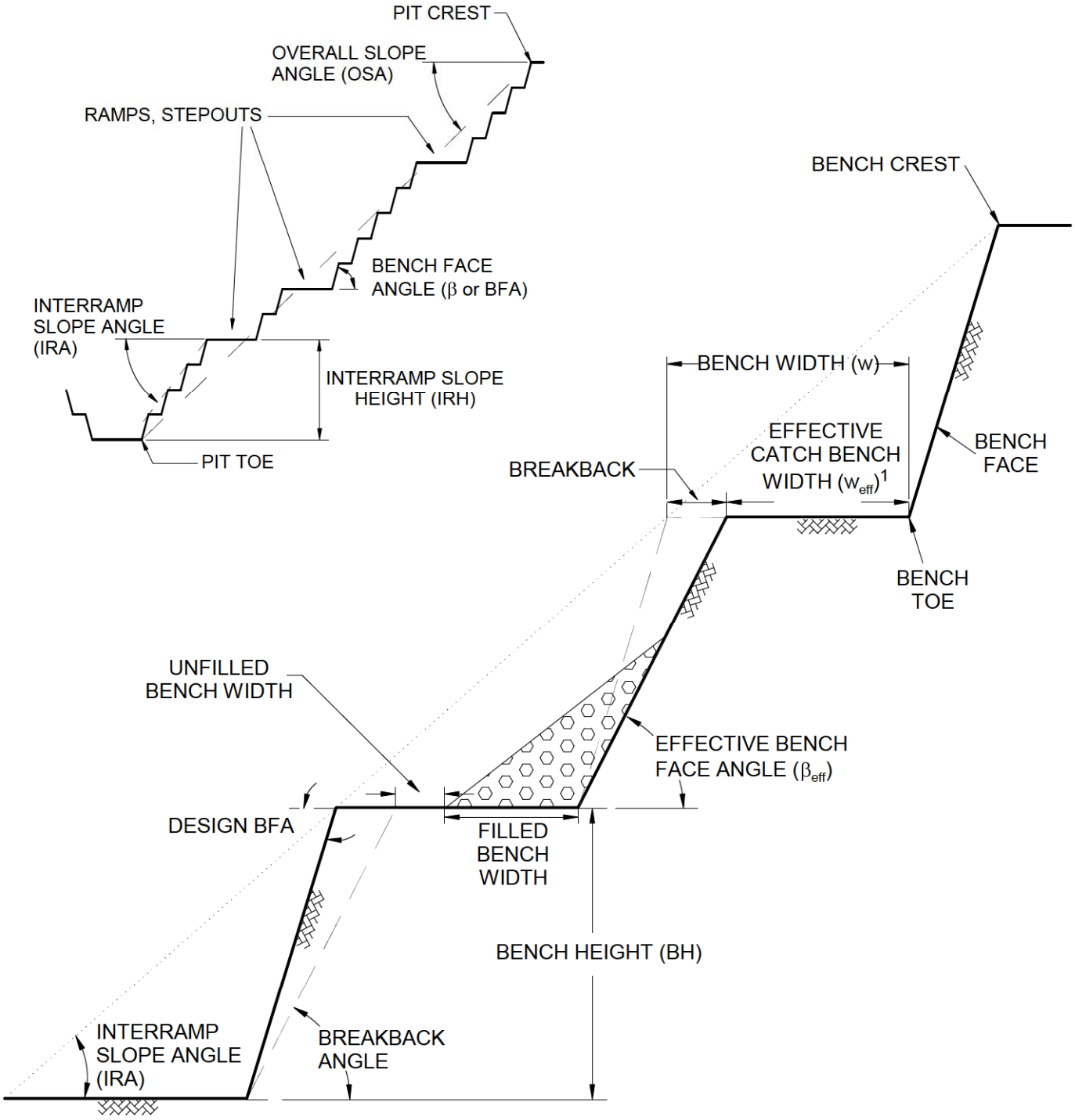
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2015 ROCK MASS STRENGTH ENVELOPES

BY:	DATE:
LCS	JAN 16
APPROVED:	FIG:
GG	12

H:\Project\1846\2015-06 slope design updates\Grapher\BasicSlopeGeom.grf



Notes: 1. Minimum effective catch berm width of 13m is assumed for rockfall protection.
2. Refer to Section 3.2 for description of basic slope geometry parameters.

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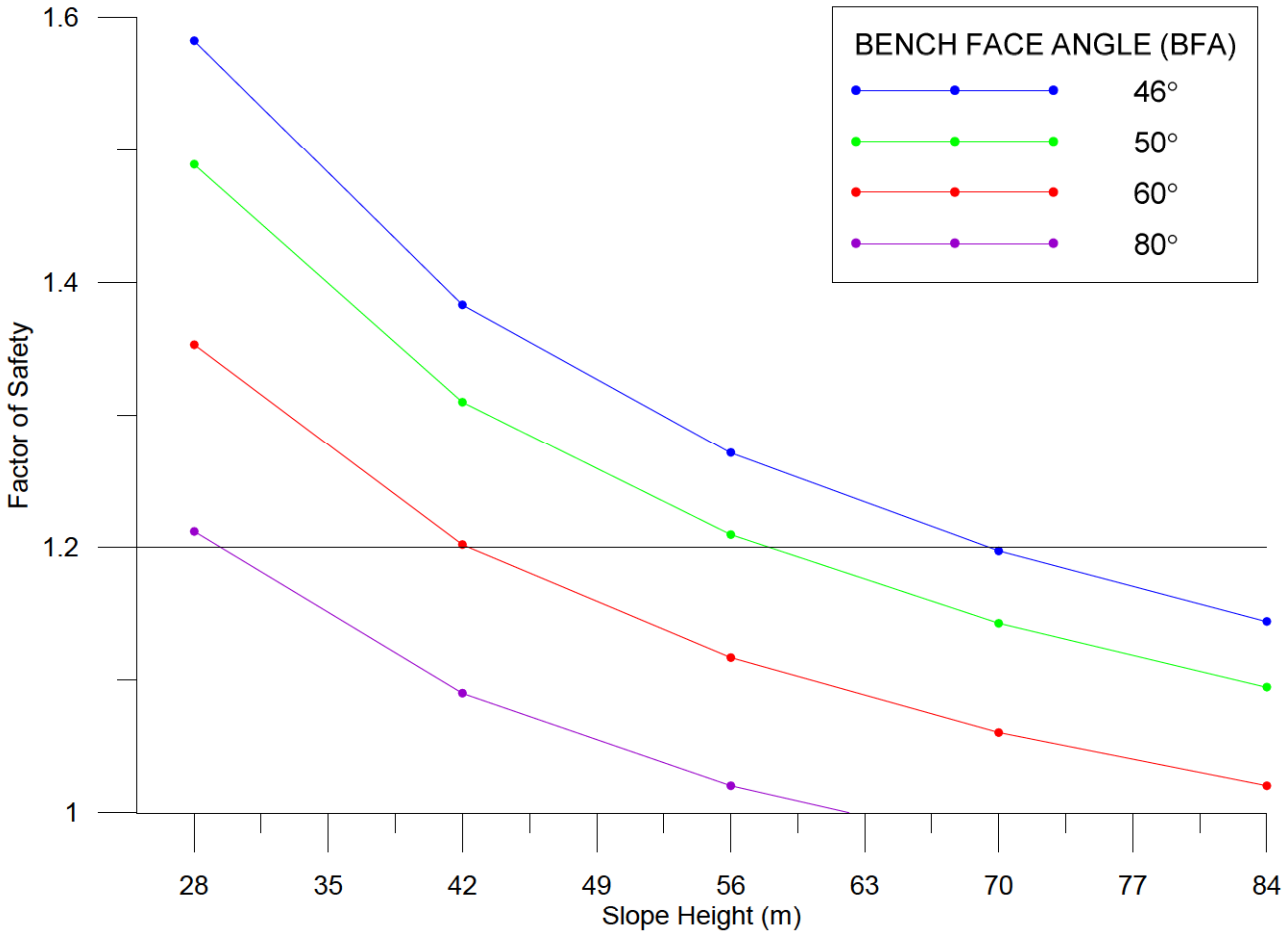
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2015 GEOTECHNICAL ASSESSMENT

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BASIC SLOPE GEOMETRY PARAMETERS

BY:	DATE:
LCS	FEB 16
APPROVED:	FIG:
GG	13

H:\Project\1846\2015-06 slope design updates\Kinematics\Bilinear_Slab\2m_Thickness_FOS_Curve.grf



Note:

1. For the purposes of preparing the slope designs, the average dip of JS1 in any given area should be considered as being representative of the BFA in that portion of the pit slope.

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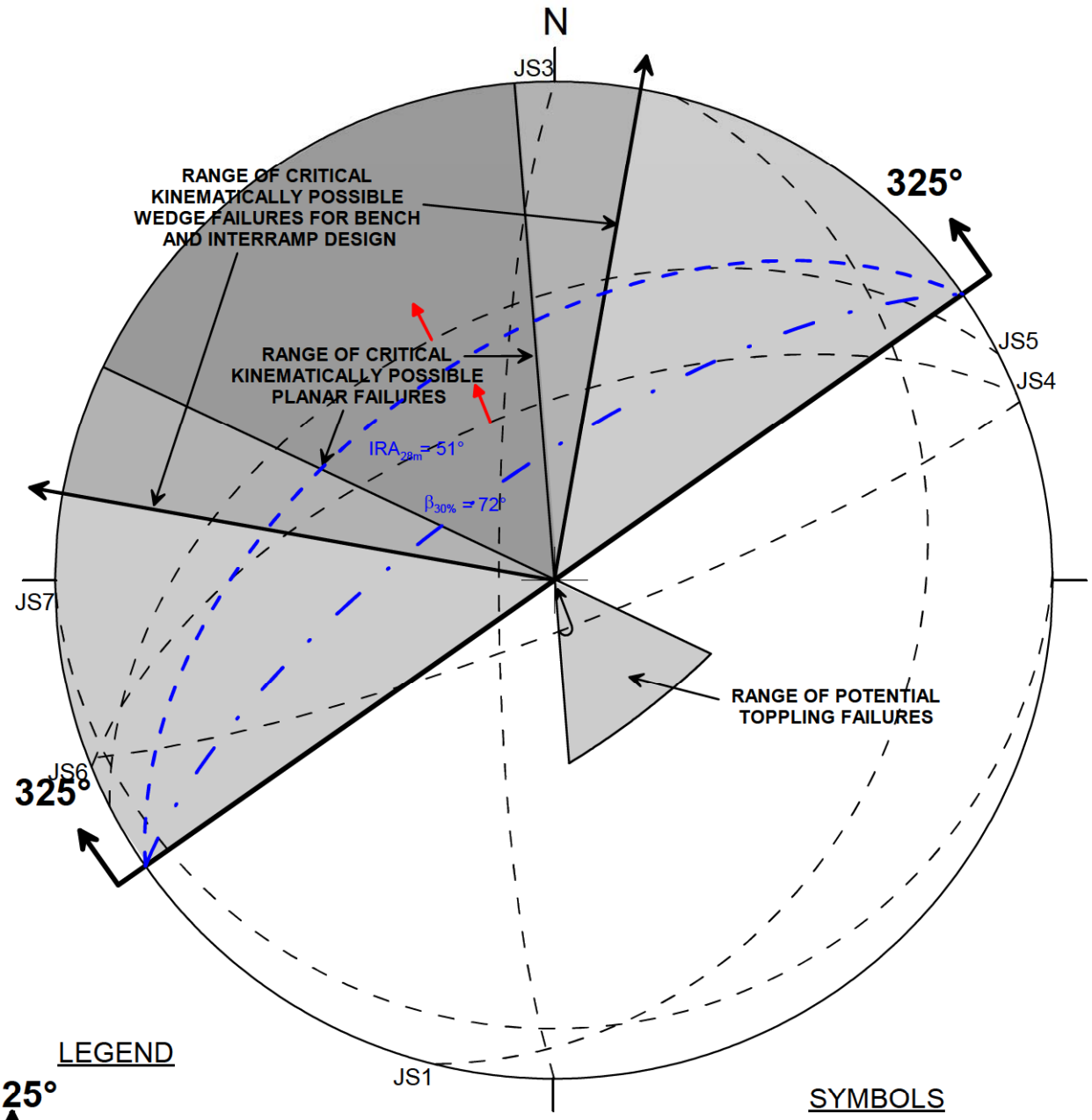
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BILINEAR SLAB ANALYSIS RESULTS FOR 2M-THICK SLAB

BY:	DATE:
LCS	JAN 16
APPROVED:	FIG:
GG	14

H:\Project\1846\2015-06 slope design updates\Grapher\Kinematics_Example_Fig.grf



LEGEND

325° — SLOPE ORIENTATION

JD1 — — — JOINT SET PLANE

FD1 ——— FAULT SET PLANE

IRA_{28m} = 51° (III) — KINEMATIC INTERRAMP ANGLE (DESIGN SECTOR)

$\beta_{30\%}$ = 72° — BENCH FACE ANGLE BASED ON 30% CFA VALUE

SYMBOLS

WEDGE	PLANAR	TOPPLING
FS = 0.00 to 1.00	FS = 0.00 to 1.00	
FS = 1.01 to 1.20	FS = 1.01 to 1.20	
FS = 1.21 to 2.00	FS = 1.21 to 2.00	

1. Kinematically possible failure modes and critical failure modes are defined in Section 3.5.2 and 3.5.4, respectively.
2. Kinematic analyses results are included in Appendix F.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

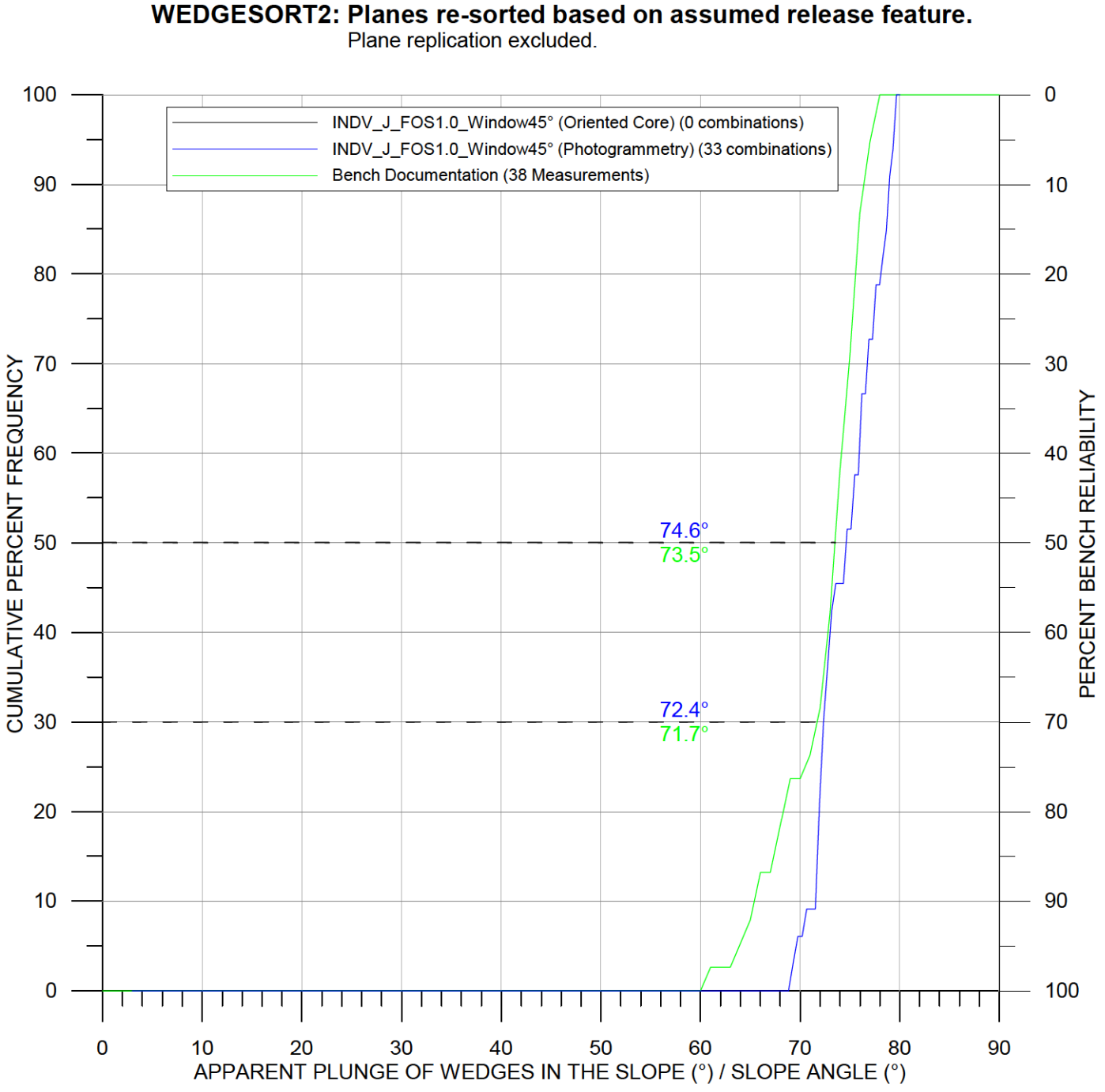
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TYPICAL LOWER HEMISPHERE EQUAL AREA PROJECTION SHOWING KINEMATICALLY POSSIBLE FAILURE MODES

BY:	DATE:
JL	MAR 16
APPROVED:	FIG:
GG	15

H:\Project\1846\2015-06 slope design updates\Grapher\Example_CFA.grf

CENTRAL 325°



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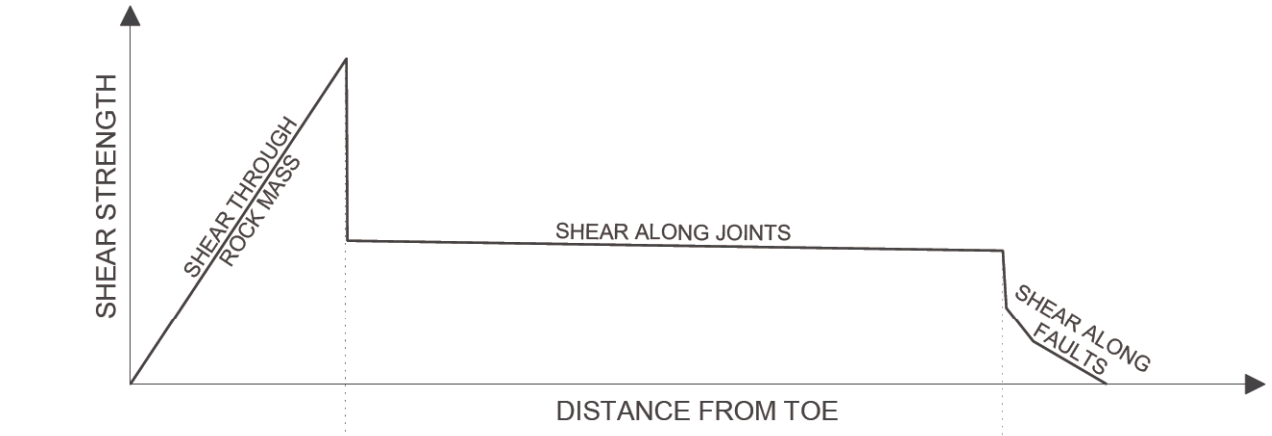
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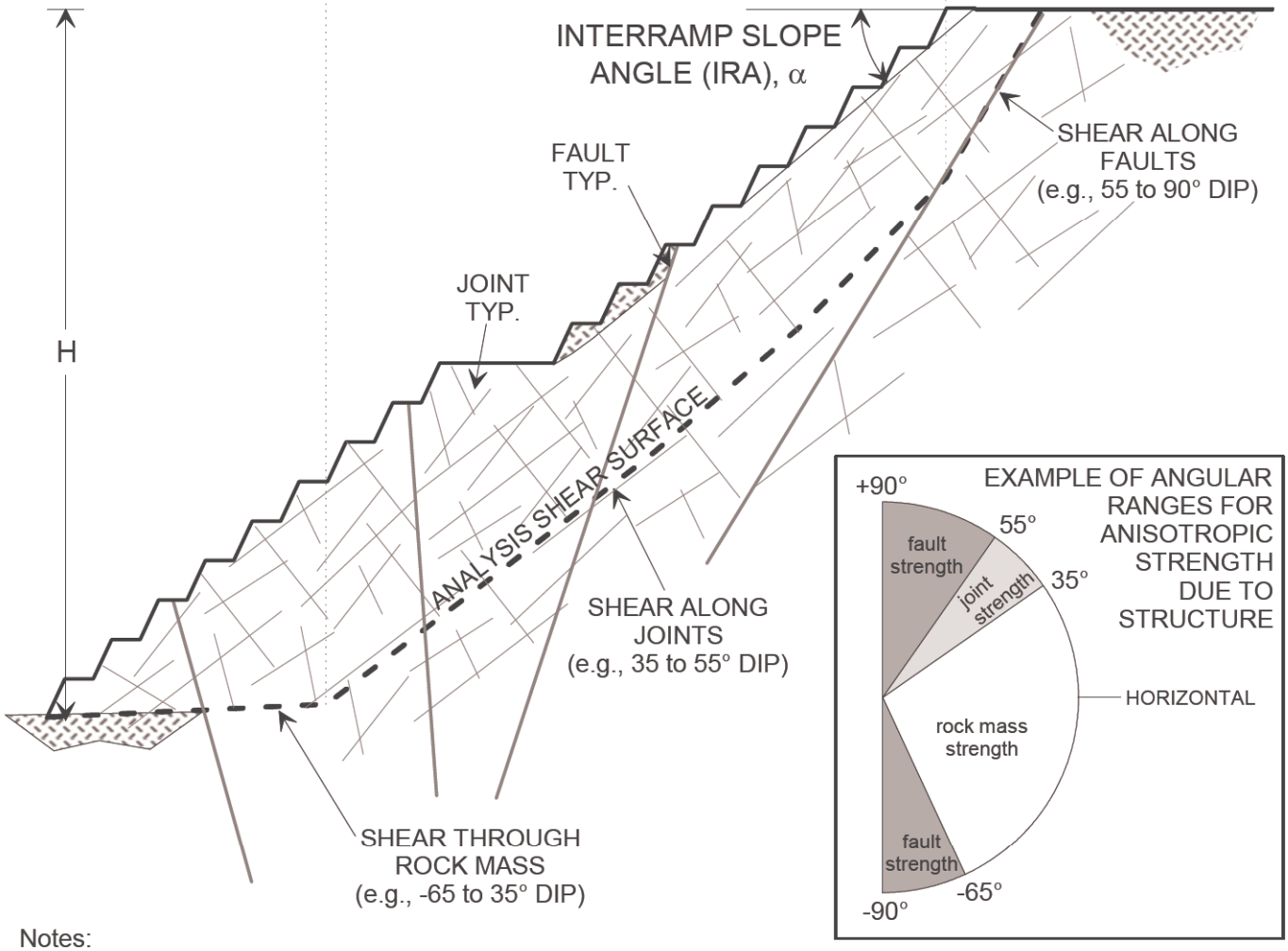
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CUMULATIVE FREQUENCY PLOT OF DOCUMENTED BENCH FACE ANGLES AND KINEMATIC ANALYSIS RESULTS FOR THE CENTRAL DOMAIN, KINEMATIC SECTOR 325°

BY:	DATE:
JL	MAR 16
APPROVED:	FIG:
GG	16

H:\Project\1846\2015-06 slope design updates\Grapher\General_aniso_model.grf





Notes:

1. Anisotropic models generated in SLIDE® using the non-circular search option.
2. Rock mass strengths for for the various geotechnical units are reported in Table III.
3. Fault and bedding joint strengths defined by a 10% rock bridging proportion.
4. Joint strengths defined by a 20% rock bridge proportion.

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2015 GEOTECHNICAL ASSESSMENT

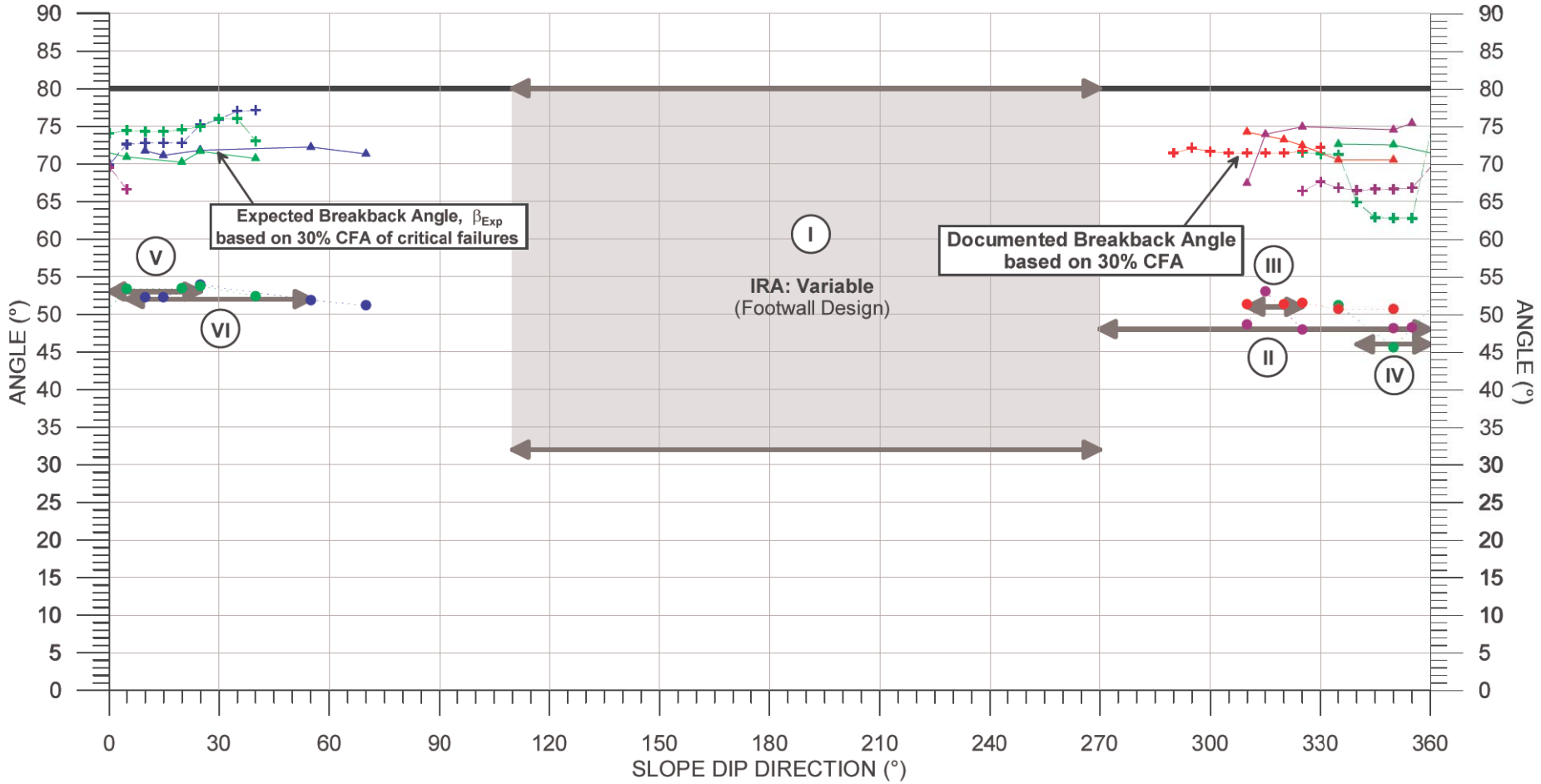
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ILLUSTRATION OF GENERALIZED ANISOTROPIC STABILITY ANALYSIS MODEL

BY:	DATE:
JL	MAR 16
APPROVED:	FIG:
GG	17

H:\Project\1846\2015-06 slope design updates\Kinematics\Manhattan\Manhattan_Irene_final.grf

IRÉNE PIT V7.0 MINE PLAN



Notes: 1. Bench breakback kinematic assessments for a 28m bench height assume a joint friction angle (ϕ') of 38° and a cohesion of 75 kPa and is based on all kinematically possible planar and wedge failure combinations defined from photogrammetry and core orientation data.
2. Refer to Tables V and VI, and report text (1846-16_R02) for description of recommended slope designs.

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LEGEND
- Recommended BFA
- Recommended IRA 28m Bench
- Maximum Allowable IRA Based on 30% CFA - Central
- Maximum Allowable IRA Based on 30% CFA - South
- Maximum Allowable IRA Based on 30% CFA - Southeast
- Maximum Allowable IRA Based on 30% CFA - West
- Expected Bench Breakback Angle - Central
- Expected Bench Breakback Angle - South
- Expected Bench Breakback Angle - Southeast
- Expected Bench Breakback Angle - West
- Documented Bench Breakback Angle - Central
- Documented Bench Breakback Angle - South
- Documented Bench Breakback Angle - Southeast
- Documented Bench Breakback Angle - West

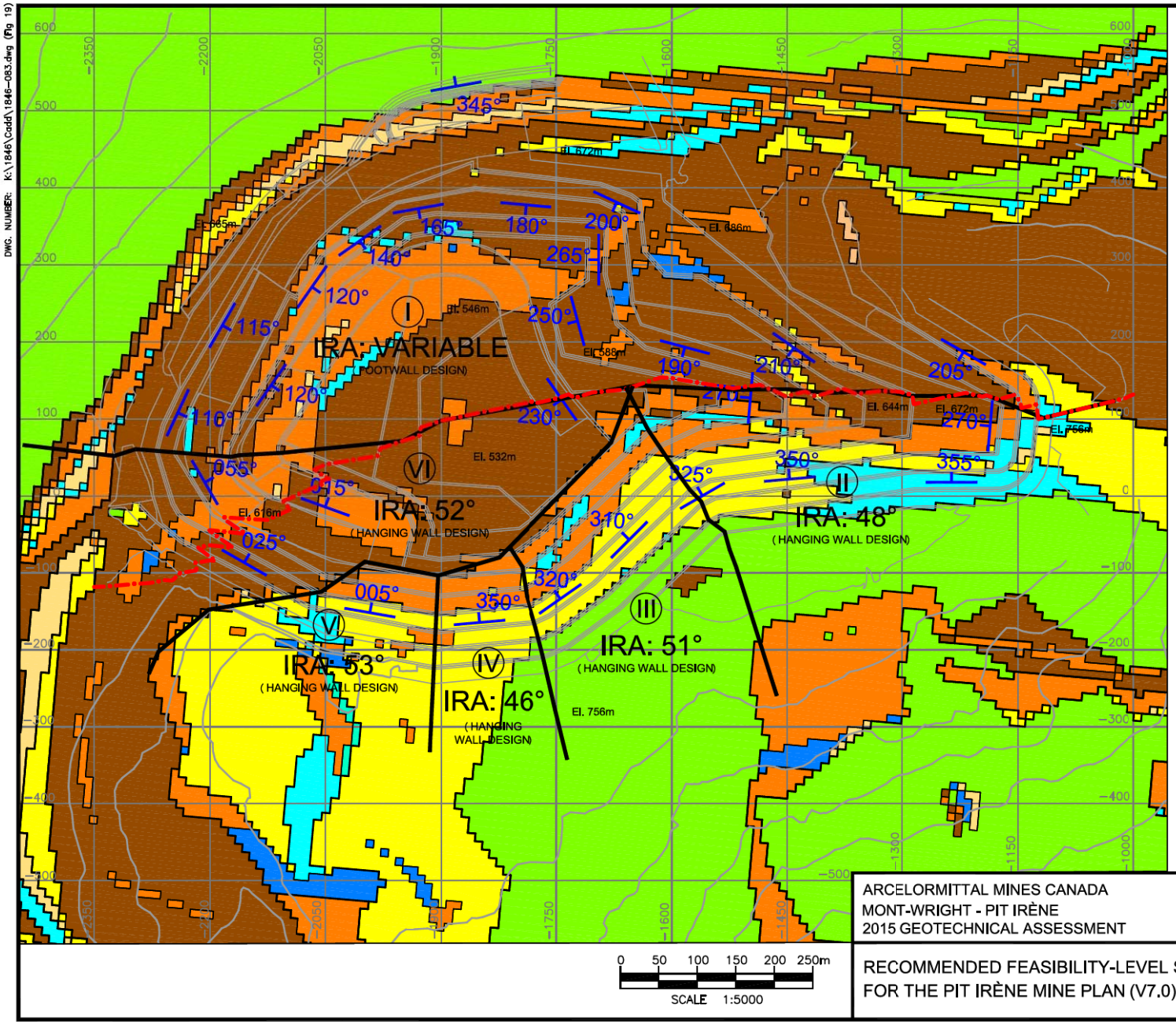
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MONT-WRIGHT - PIT IRÈNE
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MANHATTAN DIAGRAM SHOWING DOCUMENTED AND EXPECTED BENCH BREAKBACK AND RECOMMENDED FEASIBILITY-LEVEL DESIGN BENCH AND INTERRAMP SLOPE ANGLES FOR THE PIT IRÈNE MINE PLAN (V7.0)

BY:	DATE:
JL	MAR 16
APPROVED:	FIG:
GG	18

DWG. NUMBER: K:\1846\Cadd\1846-083.dwg (Fig 19)



TRUE NORTH

LEGEND

- DESIGN SECTOR BOUNDARY
- III / IRA: 51° — DESIGN SECTOR AND RECOMMENDED INTERRAMP SLOPE ANGLE
- INTERPRETED FAULT
- 000° — DESIGN SECTOR DIP DIRECTION
- AMPHIBOLITE
- IRON FORMATION
- CONTAMINATED IRON FORMATION – Al–Ti
- CONTAMINATED IRON FORMATION – Mn
- IRON FORMATION – NON–ECONOMIC
- QUARTZ ROCK
- QUARTZ ROCK IRON FORMATION
- QUARTZ ROCK MICA SCHIST
- MICA SCHIST
- GNEISS
- UNKNOWN
- OVERBURDEN

NOTES:

1. CURRENT TOPOGRAPHY (mont_wright_current_topography20150528.dxf) PROVIDED BY AMMC ON MAY 29, 2015.
2. MINE PLAN (DE_IR_v7.0_Ligne.dxf) PROVIDED BY AMMC ON JANUARY 22, 2016.
3. BLOCK MODEL (bmb_mwh_i_20150325.mdl) PROVIDED BY AMMC ON NOVEMBER 27, 2015.
4. INTERPRETED FAULT (faille_irene_20160111.dtm) PROVIDED BY AMMC ON JANUARY 15, 2016.
5. MINE PLAN CLIPPED TO CURRENT TOPOGRAPHY BY PITEAU – FOR INFORMATION ONLY.
6. MINE GRID SHOWN.
7. REFER TO TABLES V AND VI AND REPORT TEXT (1846–16_R02) FOR DESCRIPTION OF RECOMMENDED SLOPE DESIGNS.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

RECOMMENDED FEASIBILITY-LEVEL SLOPE DESIGNS FOR THE PIT IRÈNE MINE PLAN (V7.0)

BY:	DATE:
JL/sl	MAY 16
APPROVED:	FIG:
GG	19

APPENDIX A

LOWER HEMISPHERE EQUAL AREA PROJECTIONS OF PHOTOGRAMMETRIC AND ORIENTED CORE LOGGING DATA

TABLE A1
SUMMARY OF DISCONTINUITY POPULATIONS IN THE PIT IRÈNE AT THE NORTHWEST, NORTH, AND EAST DOMAINS BASED ON PHOTOGRAMMETRY AND CORE LOGGING DATA FROM THE 2015 GEOTECHNICAL DRILLING PROGRAM

STRUCTURAL DOMAIN[1]		NORTHWEST						NORTH										EAST									
DATABASE		ORIENTED CORE						ORIENTED CORE						ADAMTECH PHOTOGRAMMETRY						ORIENTED CORE						COMBINED PHOTOGRAMMETRY					
POPULATION			Poles	Entries					Poles	Entries					Poles	Entries					Poles	Entries					Poles	Entries			
Joints			183	183					221	221					220	220					123	123					66	66			
Faults			9	9					25	25					-	-					12	12					-	-			
TOTAL			**192**	**192**					**246**	**246**					**220**	**220**					**135**	**135**					**66**	**66**			
SET	STRUCTURE	NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]	
	JOINTS	JS1-1	51	100	S	11.5	21	JS1	77	185	S	7.2	16	JS1	86	163	S	8.6	19	JS1-1	46	193	S	16.3	20	JS1	54	166	W	5.0	4
		JS1-2	45	126	S	8.0	15	JS3	09	030	S	5.5	12	JS2	88	076	S	8.0	18	JS1-2	41	223	S	9.5	12	JS2-1	87	238	S	15.2	10
		JS2	80	180	W	2.5	5	JS5	70	137	M	3.5	8	JS3	15	297	M	3.0	7	JS1-3	34	180	M	8.0	10	JS2-2	85	221	M	11.0	7
		JS3	17	292	M	6.5	12	JS6	42	126	M	3.5	8	JS4	33	009	M	3.5	8	JS2	85	285	W	5.0	6	JS3	53	328	W	5.0	4
								JS7	21	302	M	3.5	8							JS3	36	336	W	3.0	4	JS4	56	195	M	7.0	5
	FAULTS	F1	56	080	M	22.2	3	F1	36	201	M	16.0	4							F1	72	215	M	25.0	3						
																				F2	36	201	M	25.0	3						

H:\Project\1846\2015-03 slope design updates\Structural\[Peak Structure Orientations.xls]Footwall

Notes: 1. Structural domains are shown on Fig. 2.
2. Dip and Dip Dir. refer to the dip and dip direction of the peak (average) orientation of the population.
3. Weight refers to the relative weighting of weak (W), moderate (M) and strong (S) based on approximately one-third divisions of the maximum peak population shown on the stereographic projections in Appendix A.
4. %/No. refers to the percent of the population and the number of poles in a one percent circle at the peak orientation.

TABLE A2
SUMMARY OF DISCONTINUITY POPULATIONS IN THE PIT IRÈNE AT THE SOUTHEAST, CENTRAL, SOUTH, AND WEST DOMAINS BASED ON PHOTOGRAMMETRY AND CORE LOGGING DATA FROM THE 2015 GEOTECHNICAL DRILLING PROGRAM

STRUCTURAL DOMAIN[1]		SOUTHEAST										CENTRAL												SOUTH										WEST					
DATABASE		Oriented Core						Combined Photogrammetry						Oriented Core						Adamtech						Oriented Core						Combined Photogrammetry						Combined Photogrammetry					
POPULATION			Poles	Entries					Poles	Entries					Poles	Entries					Poles	Entries					Poles	Entries					Poles	Entries					Poles	Entries				
Joints			21	21					174	174					134	134					163	163					309	309					165	165					53	53				
Faults			10	10					-	-					18	18					-	-					42	42					-	-					-	-				
TOTAL			**31**	**31**					**174**	**174**					**152**	**152**					**163**	**163**					**351**	**351**					**165**	**165**					**53**	**53**				
SET	STRUCTURE	NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]		NAME	DIP[2]	DIP DIR'N[2]	WT[3]	% / NO.[4]	
A	JOINTS	JS9	75	158	M	19.1	4	JS1	28	250	W	2.0	3	JS8	26	006	S	11.9	16	JS1	27	104	M	5.5	9	JS1	30	013	S	8.4	26	JS1-1	37	024	M	8.0	13	JS1	53	003	M	9.0	5
		JS10	82	152	M	15.0	3	JS4	74	339	S	16.7	29	JS9	22	334	S	8.5	11	JS3	81	270	S	10.4	17	JS3-1	77	151	M	4.5	14	JS1-2	45	347	M	7.5	12	JS2	57	086	M	9.0	5
		JS11	67	125	M	14.0	3	JS5	52	336	M	8.5	15	JS10	15	298	M	6.0	8	JS4	62	338	S	8.5	14	JS3-2	76	178	W	2.5	8	JS1-3	19	301	M	5.5	9	JS4	86	222	S	17.0	9
								JS6	50	348	M	8.0	14	JS11	76	120	M	6.0	8	JS5	45	333	S	8.0	13	JS4	12	043	M	4.5	14	JS3	83	159	S	13.9	23	JS5	86	337	M	7.0	4
								JS7	16	115	M	6.5	11							JS6	82	159	S	7.5	12	JS5	08	118	M	4.5	14												
								JS8	87	159	M	6.0	10							JS7	11	179	M	4.5	7																		
	FAULTS													F1	19	013	M	22.2	4							F1	10	114	M	9.5	4												
																										F2	14	344	M	9.5	4												

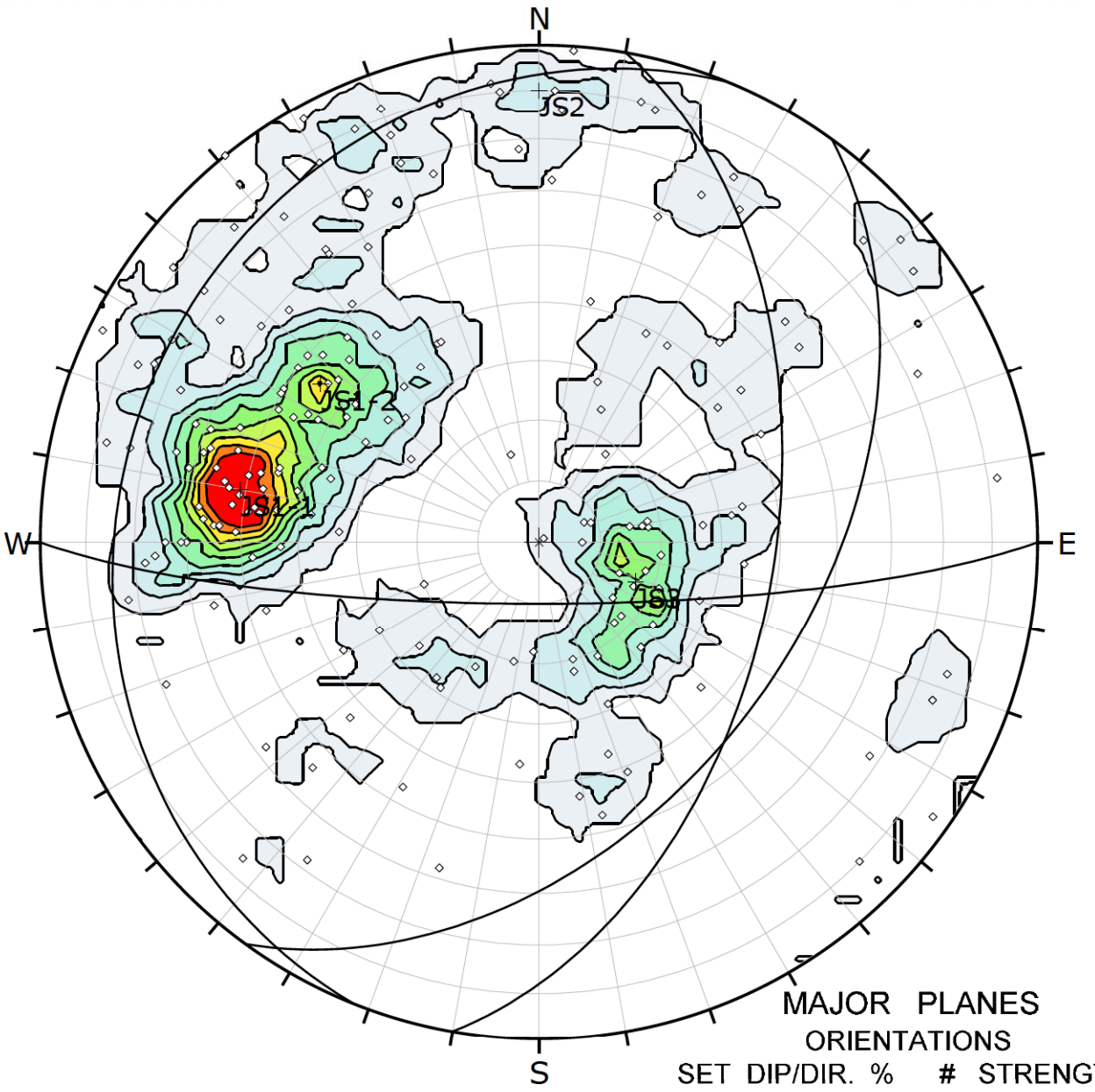
H:\Project\08-662\2015-08 slope design update\Structural\Peak Structure Orientations.xls]Hanging Wall

Notes: 1. Structural domains are shown on Fig. 2.
2. Dip and Dip Dir. refer to the dip and dip direction of the peak (average) orientation of the population.
3. Weight refers to the relative weighting of weak (W), moderate (M) and strong (S) based on approximately one-third divisions of the maximum peak population shown on the stereographic projections in Appendix A.
4. %/No. refers to the percent of the population and the number of poles in a one percent circle at the peak orientation.

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/Northwest_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

183 Poles Plotted
183 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1-1	51/100	11.5	21	S
JS1-2	45/126	8.0	15	S
JS2	80/180	2.5	5	W
JS3	17/292	6.5	12	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 11.48

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2015 GEOTECHNICAL ASSESSMENT

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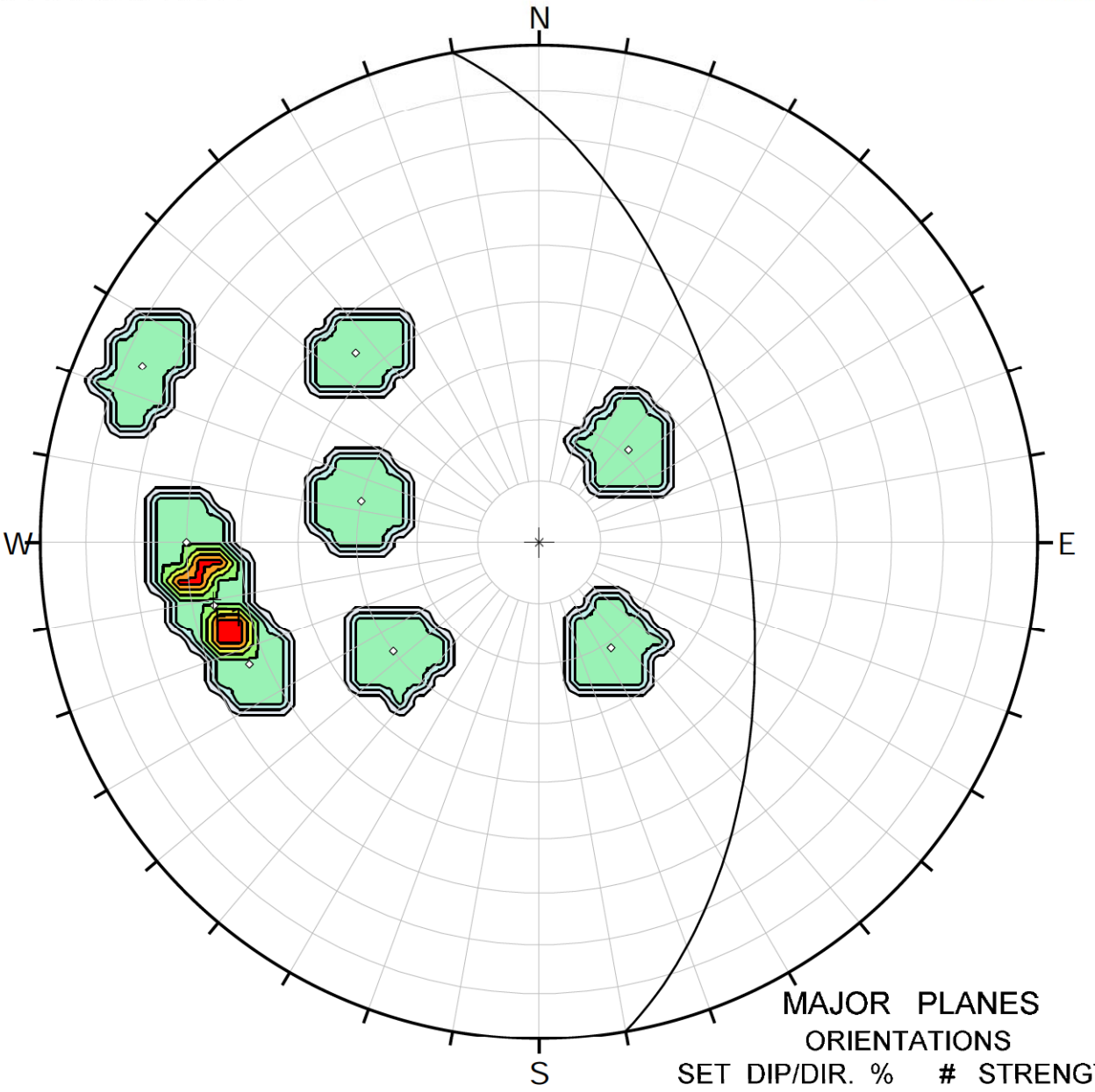
STRUCTURAL ANALYSIS OF JOINTS
NORTHWEST DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A1

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/Northwest_FL.grf

EQUAL AREA
LOWER HEMISPHERE

9 Poles Plotted
9 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
F1	56/080	22.2	3	M

CONTOUR LEGEND
SCHMIDT POLE CONCENTRATIONS
% of total per 1.0 % area

Minimum Contour	= 3.0
Contour Interval	= 3.0
Max.Concentration	= 22.22

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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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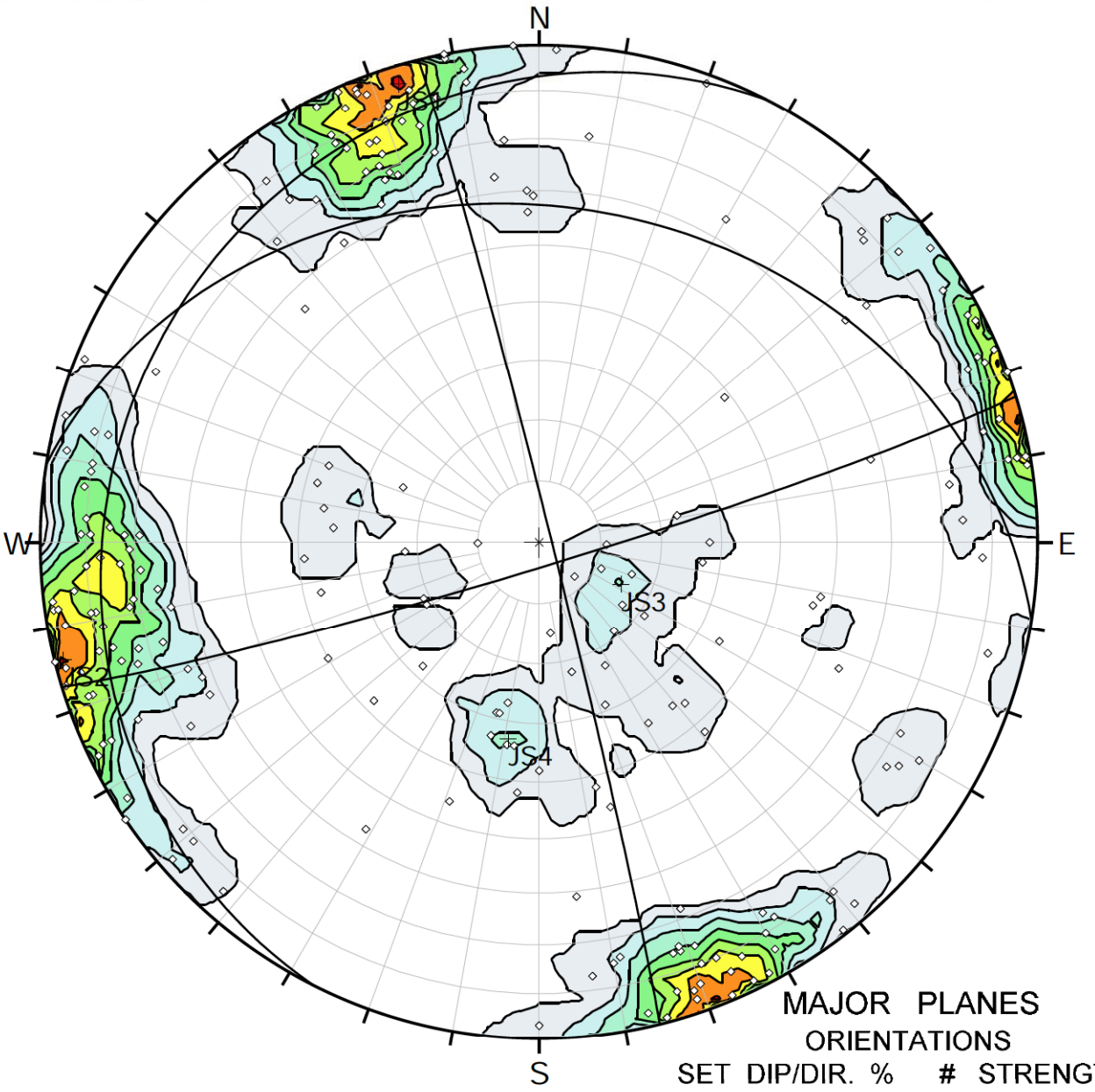
STRUCTURAL ANALYSIS OF FAULTS
NORTHWEST DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A2

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/ADAM_North_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

220 Poles Plotted
220 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1	86/163	8.6	19	S
JS2	88/076	8.0	18	S
JS3	15/297	3.0	7	M
JS4	33/009	3.5	8	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 8.64

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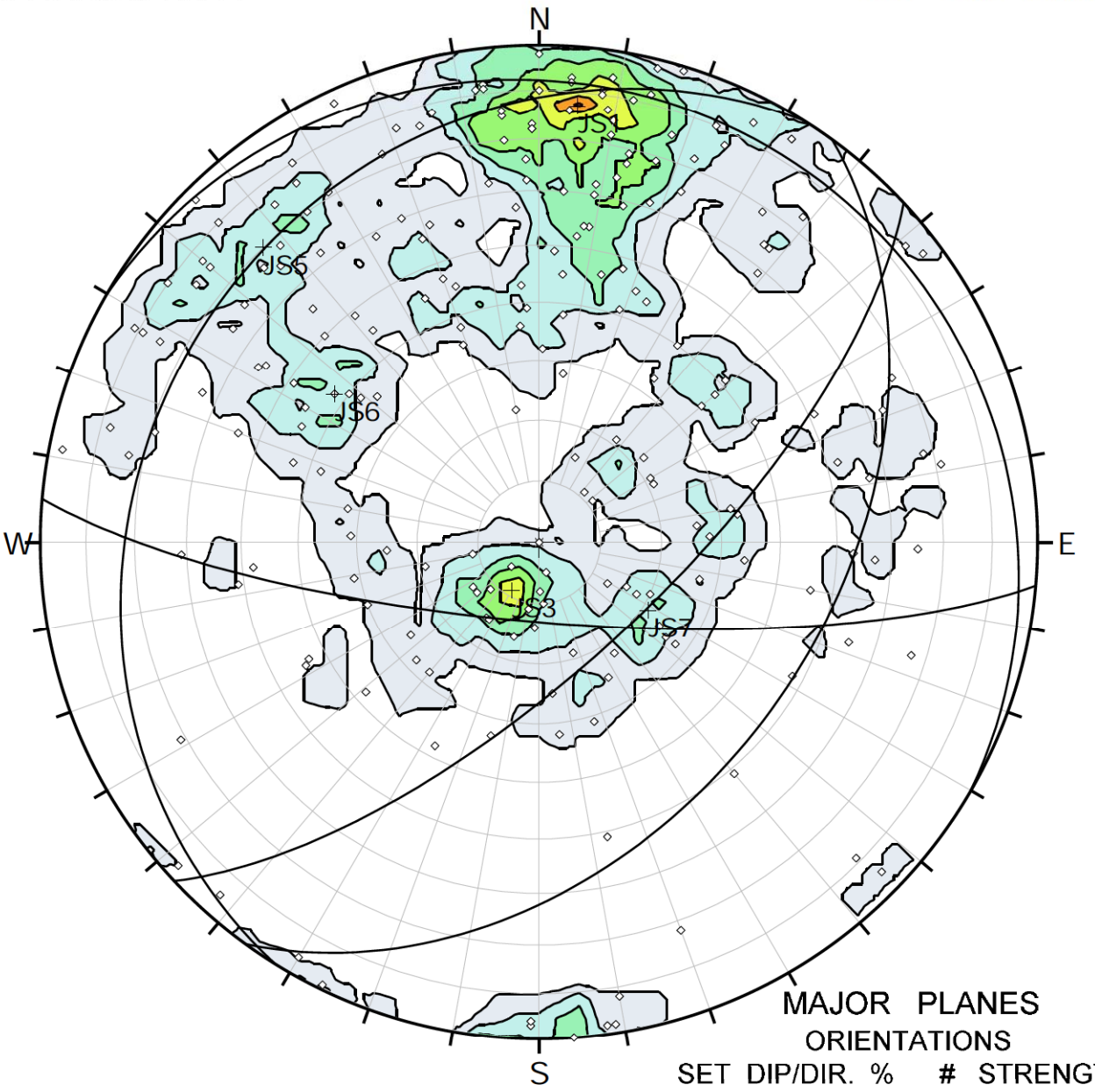
STRUCTURAL ANALYSIS OF JOINTS
NORTH DOMAIN
ADAMTECH PHOTOGRAMMETRY

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A3

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/North_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

221 Poles Plotted
221 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1	77/185	7.2	16	S
JS3	9/030	5.5	12	S
JS5	70/137	3.5	8	M
JS6	42/126	3.5	8	M
JS7	21/302	3.5	8	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 7.24

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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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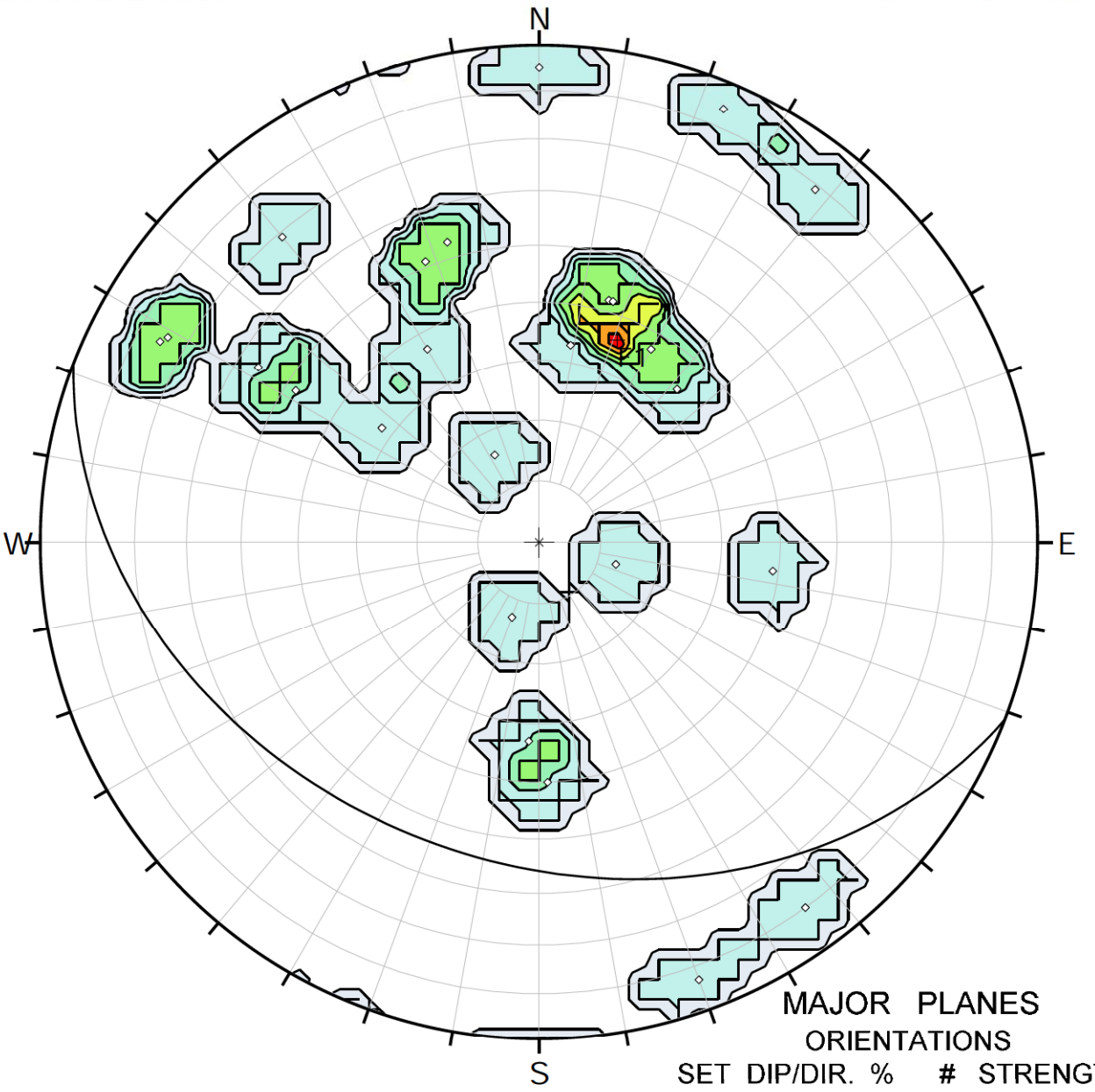
STRUCTURAL ANALYSIS OF JOINTS
NORTH DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A4

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/North_FL.grf

EQUAL AREA
LOWER HEMISPHERE

25 Poles Plotted
25 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
F1	36/201	16.0	4	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 2.0
Contour Interval	= 2.0
Max.Concentration	= 16.00

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MONT-WRIGHT - PIT IRÈNE
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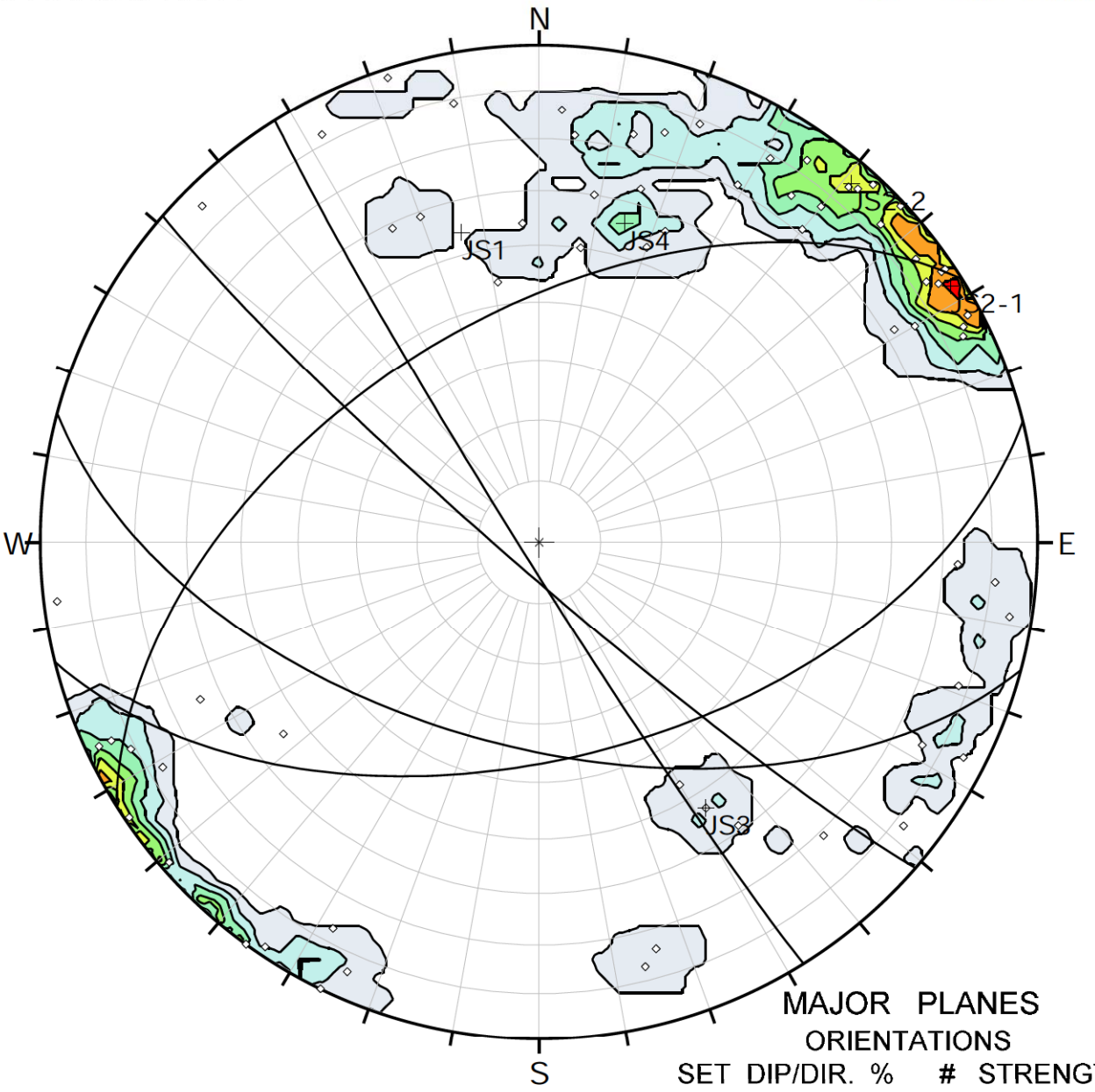
STRUCTURAL ANALYSIS OF FAULTS
NORTH DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A5

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/SIRO_ADAM_East_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

66 Poles Plotted
66 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1	54/166	5.0	4	W
JS2-1	87/238	15.2	10	S
JS2-2	85/221	11.0	7	M
JS3	53/328	5.0	4	W
JS4	56/195	7.0	5	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 2.0
Contour Interval	= 2.0
Max.Concentration	= 15.15

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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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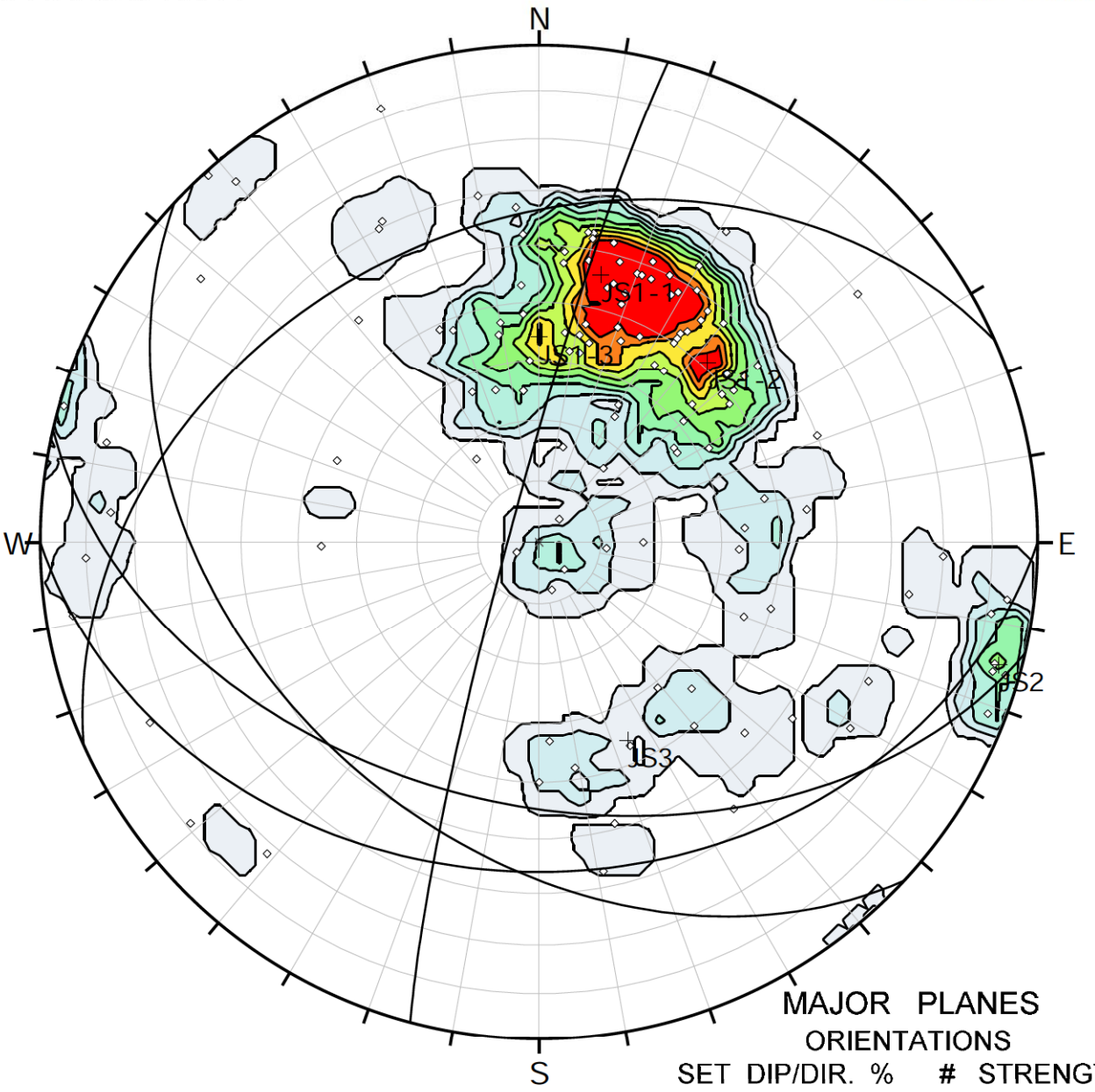
STRUCTURAL ANALYSIS OF JOINTS
EAST DOMAIN
COMBINED ADAMTECH AND SIROVISION PHOTOGRAMMETRY

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A6

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/East_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

123 Poles Plotted
123 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1-1	46/193	16.3	20	S
JS1-2	41/223	9.5	12	S
JS1-3	34/180	8.0	10	M
JS2	85/285	5.0	6	W
JS3	36/336	3.0	4	W

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 16.26

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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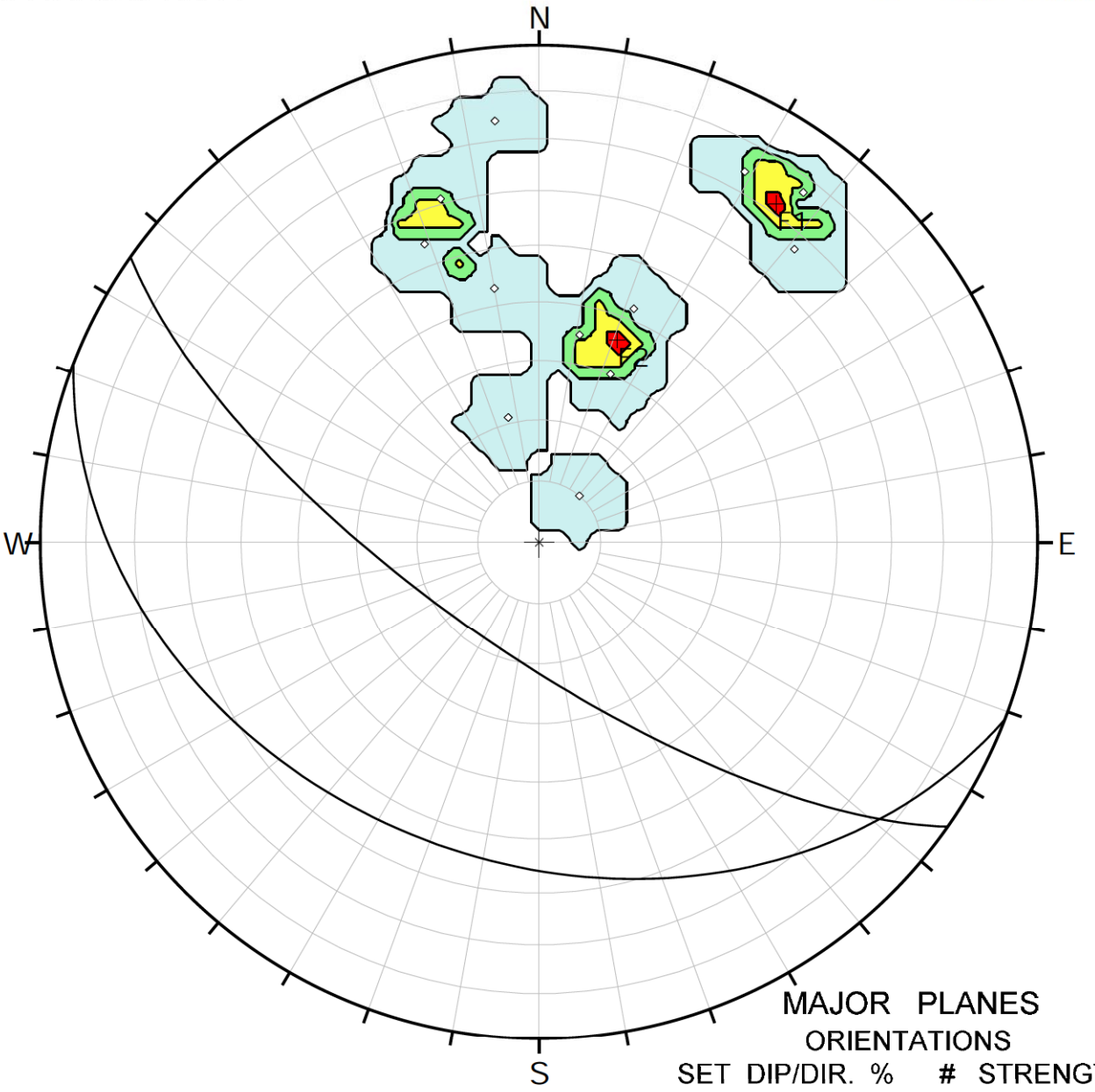
STRUCTURAL ANALYSIS OF JOINTS
EAST DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A7

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/East_FL.grf

EQUAL AREA
LOWER HEMISPHERE

12 Poles Plotted
12 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
F1	72/215	25.0	3	M
F2	36/201	25.0	3	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 5.0
Contour Interval	= 5.0
Max.Concentration	= 25.00

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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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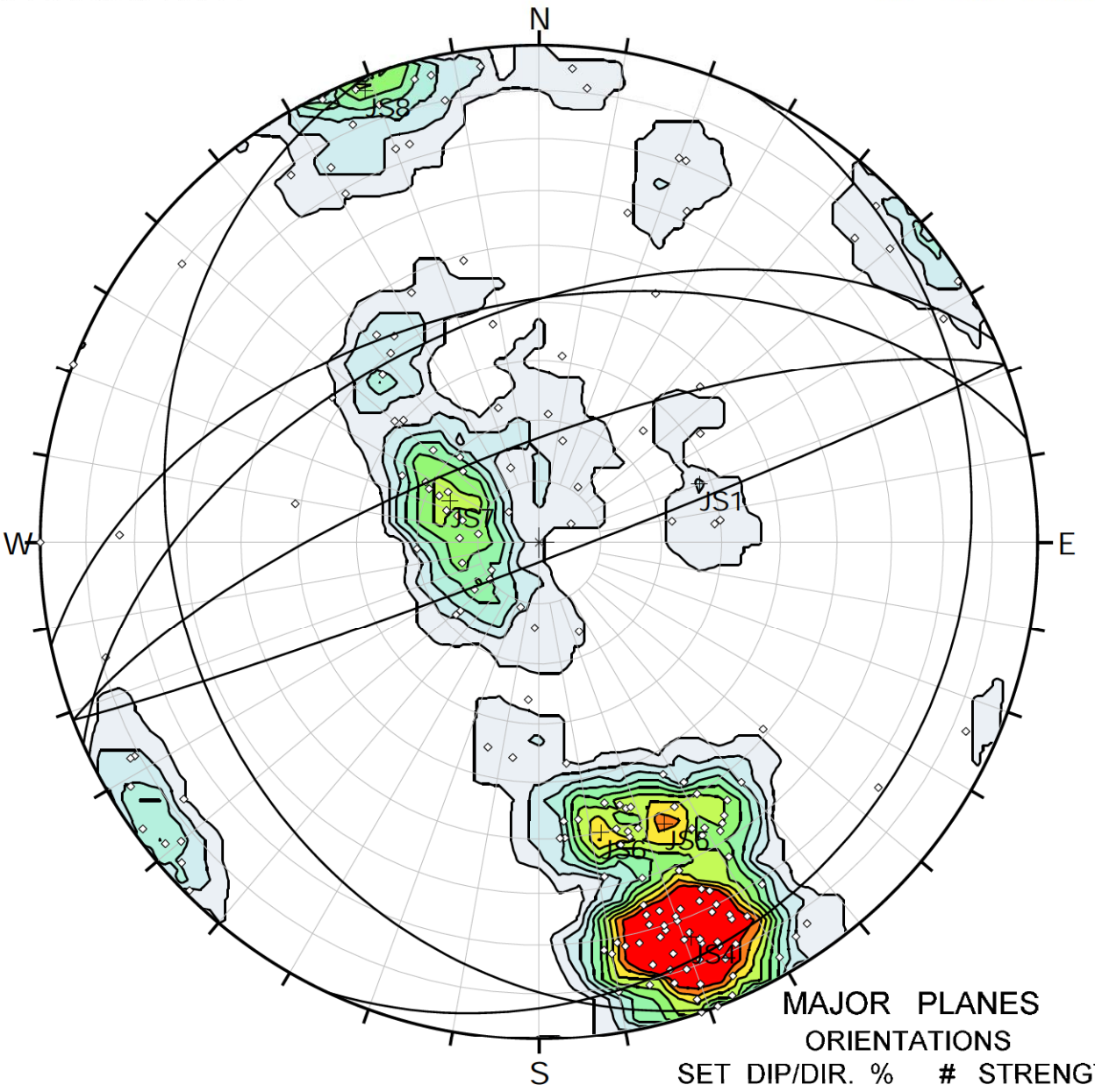
STRUCTURAL ANALYSIS OF FAULTS
EAST DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A8

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/SIRO_ADAM_Southeast_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

174 Poles Plotted
174 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1	28/250	2.0	3	W
JS4	74/339	16.7	29	S
JS5	52/336	8.5	15	M
JS6	50/348	8.0	14	M
JS7	16/115	6.5	11	M
JS8	87/159	6.0	10	M

CONTOUR LEGEND
SCHMIDT POLE CONCENTRATIONS
% of total per 1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 16.67

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

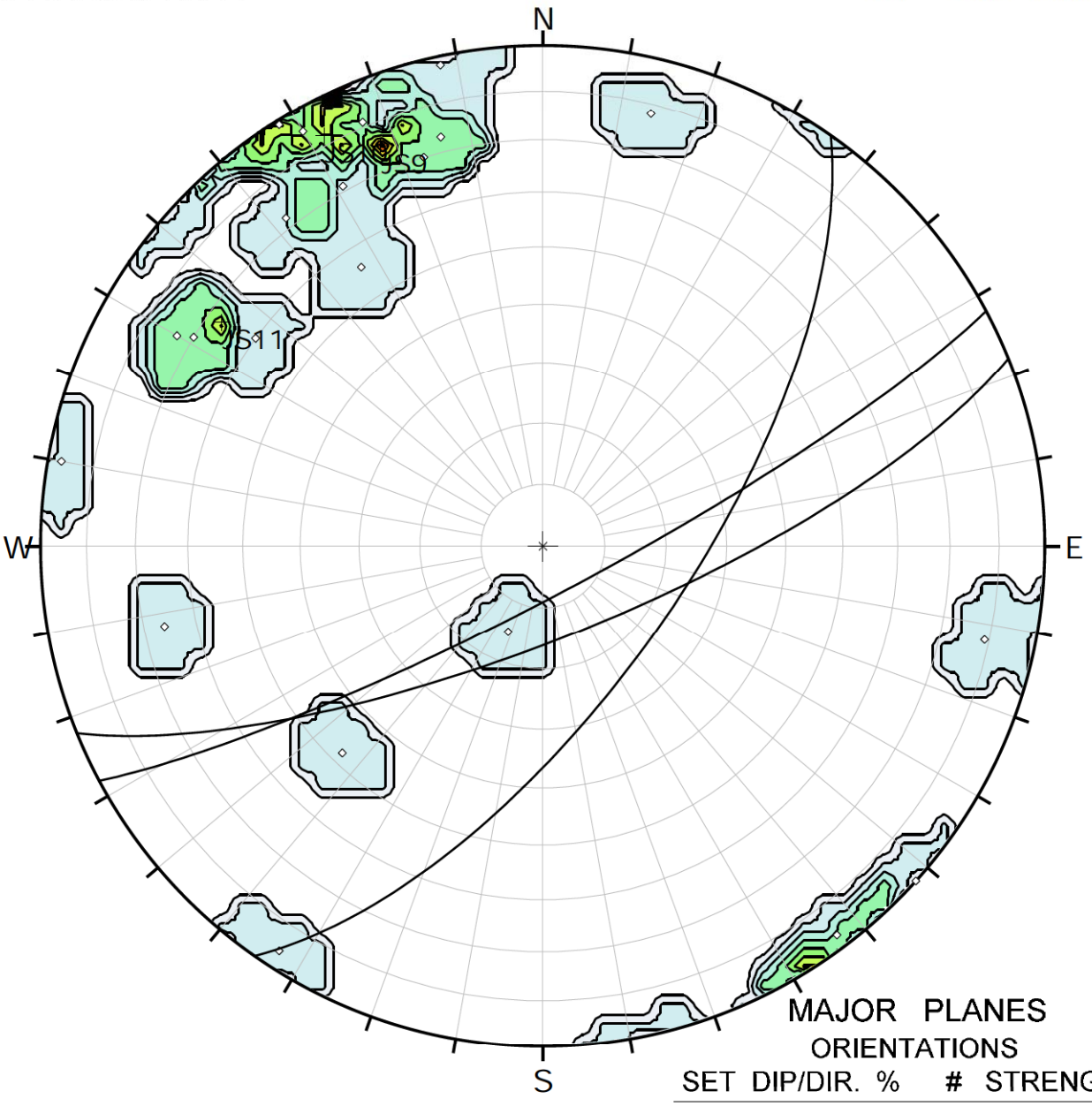
STRUCTURAL ANALYSIS OF JOINTS
SOUTHEAST DOMAIN
COMBINED ADAMTECH AND SIROVISION PHOTOGRAMMETRY

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A9

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/Southeast_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

21 Poles Plotted
21 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS9	75/158	19.1	4	M
JS10	82/152	15.0	3	M
JS11	67/125	14.0	3	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 2.0
Contour Interval	= 2.0
Max.Concentration	= 19.05

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

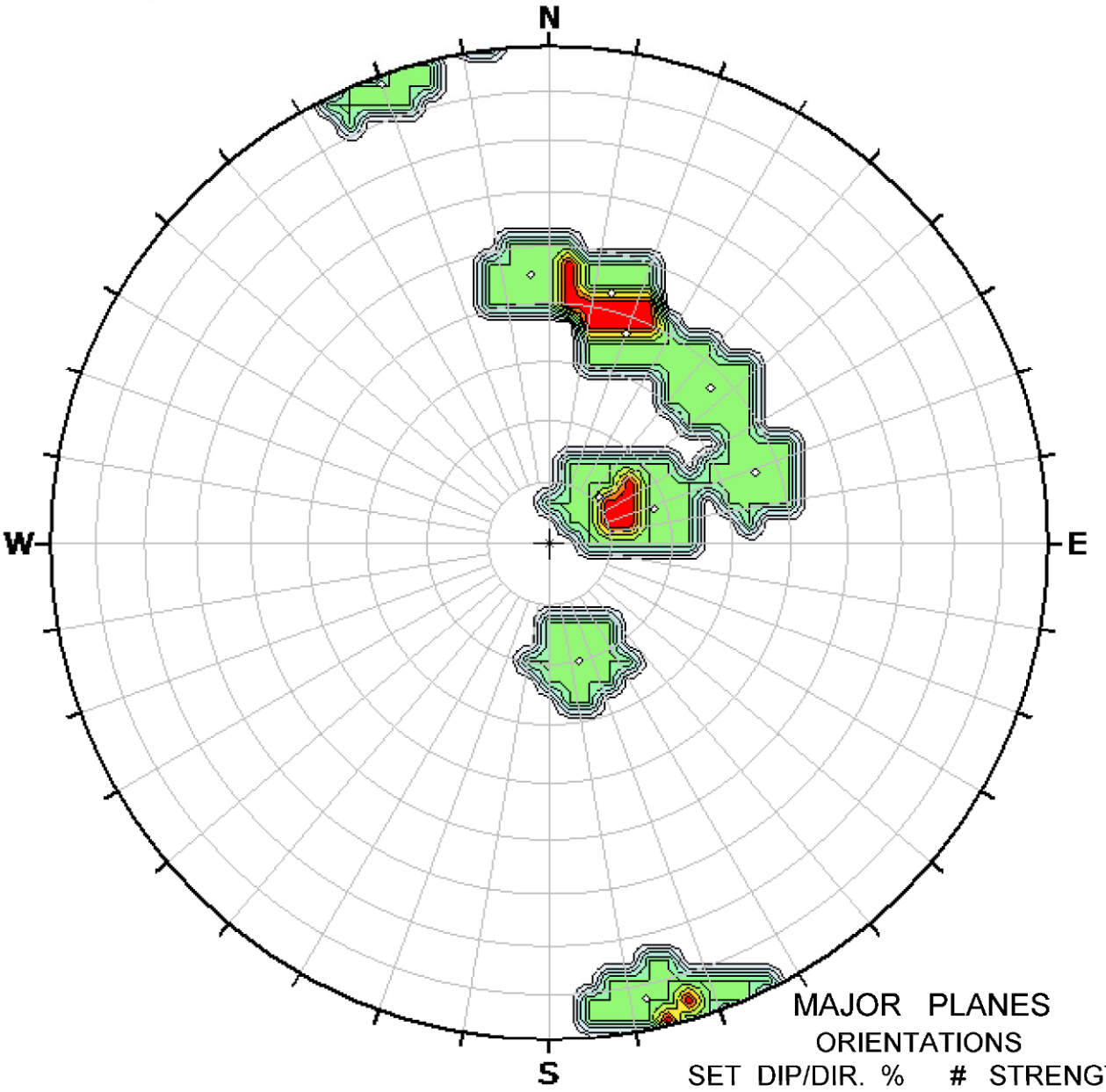
STRUCTURAL ANALYSIS OF JOINTS
SOUTHEAST DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A10

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/Southeast_FL.grf

EQUAL AREA
LOWER HEMISPHERE

10 Poles Plotted
10 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH

NO MODERATE OR STRONG PEAK FAULT CONCENTRATIONS WERE IDENTIFIED

CONTOUR LEGEND
SCHMIDT POLE CONCENTRATIONS
% of total per 1.0 % area

Minimum Contour	= 2.0
Contour Interval	= 2.0
Max.Concentration	= 20.00

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

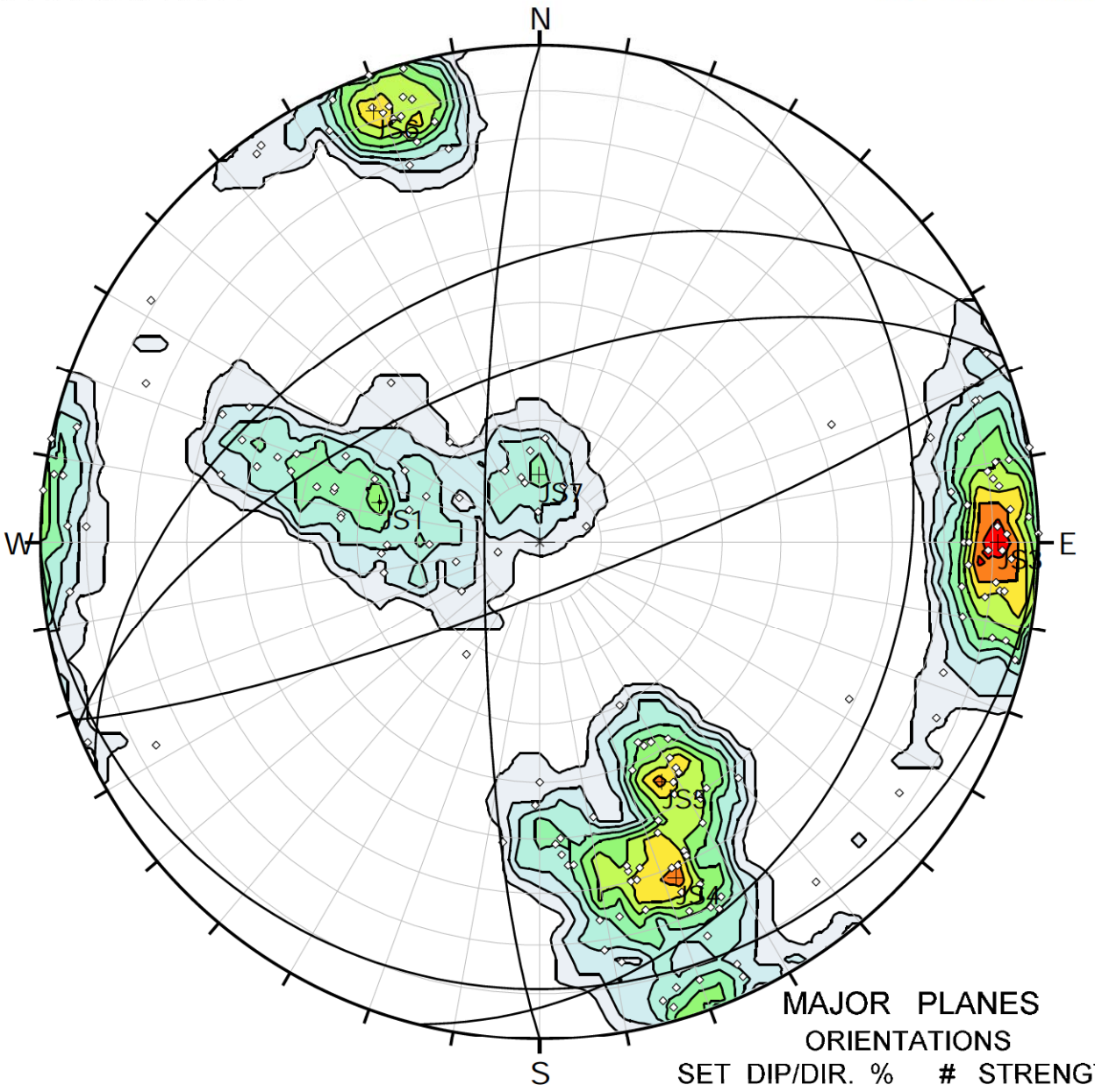
STRUCTURAL ANALYSIS OF FAULTS
SOUTHEAST DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A11

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/ADAM_Central_Combined_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

163 Poles Plotted
163 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1	27/104	5.5	9	M
JS3	81/270	10.4	17	S
JS4	62/338	8.5	14	S
JS5	45/333	8.0	13	S
JS6	82/159	7.5	12	S
JS7	11/179	4.5	7	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 10.43

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

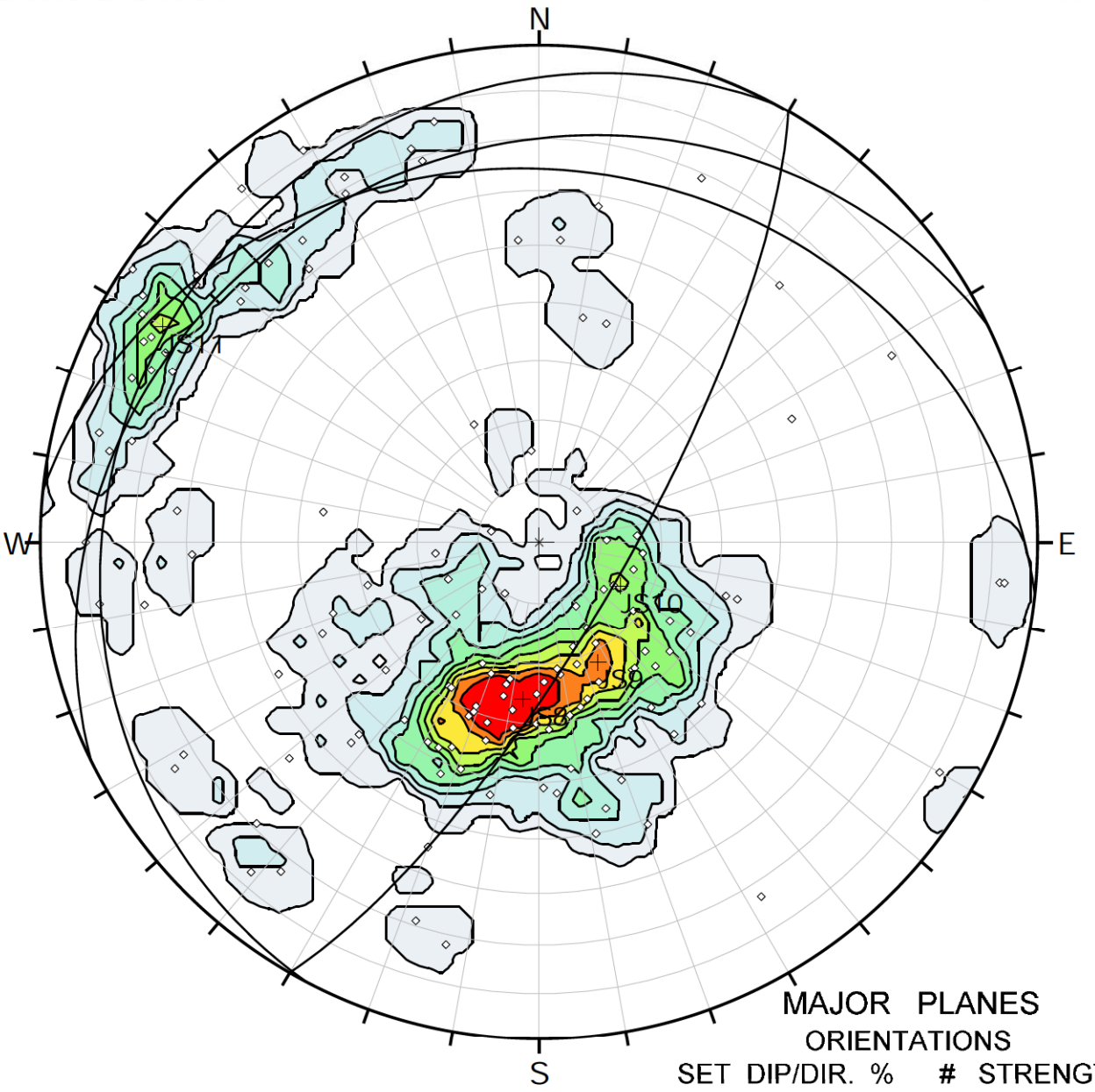
STRUCTURAL ANALYSIS OF JOINTS
CENTRAL DOMAIN
ADAMTECH PHOTOGRAMMETRY

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A12

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/Central_Combined_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

134 Poles Plotted
134 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS8	26/006	11.9	16	S
JS9	22/334	8.5	11	S
JS10	15/298	6.0	8	M
JS11	76/120	6.0	8	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 11.94

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

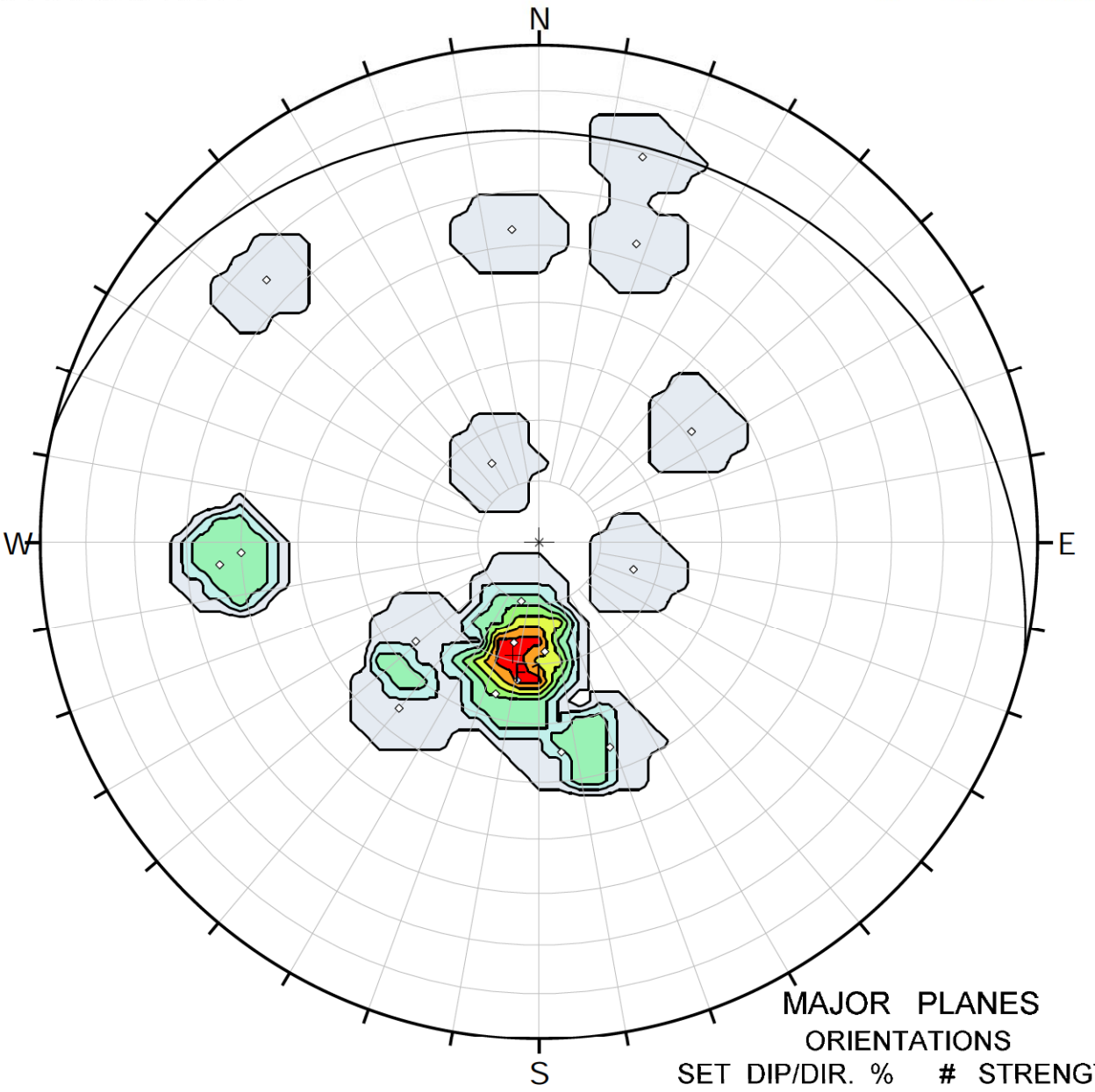
STRUCTURAL ANALYSIS OF JOINTS
CENTRAL DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A13

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/Central_Combined_FL.grf

EQUAL AREA
LOWER HEMISPHERE

18 Poles Plotted
18 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
F1	19/013	22.2	4	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 3.0
Contour Interval	= 3.0
Max.Concentration	= 22.22

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

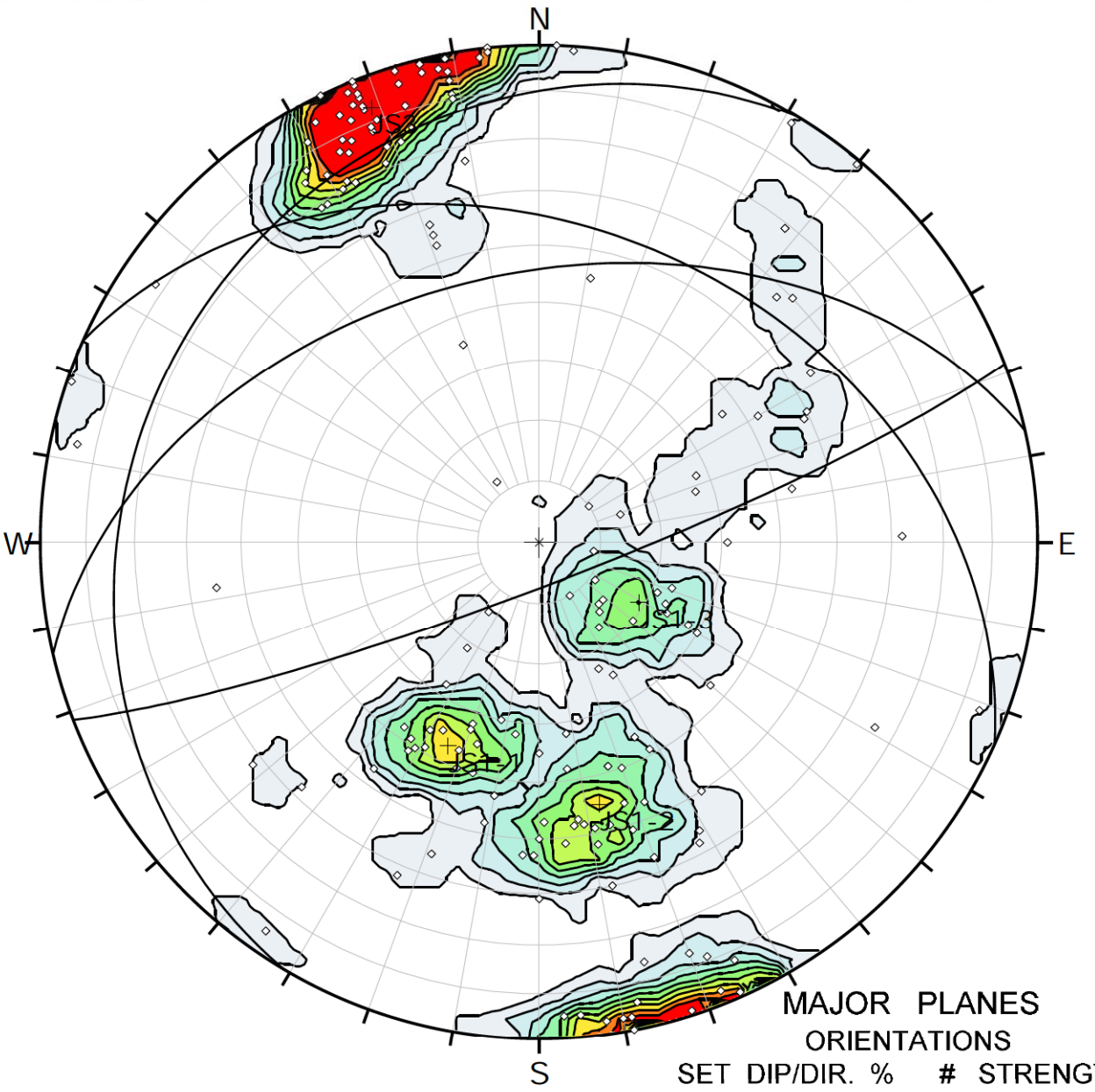
STRUCTURAL ANALYSIS OF FAULTS
CENTRAL DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A14

H:/Project/18846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/SIRO_ADAM_South_Combined_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

165 Poles Plotted
165 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1-1	37/024	8.0	13	M
JS1-2	45/347	7.5	12	M
JS1-3	19/301	5.5	9	M
JS3	83/159	13.9	23	S

CONTOUR LEGEND
SCHMIDT POLE CONCENTRATIONS
% of total per 1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 13.94

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

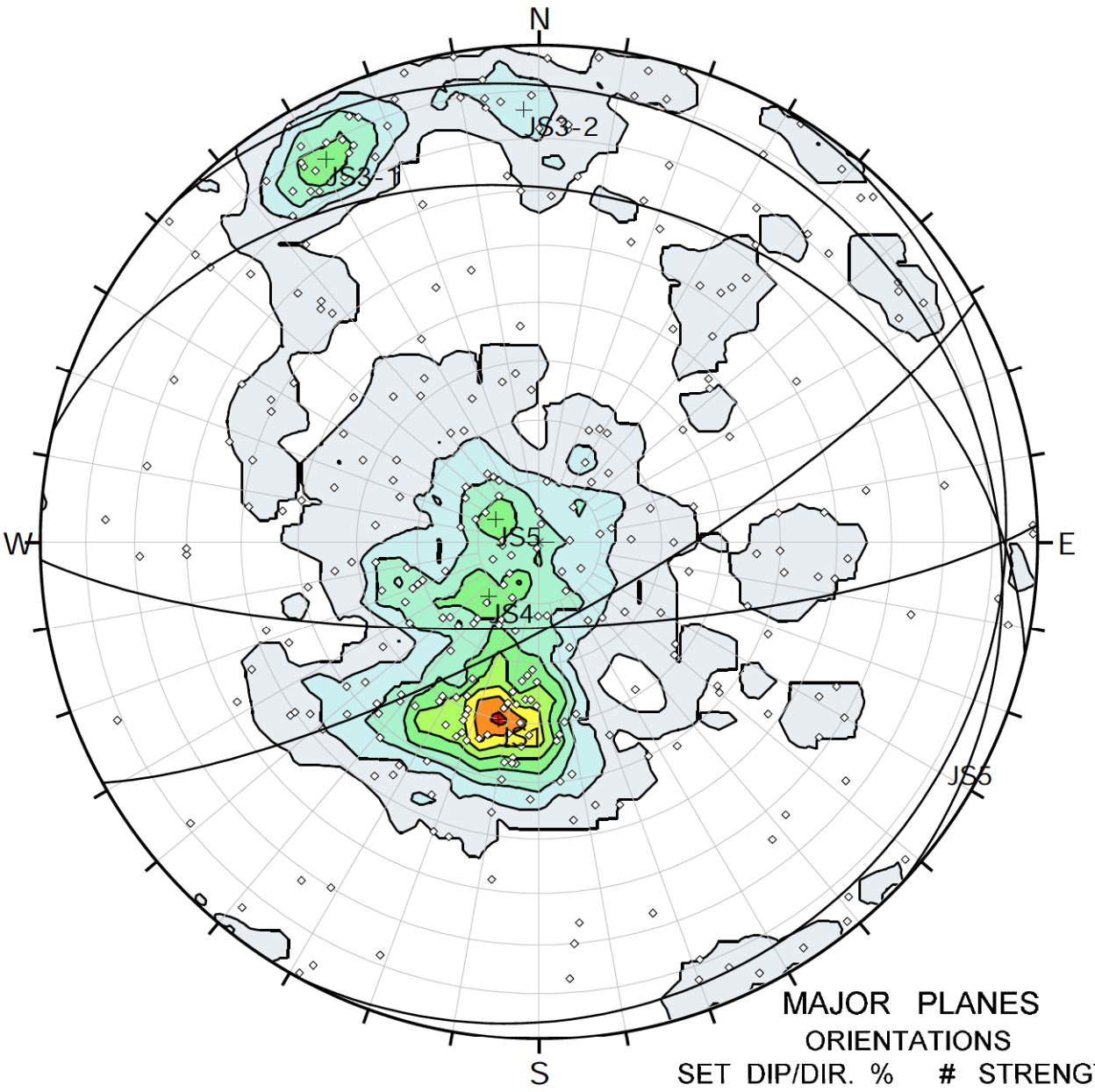
STRUCTURAL ANALYSIS OF JOINTS
SOUTH DOMAIN
COMBINED ADAMTECH AND SIROVISION PHOTOGRAMMETRY

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A15

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/South_Combined_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

309 Poles Plotted
309 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1	30/013	8.4	26	S
JS3-1	77/151	4.5	14	M
JS3-2	76/178	2.5	8	W
JS4	12/043	4.5	14	M
JS5	8/118	4.5	14	M

CONTOUR LEGEND
SCHMIDT POLE
CONCENTRATIONS
% of total per
1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 8.41

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

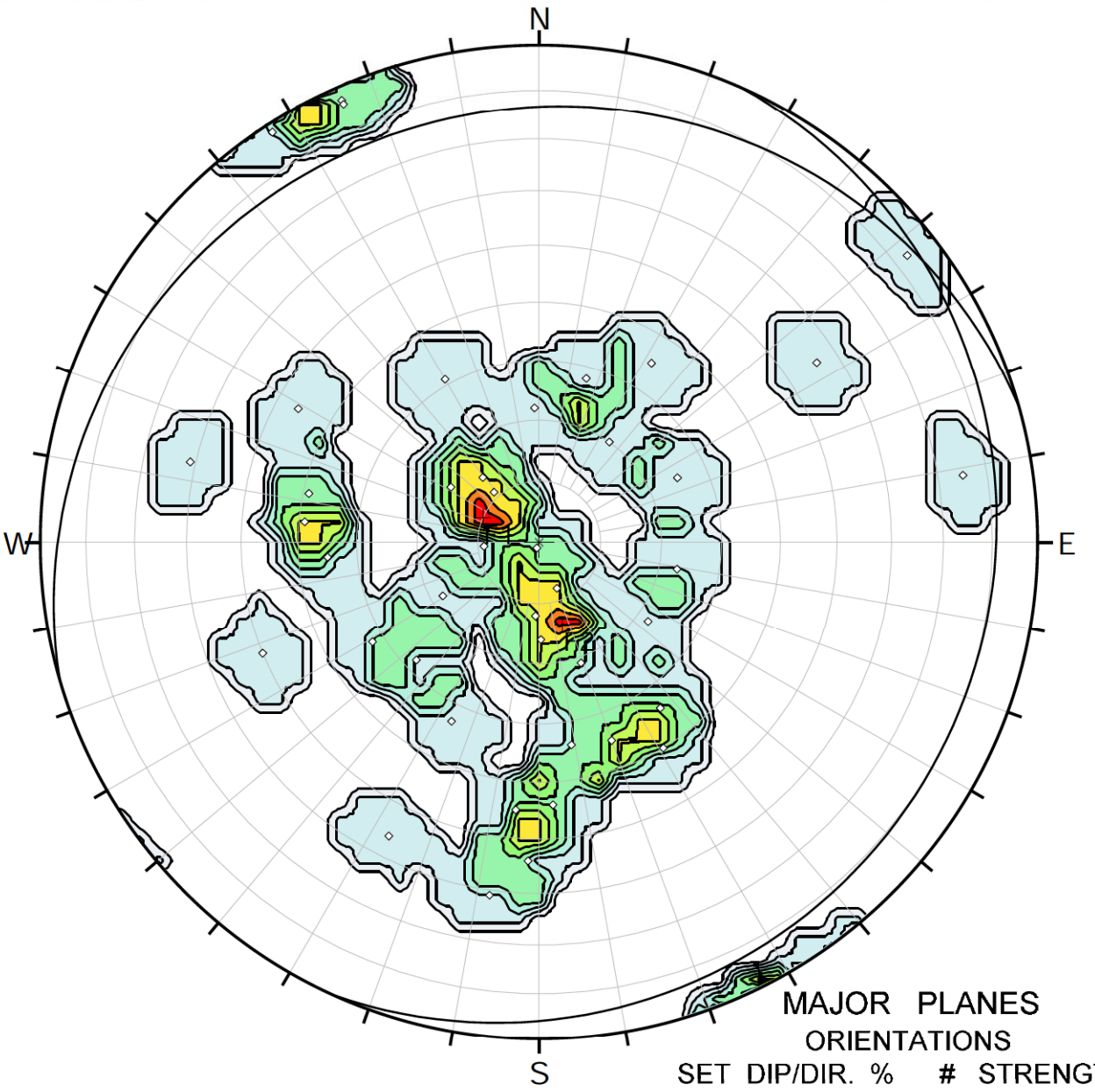
STRUCTURAL ANALYSIS OF JOINTS
SOUTH DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A16

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/South_Combined_FL.grf

EQUAL AREA
LOWER HEMISPHERE

42 Poles Plotted
42 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
F1	10/114	9.5	4	M
F2	14/344	9.5	4	M

CONTOUR LEGEND
SCHMIDT POLE CONCENTRATIONS
% of total per 1.0 % area

Minimum Contour	= 1.0
Contour Interval	= 1.0
Max.Concentration	= 9.52

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

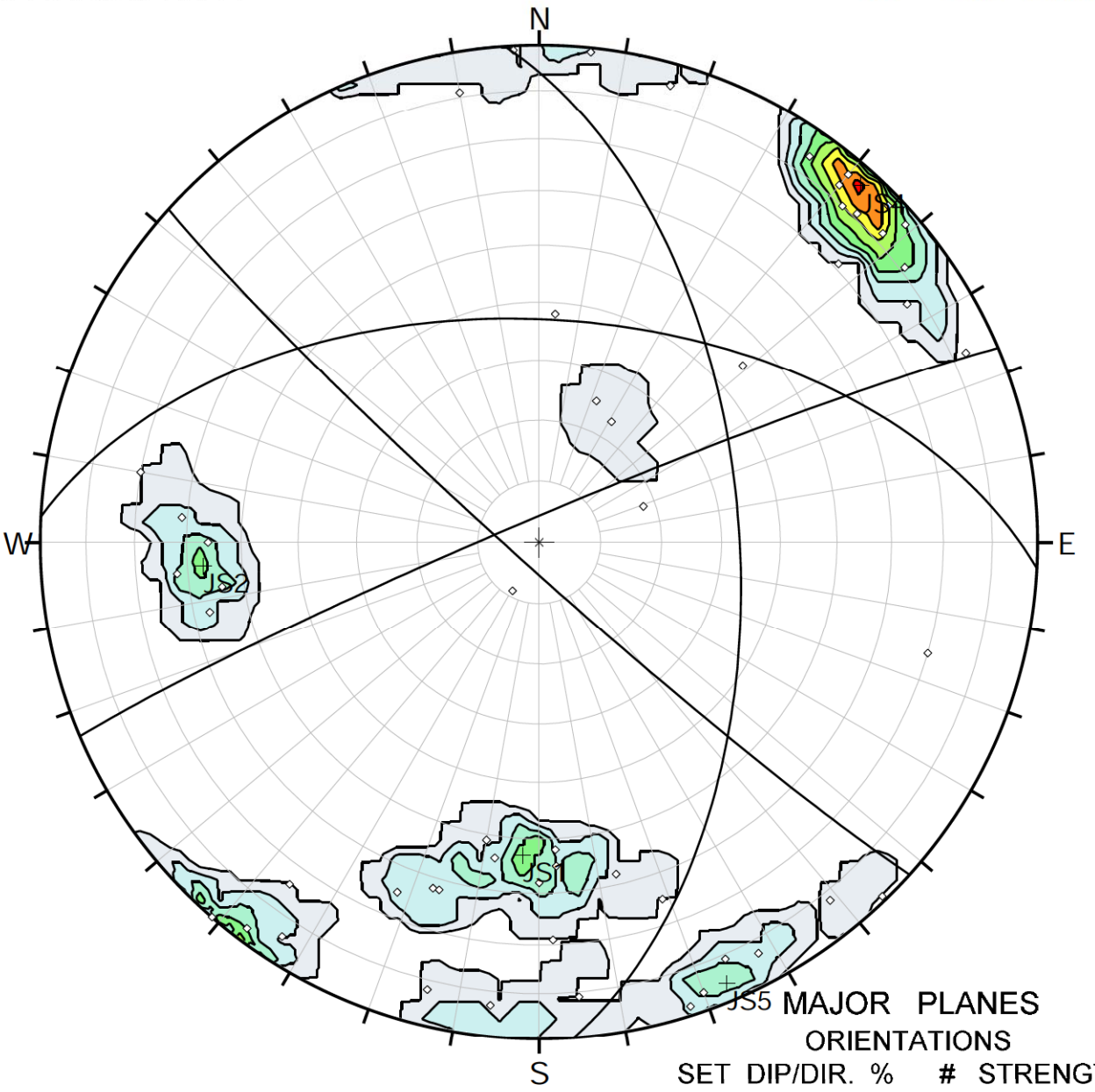
STRUCTURAL ANALYSIS OF FAULTS
SOUTH DOMAIN
ORIENTED CORE

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A17

H:/Project/1846/2015-06 slope design updates/Structure/DIPS/Grapher_Nets/SIRO_ADAM_West_JN+FO.grf

EQUAL AREA
LOWER HEMISPHERE

53 Poles Plotted
53 Data Entries



MAJOR PLANES
ORIENTATIONS

SET	DIP/DIR.	%	#	STRENGTH
JS1	53/003	9.0	5	M
JS2	57/086	9.0	5	M
JS4	86/222	17.0	9	S
JS5	86/337	7.0	4	M

CONTOUR LEGEND
SCHMIDT POLE CONCENTRATIONS
% of total per 1.0 % area

Minimum Contour	= 2.0
Contour Interval	= 2.0
Max.Concentration	= 16.98

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

STRUCTURAL ANALYSIS OF JOINTS
WEST DOMAIN
COMBINED ADAMTECH AND SIROVISION PHOTOGRAMMETRY

BY:	DATE:
RS	JAN 16
APPROVED:	FIG:
GG	A18

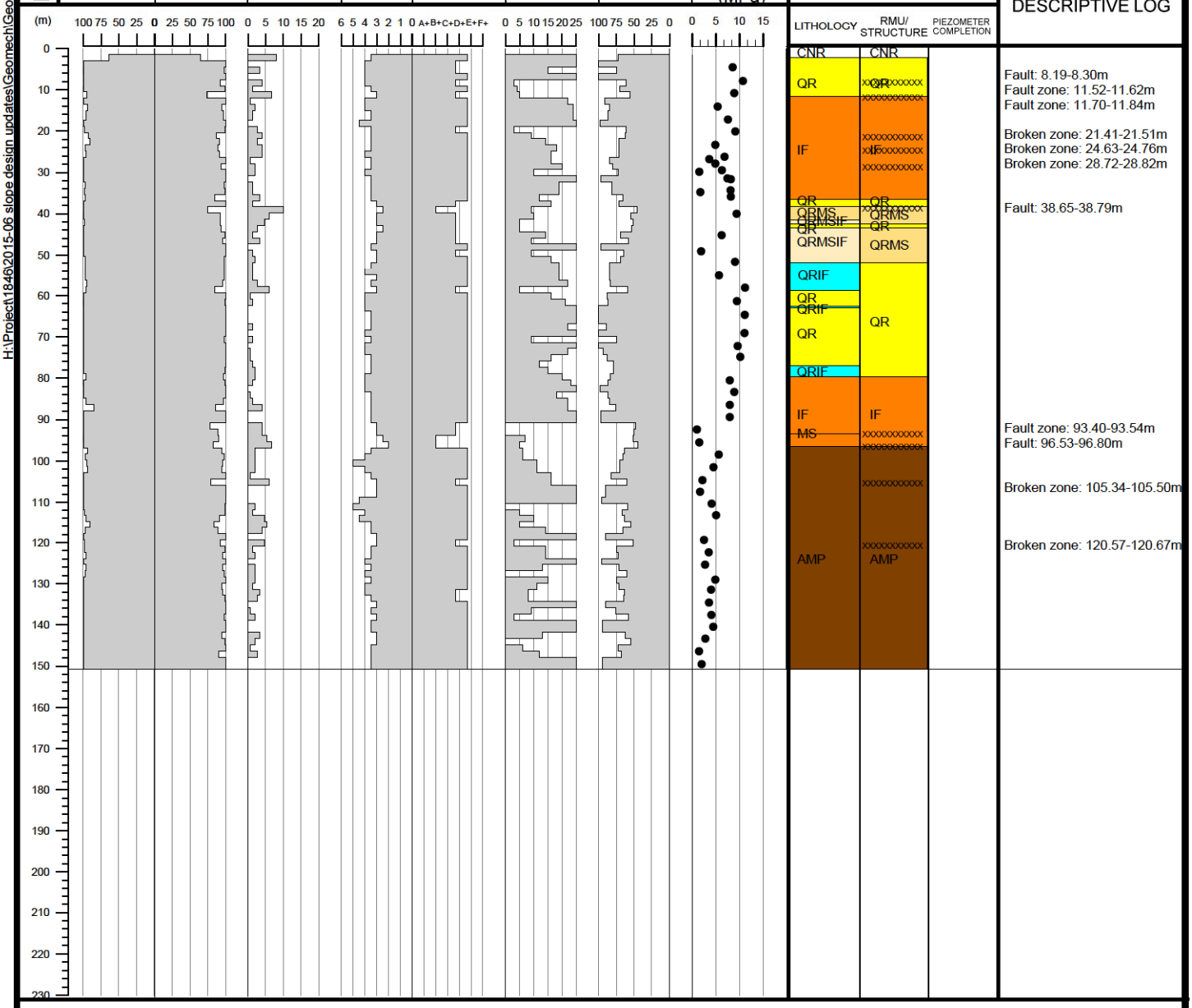
APPENDIX B

GEOTECHNICAL CORE LOGS FOR 2015 GEOTECHNICAL DRILLHOLES

H:\Project\1846\2015-06 slope design updates\Geomech\Geomech Logs\GT15-I001.grf

GEOMECHANICAL LOG: GT15-I001

Coordinates: N 5846311.3 E 608188 Collar Elevation: 699.9m Depth: 150.8m Azimuth: 199.7° Dip: -69.5°



EOH 150.8m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
XX STRUCTURE

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

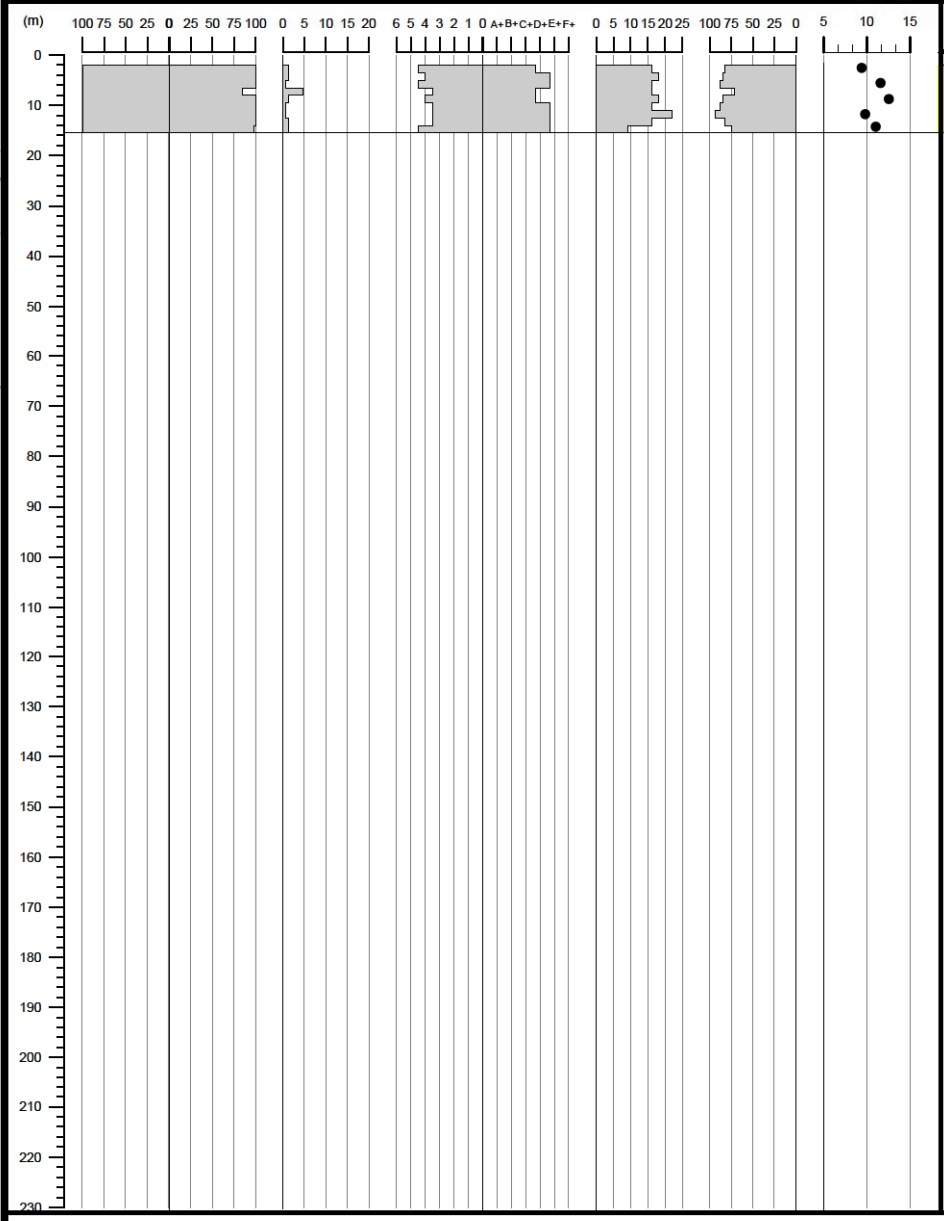
GEOMECHANICAL CORE LOG: GT15-I001

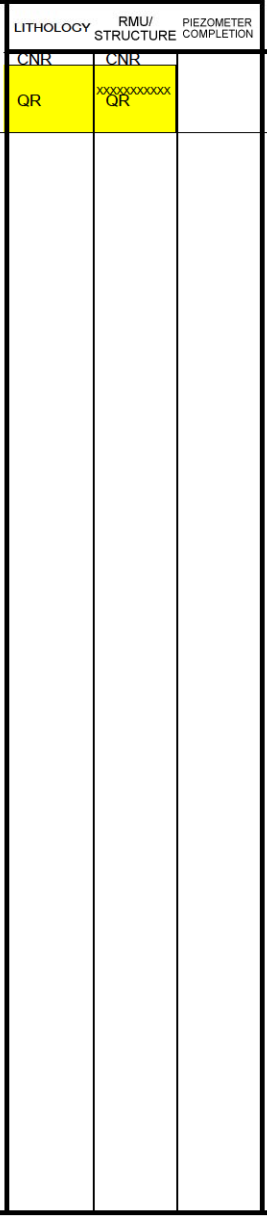
BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B1

H:\Project\1846\2015-06 slope design updates\Geomech\Geomech Logs\GT15-I002.grf

GEOMECHANICAL LOG: GT15-I002

Coordinates: N 5846220.4 E 608157.8 Collar Elevation: 713.5m Depth: 15.5m Azimuth: 322.8° Dip: -43.4°





DESCRIPTIVE LOG

Broken zone: 7.04-7.27m

EOH 15.5m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
XX STRUCTURE

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

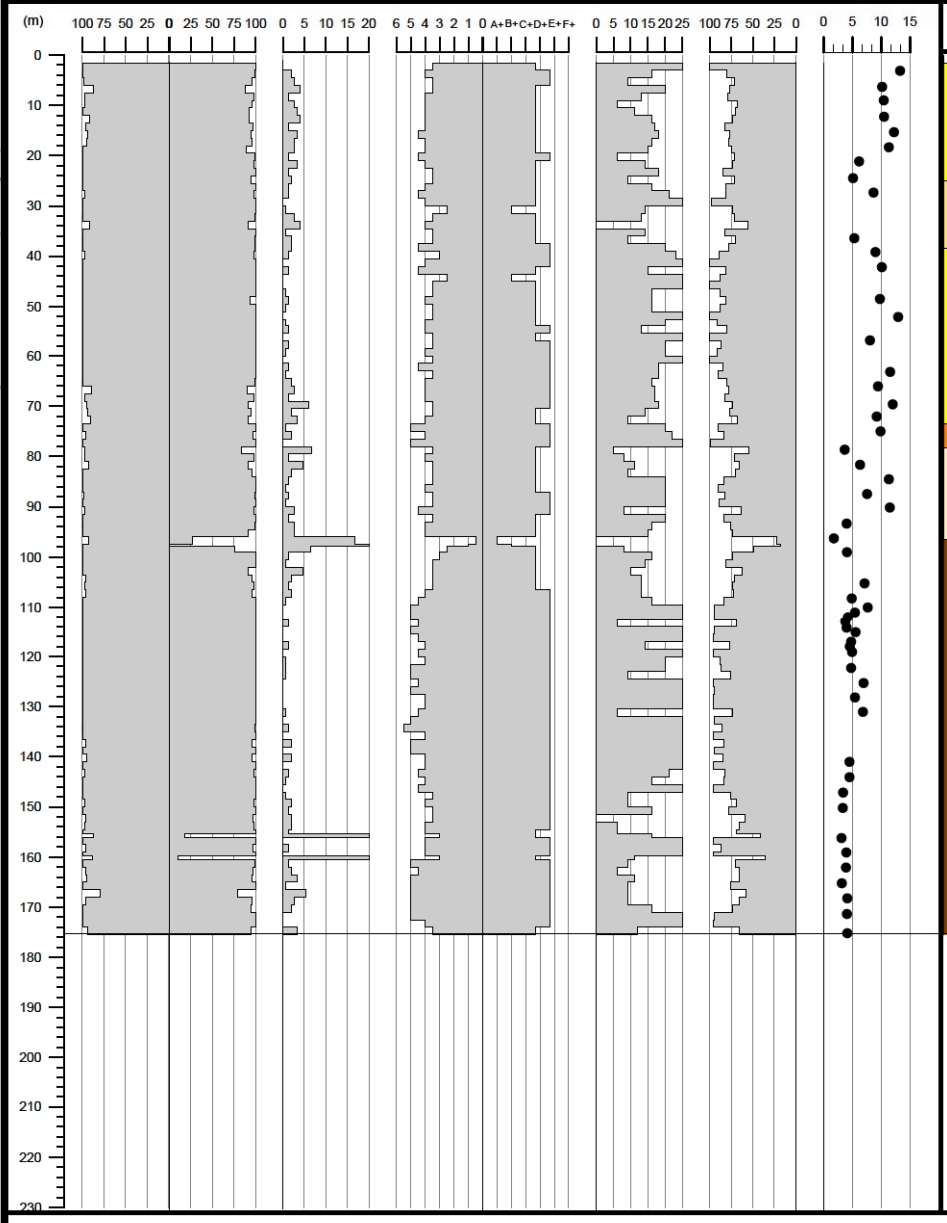
GEOMECHANICAL CORE LOG: GT15-I002

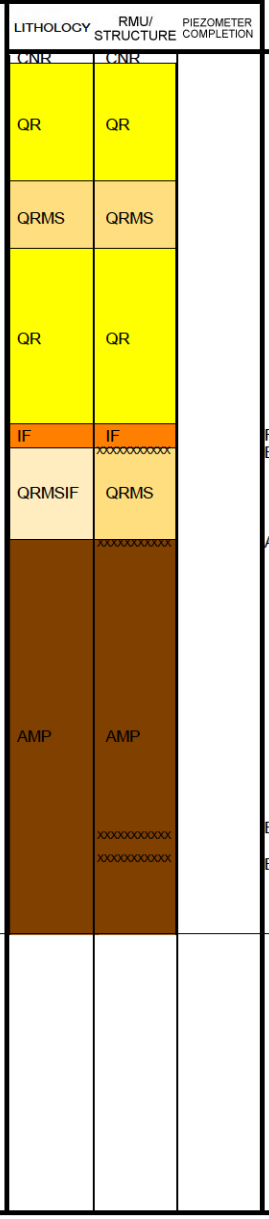
BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B2

H:\Project\1846\2015-06 slope design updates\Geomech\Geomech Logs\GT15-I002A.grf

GEOMECHANICAL LOG: GT15-I002A

Coordinates: N 5846220.4 E 608157.8 Collar Elevation: 713.5m Depth: 175.5m Azimuth: 322.8° Dip: -43.4°





DESCRIPTIVE LOG

Fault: 78.31-78.34m
Broken zone: 78.96-79.10m

Altered zone: 96.50-97.90m

Broken zone: 155.35-155.87m

Broken zone: 159.88-160.50m

EOH 175.5m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
XX STRUCTURE

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

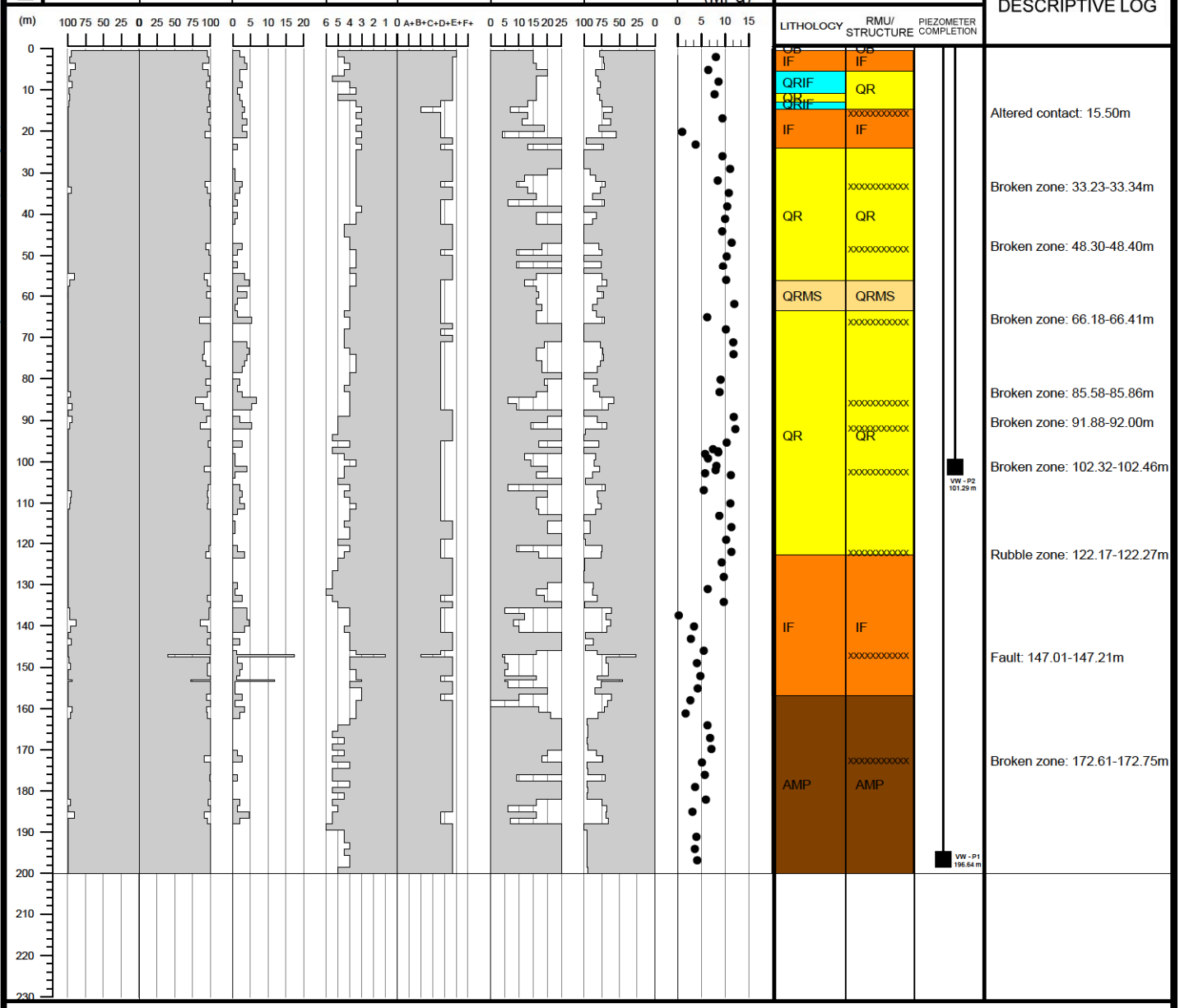
GEOMECHANICAL CORE LOG: GT15-I002A

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B3

H:\Project\1846\2015-06 slope design updates\Geomech\Geomech Logs\GT15-I003.grf

GEOMECHANICAL LOG: GT15-I003

Coordinates: N 5846132.7 E 608127.5 Collar Elevation: 767.8m Depth: 200m Azimuth: 24.4° Dip: -61°



EOH 200m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
XX STRUCTURE

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

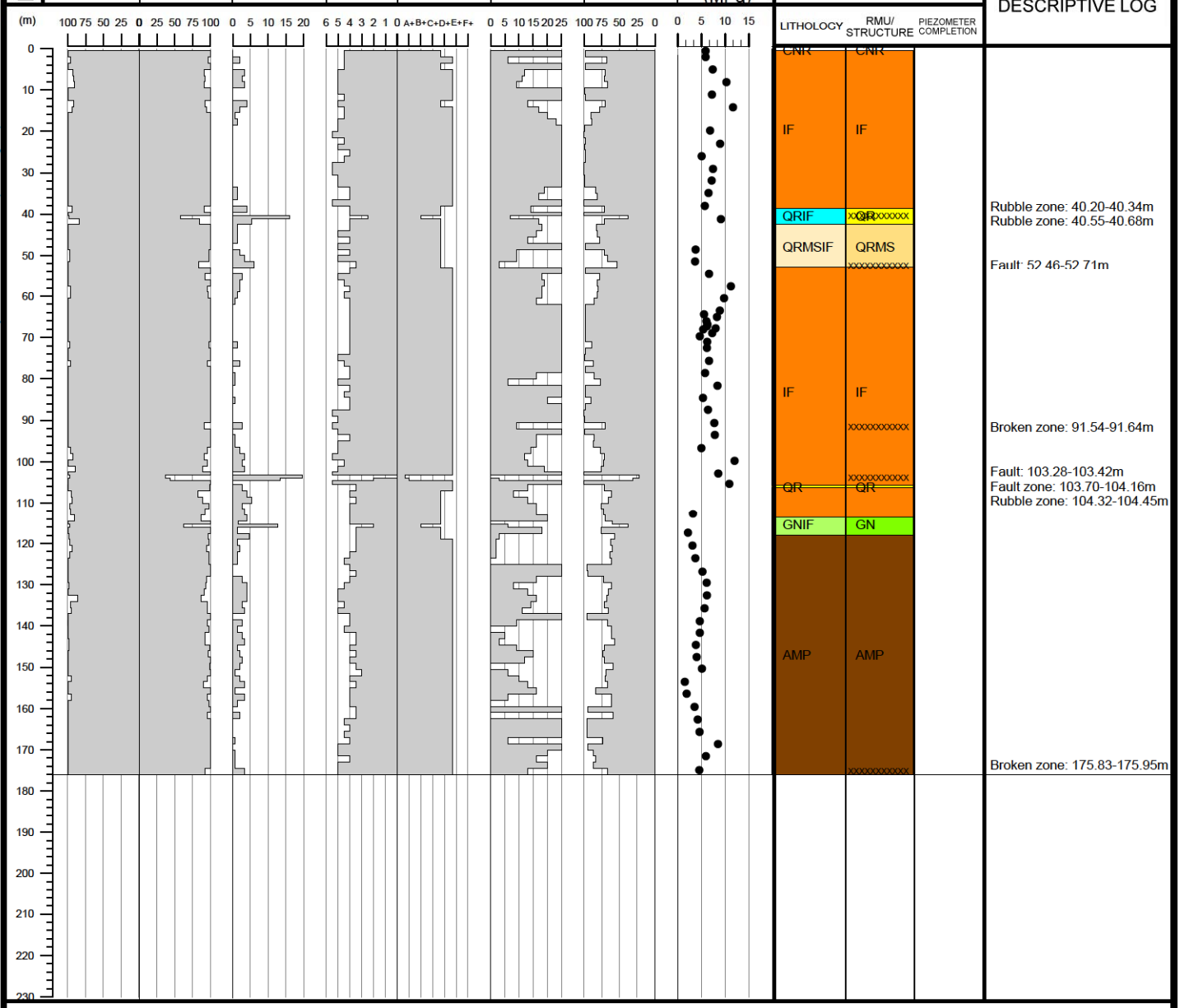
GEOMECHANICAL CORE LOG: GT15-I003

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B4

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GEOMECHANICAL LOG: GT15-I004

Coordinates: N 5846255.2 E 608250.1 Collar Elevation: 700.6m Depth: 176m Azimuth: 208.8° Dip: -66.4°



EOH 176m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
XX STRUCTURE

PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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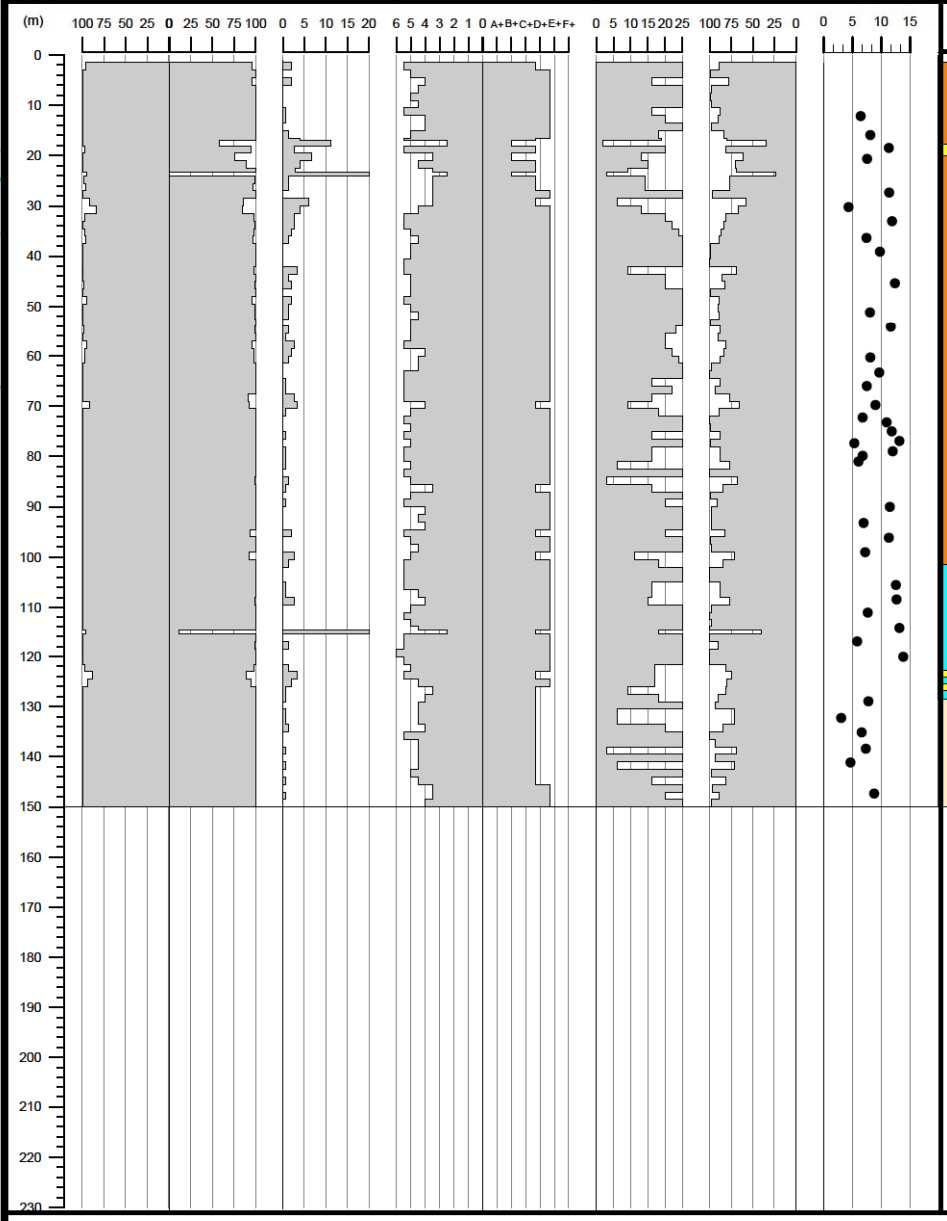
GEOMECHANICAL CORE LOG: GT15-I004

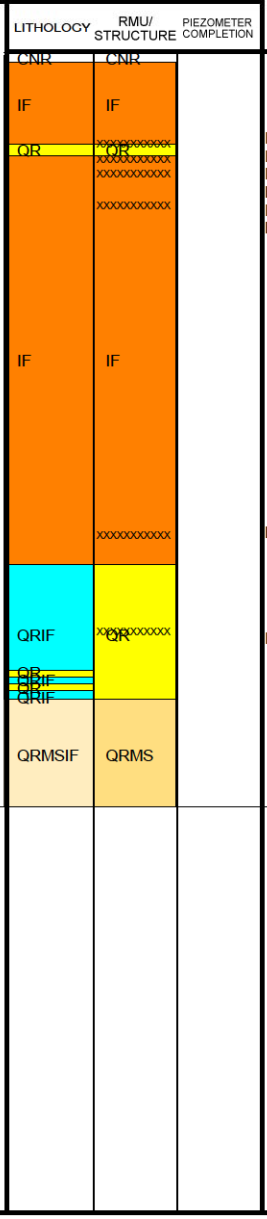
BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B5

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GEOMECHANICAL LOG: GT15-I005

Coordinates: N 5846254 E 608257.4 Collar Elevation: 700.6m Depth: 150m Azimuth: 32.2° Dip: -44.5°





DESCRIPTIVE LOG

Fault zone: 17.26-17.51m
Fault zone: 17.73-17.90m
Rubble zone: 20.10-20.31m
Broken zone: 20.75-20.90m
Rubble zone: 23.24-24.00m
Broken zone: 29.77-29.87m

Broken zone: 95.54-95.64m

Fractured zone: 114.68-115.5m

EOH 150m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
XX STRUCTURE

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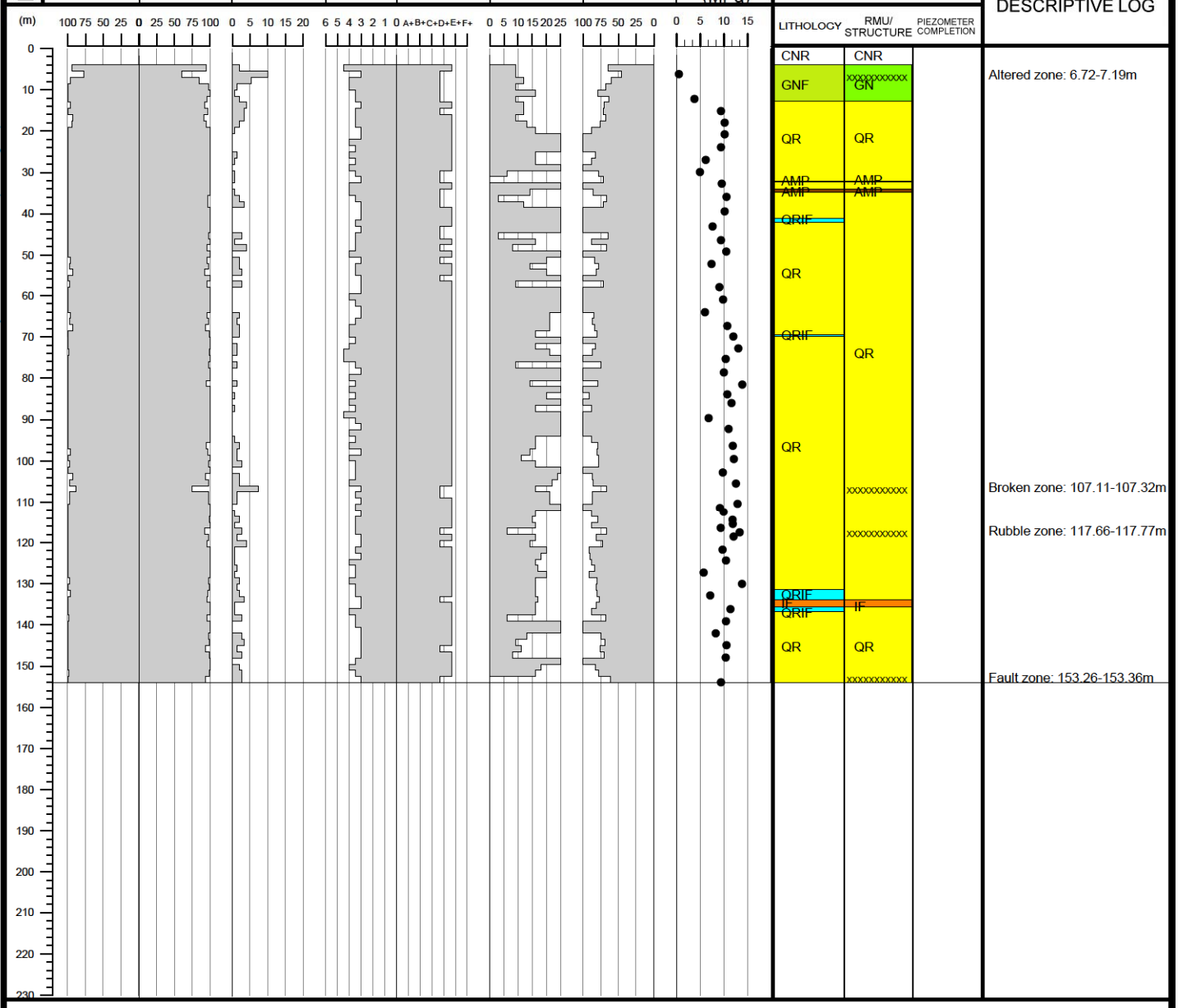
GEOMECHANICAL CORE LOG: GT15-I005

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B6

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GEOMECHANICAL LOG: GT15-I006

Coordinates: N 5846310.1 E 608449.8 Collar Elevation: 755.1m Depth: 154m Azimuth: 104.3° Dip: -75.3°



EOH 154m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

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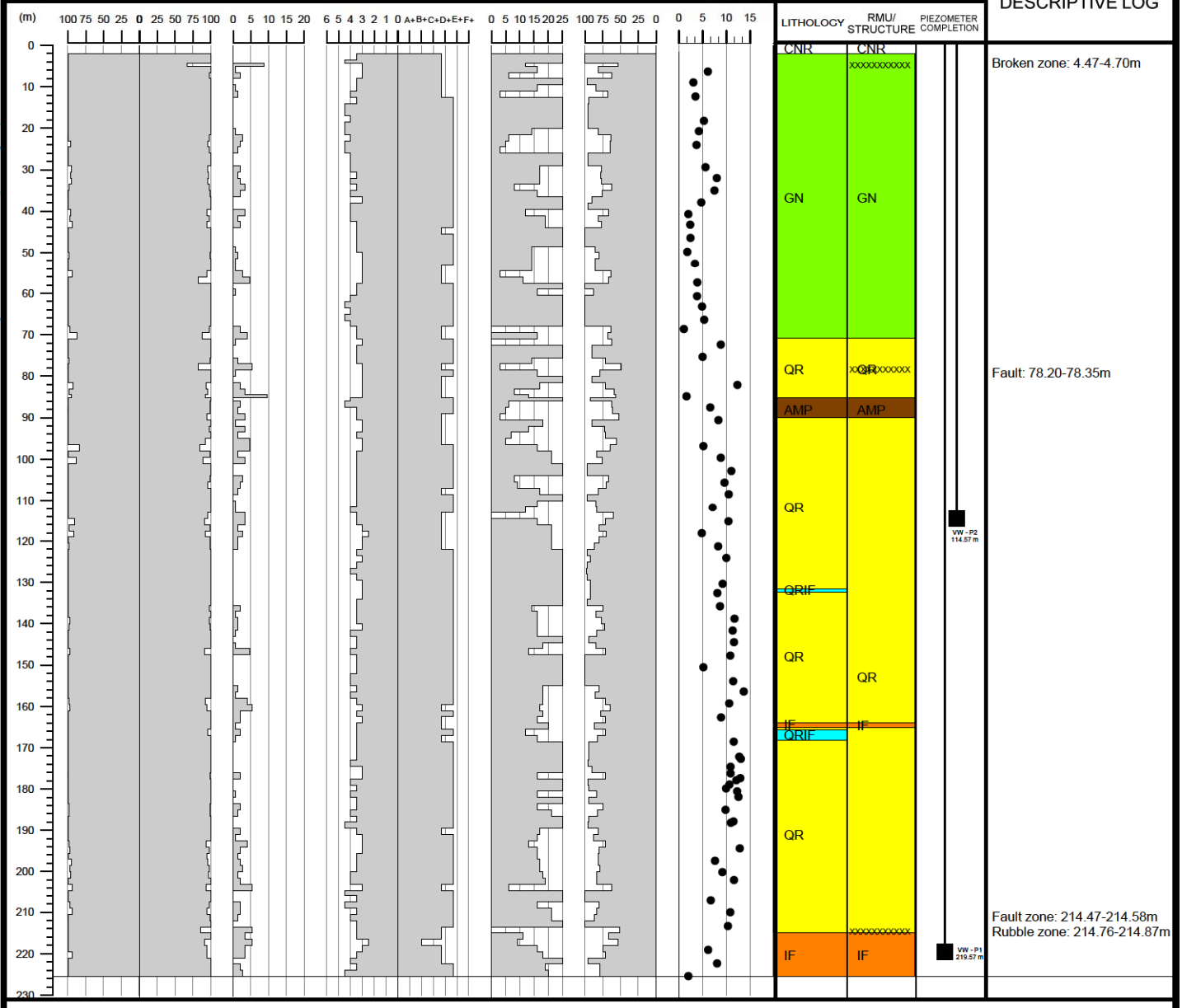
GEOMECHANICAL CORE LOG: GT15-I006

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B7

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GEOMECHANICAL LOG: GT15-I007

Coordinates: N 5846239.4 E 608525.2 Collar Elevation: 774.2m Depth: 225.5m Azimuth: 298.7° Dip: -59.6°



EOH 225.5m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
XX STRUCTURE

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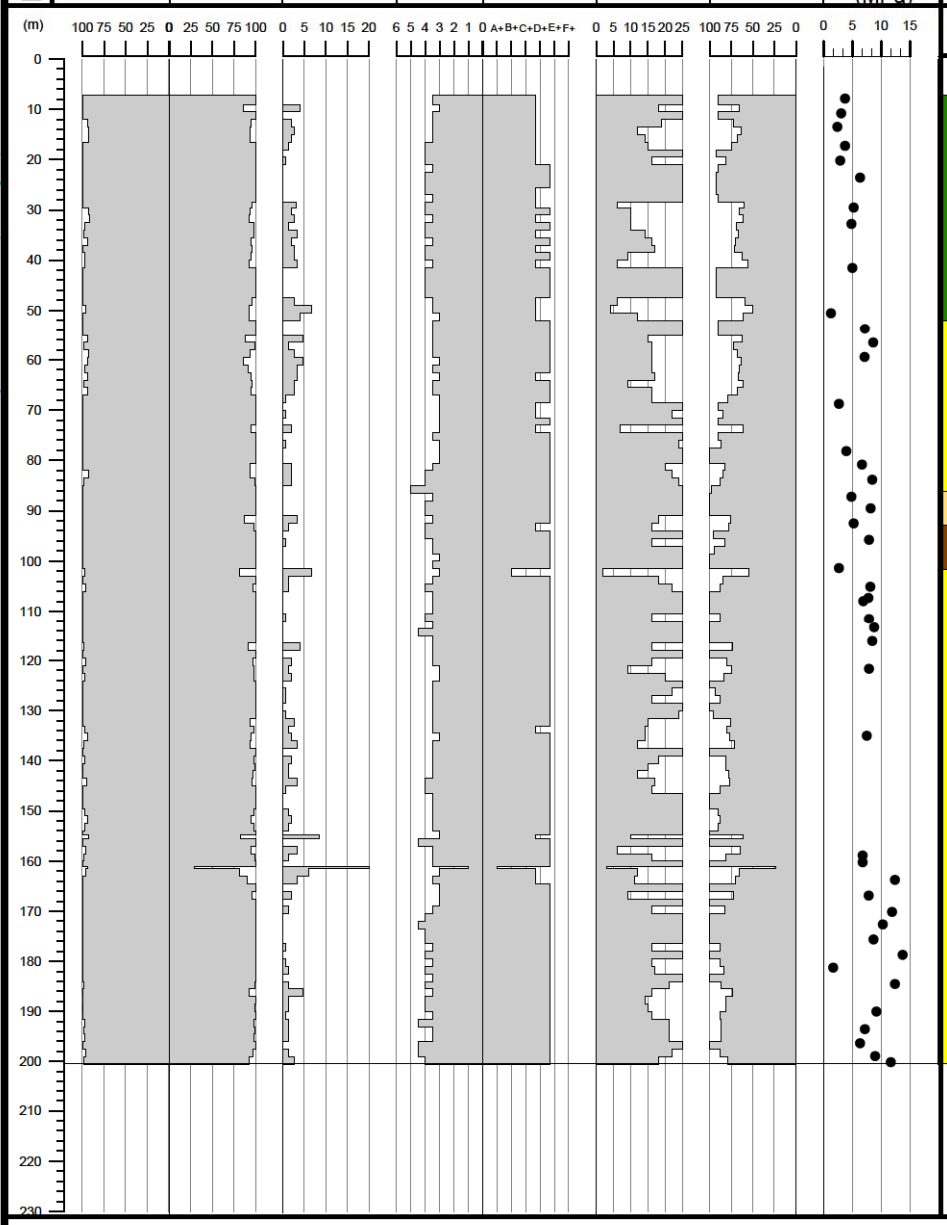
GEOMECHANICAL CORE LOG: GT15-I007

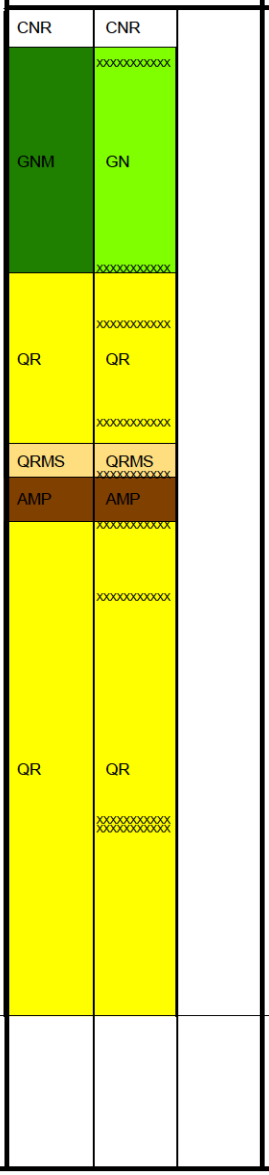
BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B8

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GEOMECHANICAL LOG: GT15-I008

Coordinates: N 5846376.5 E 608599.1 Collar Elevation: 775.8m Depth: 200.5m Azimuth: 303.1° Dip: -64.7°





DESCRIPTIVE LOG

- Broken zone: 10.15-10.37m
- Broken zone: 51.20-51.32m
- Broken zone: 62.33-62.43m
- Broken zone: 81.88-81.98m
- Broken zone: 92.24-92.44m
- Fault: 101.67m
  Shear: 101.72m
  Fault: 102.69-102.89m
- Broken zone: 116.78-116.90m
- Rubble zone: 161.20-161.45m
  Broken zone: 162.78-163.15m

EOH 200.5m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
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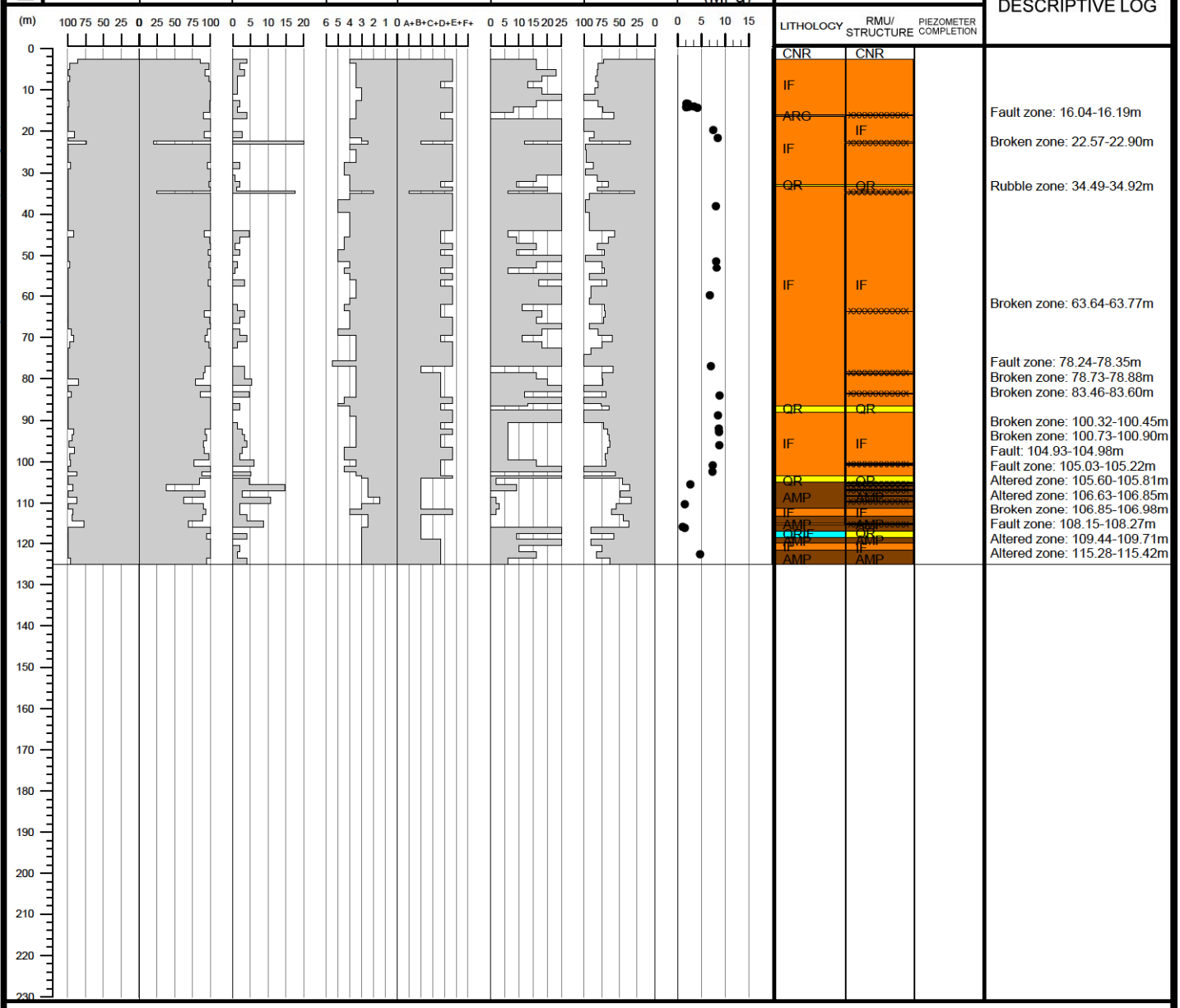
GEOMECHANICAL CORE LOG: GT15-I008

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B9

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GEOMECHANICAL LOG: GT15-I009

Coordinates: N 5846490 E 608644 Collar Elevation: 742.2m Depth: 125m Azimuth: 326.4° Dip: -58.4°



EOH 125m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

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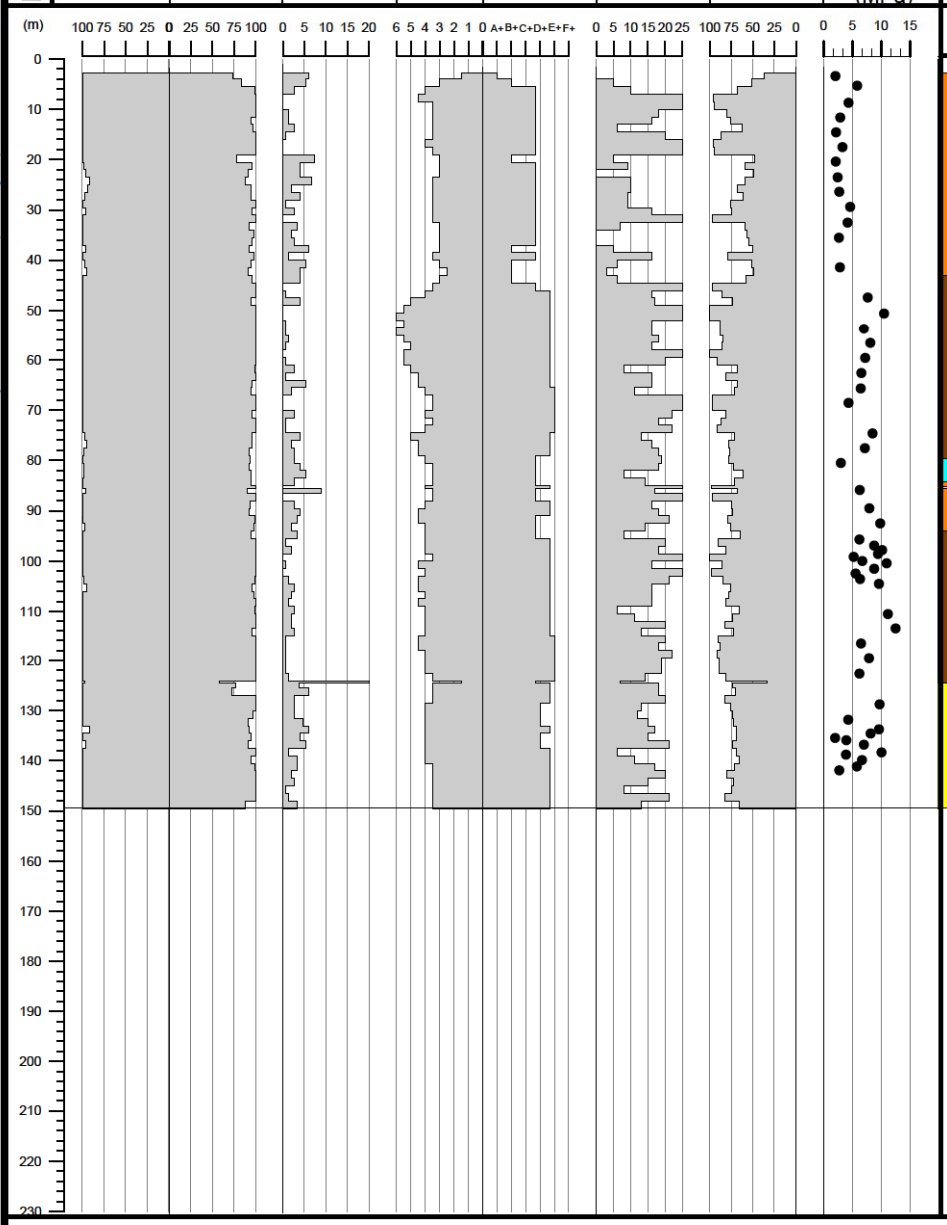
GEOMECHANICAL CORE LOG: GT15-I009

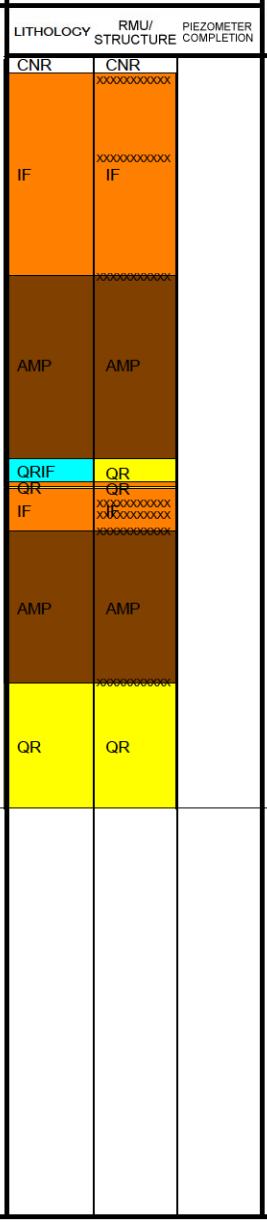
BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B10

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GEOMECHANICAL LOG: GT15-I010

Coordinates: N 5846700.2 E 608475.2 Collar Elevation: 686.2m Depth: 149.5m Azimuth: 40° Dip: -56°





DESCRIPTIVE LOG

Fault zone: 3.60-4.00m
Fault: 4.41-4.56m

Fault: 19.40-19.53m
Fault: 19.96-20.09m

Shear: 43.10m
Fault: 43.10-43.17m

Broken zone: 88.51-88.61m
Broken zone: 90.84-90.96m
Fault: 94.00-94.09m

Fault zone: 124.27-124.45m

EOH 149.5m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
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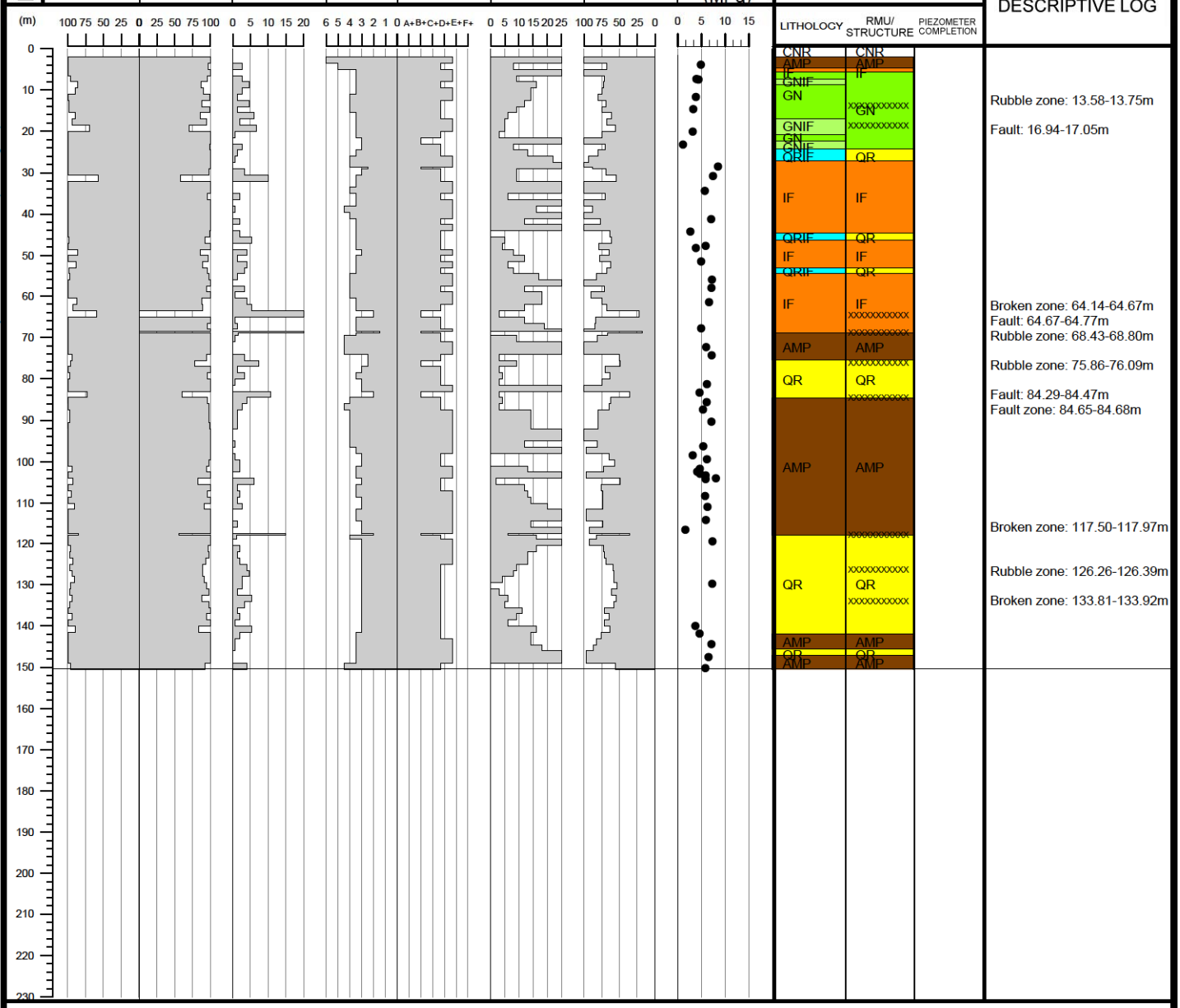
GEOMECHANICAL CORE LOG: GT15-I010

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B11

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GEOMECHANICAL LOG: GT15-I011

Coordinates: N 5846742.6 E 608335.9 Collar Elevation: 686.1m Depth: 150.5m Azimuth: 16.4° Dip: -54.8°



EOH 150.5m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
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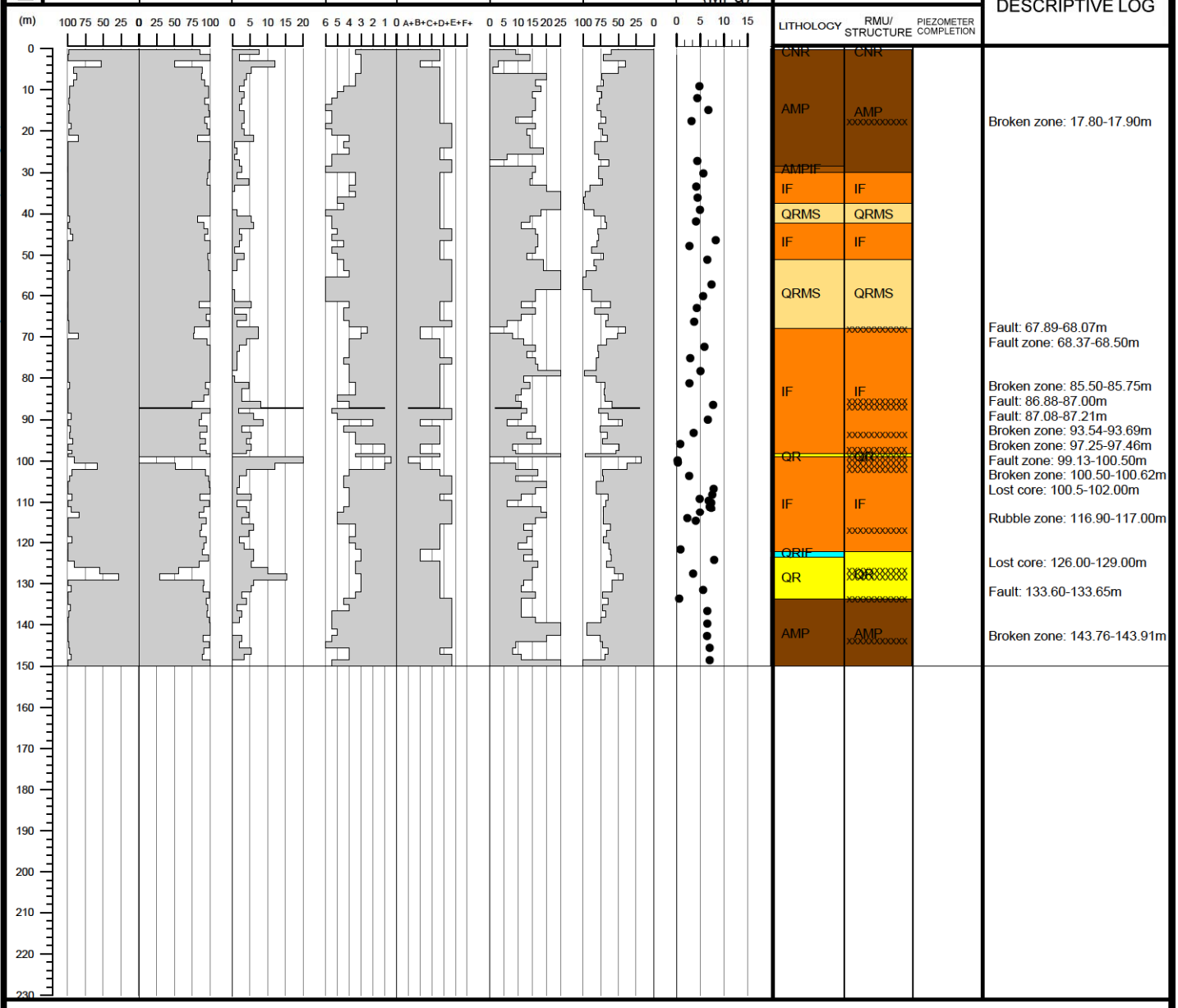
GEOMECHANICAL CORE LOG: GT15-I011

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B12

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GEOMECHANICAL LOG: GT15-I012

Coordinates: N 5846703.1 E 608245.8 Collar Elevation: 685.9m Depth: 150m Azimuth: 349.5° Dip: -62.3°



EOH 150m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

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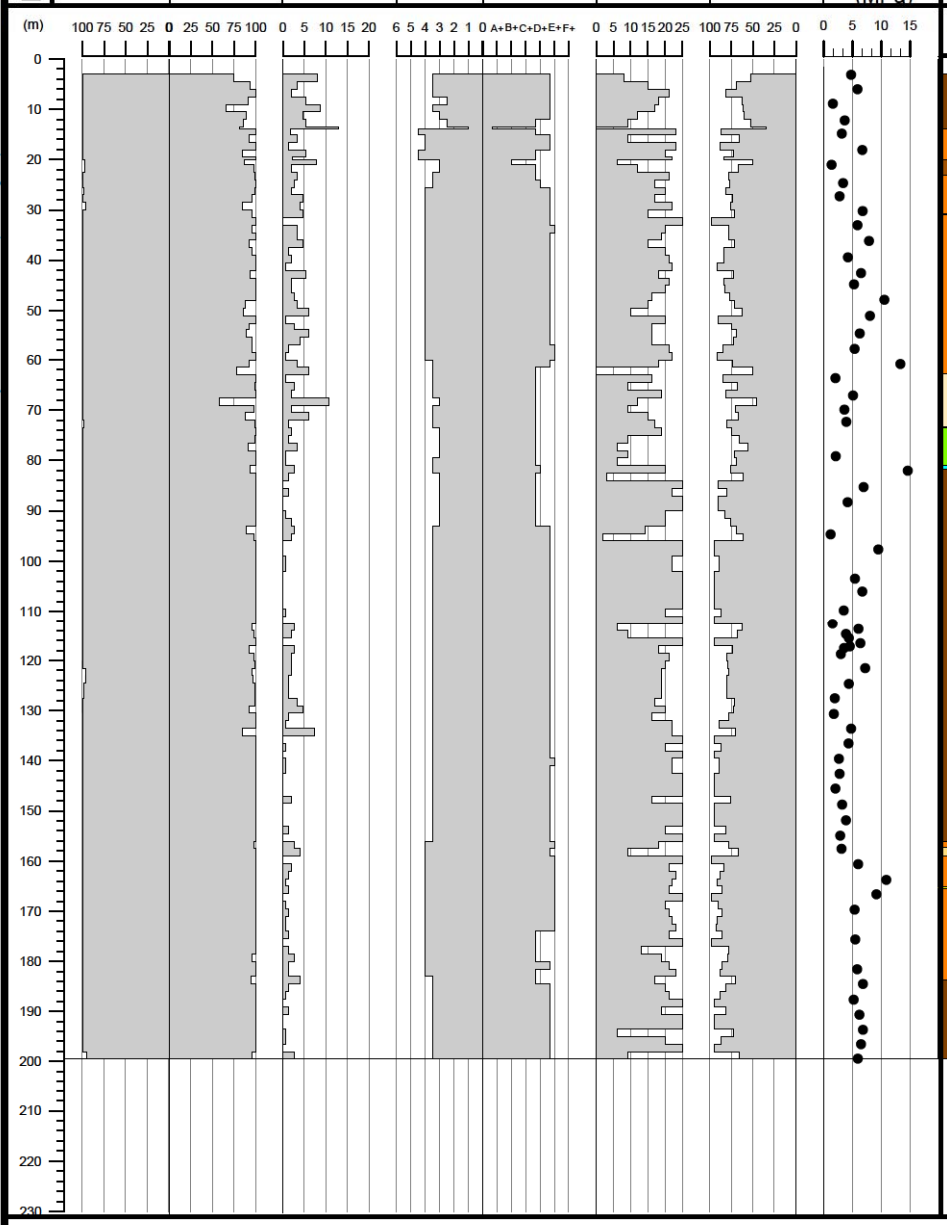
GEOMECHANICAL CORE LOG: GT15-I012

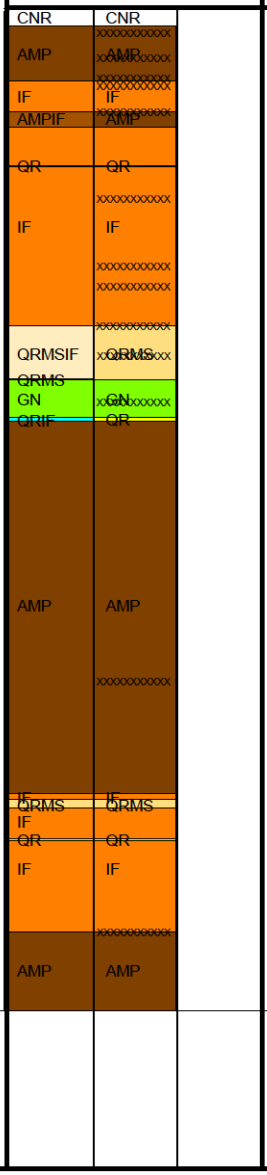
BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B13

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GEOMECHANICAL LOG: GT15-I013

Coordinates: N 5846621 E 608300.1 Collar Elevation: 685.9m Depth: 199.5m Azimuth: 22° Dip: -59.9°





DESCRIPTIVE LOG

Broken zone: 2.98-3.12m
Broken zone: 4.33-4.50m
Broken zone: 4.46-4.56m
Broken zone: 9.22-9.41m
Broken zone: 13.24-13.37m
Fault zone: 13.67-13.73m
Broken zone: 14.95-15.06m
Broken zone: 20.05-20.17m
Broken zone: 37.34-37.46m
Broken zone: 50.65-50.87m
Broken zone: 54.87-54.98m
Fault zone: 62.60-62.93m
Broken zone: 68.51-68.96m
Broken zone: 77.83-77.96m
Broken zone: 133.60-133.77m
Fault: 183.71-183.76m

EOH 199.5m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

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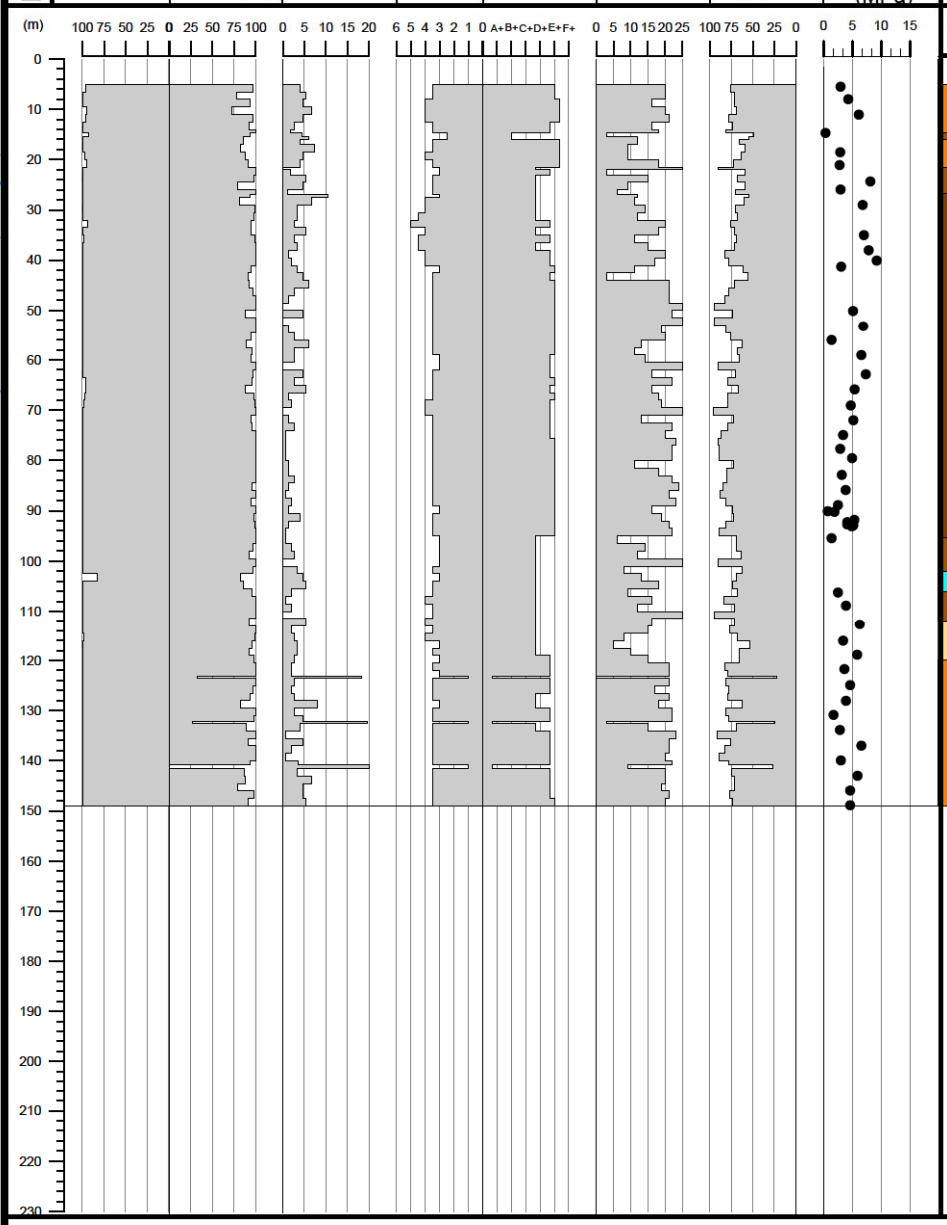
GEOMECHANICAL CORE LOG: GT15-I013

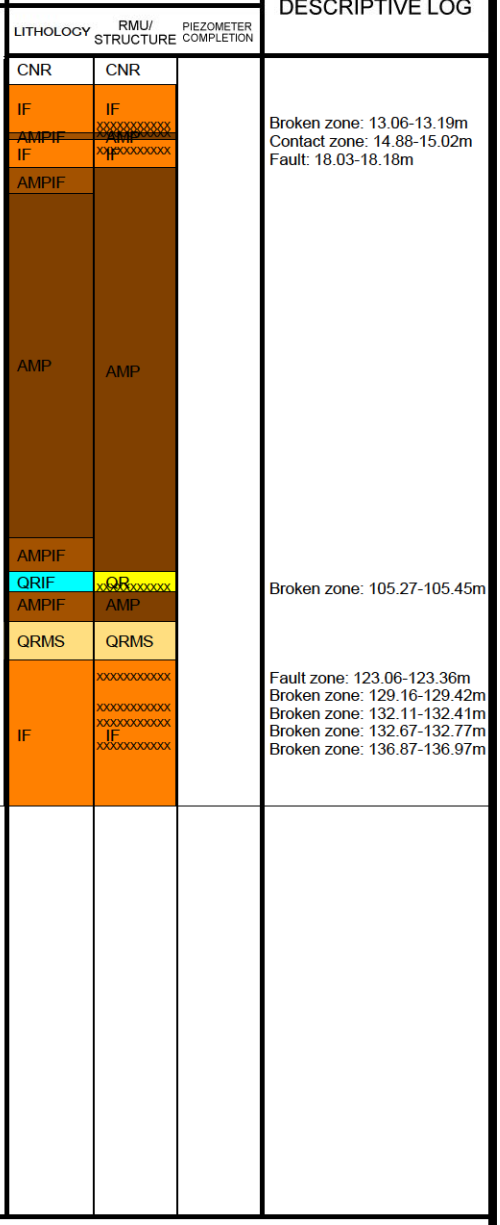
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JL	OCT 15
APPROVED:	FIG:
GG	B14

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GEOMECHANICAL LOG: GT15-I014

Coordinates: N 5846589.9 E 608141.1 Collar Elevation: 686.5m Depth: 149m Azimuth: 306.5° Dip: -65.6°





DESCRIPTIVE LOG

Broken zone: 13.06-13.19m
Contact zone: 14.88-15.02m
Fault: 18.03-18.18m

Broken zone: 105.27-105.45m

Fault zone: 123.06-123.36m
Broken zone: 129.16-129.42m
Broken zone: 132.11-132.41m
Broken zone: 132.67-132.77m
Broken zone: 136.87-136.97m

EOH 149m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
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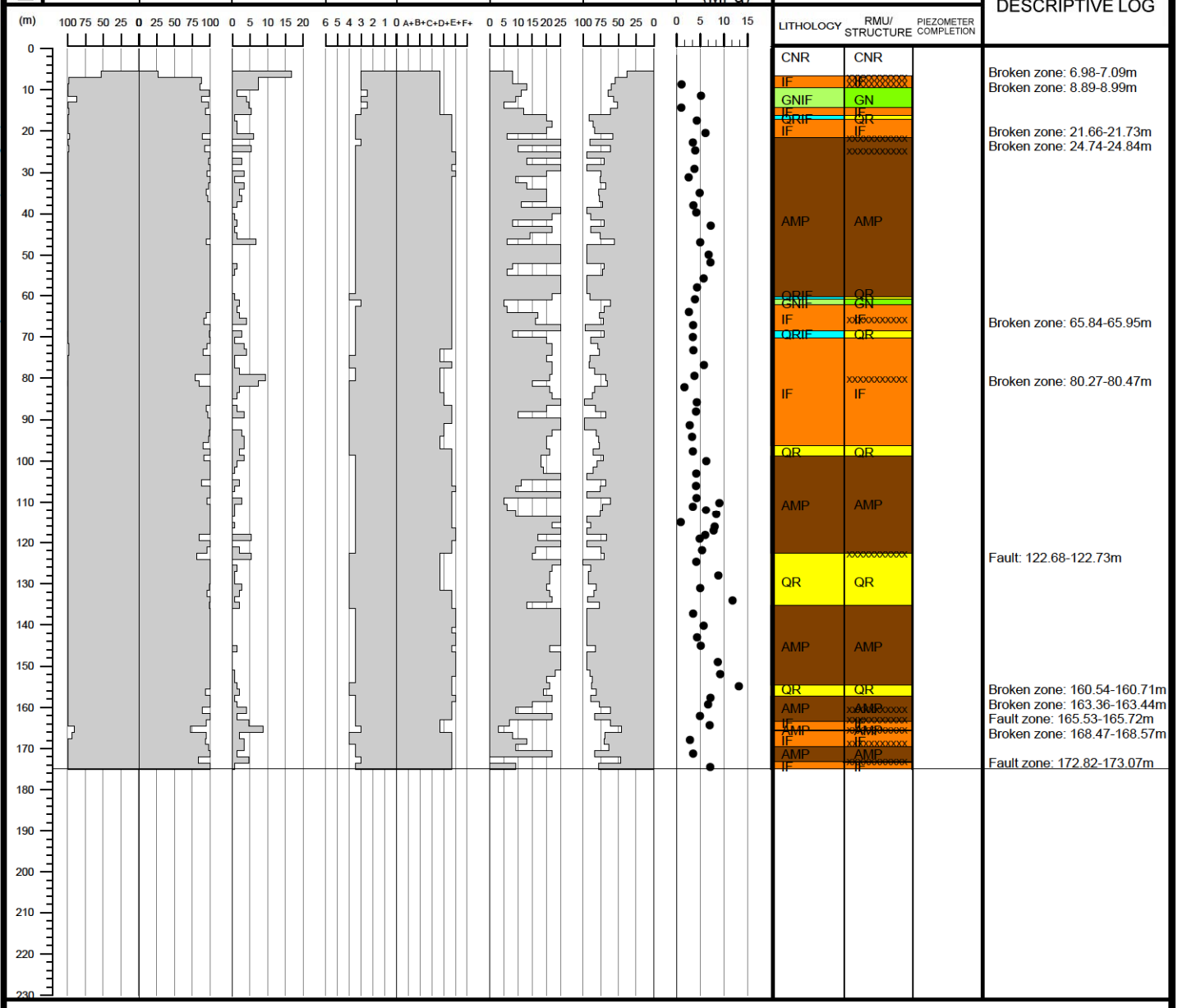
GEOMECHANICAL CORE LOG: GT15-I014

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B15

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GEOMECHANICAL LOG: GT15-I015

Coordinates: N 5846470.8 E 608050.5 Collar Elevation: 685.6m Depth: 175m Azimuth: 290.8° Dip: -50.9°



EOH 175m

- AMPHIBOLITE (AMP)
- AMPHIBOLITE IRON FORMATION (AMPIF)
- IRON FORMATION (IF)
- QUARTZ ROCK (QR)
- QUARTZ ROCK IRON FORMATION (QRIF)
- QUARTZ ROCK MICA SCHIST (QRMS)
- QUARTZ ROCK MICA SCHIST IRON FORMATION (QRMSIF)
- MICA SCHIST (MS)
- GNEISS (GN)
- GNEISS IRON FORMATION (GNIF)
- FELSIC GNEISS (GNF)
- MAFIC GNEISS (GNM)
- ARGILLITE (ARG)
- UNRECOVERED CORE / OVERBURDEN (CNR/OB)

● PLI - DIAMETRAL
XX STRUCTURE

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

GEOMECHANICAL CORE LOG: GT15-I015

BY:	DATE:
JL	OCT 15
APPROVED:	FIG:
GG	B16

APPENDIX C

SUMMARY AND INTERPRETATION OF LABORATORY TESTING RESULTS ON ROCK CORE SAMPLES

TABLE C1
SUMMARY OF UNIAXIAL COMPRESSIVE STRENGTH TESTING RESULTS
PIT IRÈNE 2015 GEOTECHNICAL ASSESSMENT[1]

Geotechnical Unit	AMEC Sample ID	Drillhole ID	AMMC Sample ID	AMMC Lithology[2]	Depth From-To (m)	Height (mm)	Diameter (mm)	H/D Ratio	Hardness (R) [3]	DOA [4]	Unconfined Compressive Strength (MPa)
Amphibolite (AMP)	R4065	GT15-I002A	UCS-I002A-01	AMP	114.63 - 114.73	94.85	45.05	2.11	5.0	E	70.2
	R4066	GT15-I010	UCS-I010-02	AMP	99.55 - 99.65	94.84	44.75	2.12	3.5	E	214.4
	R4067	GT15-I011	UCS-I011-02	AMP	102.71 - 102.81	94.62	44.69	2.12	3.5	E	97.3
	R4068	GT15-I013	UCS-I013-01	AMP	117.30 - 117.40	94.84	44.92	2.11	3.5	E	132.1
	R4069	GT15-I015	UCS-I015-01	AMP	114.61 - 114.71	94.84	45.09	2.10	3.5	E	146.2
	Average										132
Iron Formation (IF)	R4070	GT15-I001	UCS-I001-01	IF	31.13 - 31.23	95.06	45.07	2.11	3.5	E	325.9
	R4071	GT15-I005	UCS-I005-01	IF	75.70 - 75.80	94.92	44.93	2.11	5.5	E	162.3
	R4072	GT15-I009	UCS-I009-01	IF	13.81 - 13.91	94.46	44.57	2.12	3.5	E	146.7
	R4073	GT15-I011	UCS-I011-01	IF	55.09 - 55.19	94.72	44.95	2.11	4.0	E	220.7
	R4074	GT15-I012	UCS-I012-01	IF	110.39 - 110.49	95.23	44.71	2.13	4.0	E	189.0
	Average										209
Quartz Rock Mica Schist (QRMS)	R4220	GT15-I001	UCS-I001-11	QRMSIF	40.77 - 40.87	95.21	45.09	2.11	3.5	E	163.6
	R4221	GT15-I002A	UCS-I002A-11	QRMS	29.28 - 29.38	95.33	45.07	2.12	3.5	E	259.7
	R4222	GT15-I002A	UCS-I002A-12	QRMS	36.94 - 37.04	95.73	45.08	2.12	3.5	E	158.3
	R4223	GT15-I002A	UCS-I002A-13	QRMS	38.28 - 38.38	95.34	45.02	2.12	3.5	E	218.6
	R4224	GT15-I008	UCS-I008-11	QRMS	89.97 - 90.07	95.42	44.96	2.12	3.5	E	141.0
	Average										188
Quartz Rock (QR)	R4075	GT15-I003	UCS-I003-01	QR	98.25 - 98.35	94.71	44.97	2.11	4.5	D	161.1
	R4076	GT15-I006	UCS-I006-01	QR	113.60 - 113.70	94.48	45.02	2.10	3.5	D	358.5
	R4077	GT15-I007	UCS-I007-01	QR	177.72 - 177.82	94.21	44.91	2.10	4.0	E	437.0
	R4078	GT15-I008	UCS-I008-01	QR	109.18 - 109.28	94.32	44.93	2.10	3.5	E	248.4
	R4079	GT15-I011	UCS-I011-03	QR	131.97 - 132.07	92.83	44.93	2.07	3.5	E	252.4
	Average										291
Gneiss (GN)	R4225	GT15-I007	UCS-I007-12	GN	26.21 - 26.31	95.95	44.91	2.14	3.5	F	160.0
	R4226	GT15-I007	UCS-I007-14	GN	62.85 - 62.95	95.32	44.97	2.12	3.5	F	73.9
	R4227	GT15-I008	UCS-I008-12	GNM	24.55 - 24.65	95.21	44.82	2.12	3.5	E	75.1
	R4228	GT15-I008	UCS-I008-13	GNM	36.50 - 36.60	95.01	44.67	2.13	3.5	E	85.9
	R4229	GT15-I007	UCS-I007-11	GN	12.65 - 12.75	95.97	44.85	2.14	3.5	F	59.5
	Average										91

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Notes: 1. Laboratory uniaxial compressive strength testing carried out by AMEC's laboratory in Hamilton, Ontario (Appendix D).
2. AMMC Run Lithology based on data received on September 30, 2015.
3. Hardness as per ISRM (1981) field Hardness scale.
4. Degree of Alteration (DOA). DOA ratings: A = residual soil, B = completely altered, C = highly altered, D = moderately altered, E = slightly altered, F = fresh and unweathered.

TABLE C2
SUMMARY OF TRIAXIAL COMPRESSIVE STRENGTH TESTING RESULTS
PIT IRÈNE 2015 GEOTECHNICAL ASSESSMENT[1]

Geotechnical Unit	AMEC Sample ID	Drillhole ID	AMMC Sample ID	AMMC Lithology[2]	Depth From-To (m)	Height (mm)	Diameter (mm)	H/D Ratio	Hardness (R) [3]	DOA [4]	Confining Pressure (MPa)	Failure Pressure (MPa)
Amphibolite (AMP)	R4080	GT15-I001	TCS-I001-04	AMP	102.45 - 102.55	95.02	44.88	2.12	4.0	E	10	165.9
	R4082	GT15-I008	TCS-I008-02	AMP	96.39 - 96.49	95.17	44.77	2.13	3.5	E	10	166.4
	R4087	GT15-I014	TCS-I014-02	AMP	53.33 - 53.43	95.19	44.89	2.12	3.5	F	10	155.8
	Average											163
	R4081	GT15-I002A	TCS-I002A-02	AMP	128.70 - 128.80	94.95	45.07	2.11	4.0	E	20	298.5
	R4084	GT15-I011	TCS-I011-01	AMP	101.94 - 102.04	94.95	44.77	2.12	3.5	E	20	230.2
	R4088	GT15-I015	TCS-I015-01	AMP	50.72 - 50.82	95.06	44.70	2.13	3.5	E	20	327.3
	Average											285
	R4083	GT15-I010	TCS-I010-02	AMP	122.09 - 122.19	95.49	44.79	2.13	4.0	F	32	387.3
	R4085	GT15-I012	TCS-I012-01	AMP	142.96 - 143.06	94.39	44.90	2.10	5.5	E	32	300.7
	R4086	GT15-I013	TCS-I013-04	AMP	194.33 - 194.43	95.17	44.93	2.12	3.5	E	32	270.7
	Average											320
Iron Formation (IF)	R4090	GT15-I001	TCS-I001-03	IF	91.18 - 91.28	94.84	44.97	2.11	3.0	D	10	509.2
	R4091	GT15-I002A	TCS-I002A-01	IF	75.89 - 75.99	94.52	45.10	2.10	4.0	E	10	399.8
	R4093	GT15-I004	TCS-I004-01	IF	98.38 - 98.48	95.00	44.65	2.13	5.5	E	10	366.8
	Average											425
	R4089	GT15-I001	TCS-I001-01	IF	35.31 - 35.41	94.74	45.03	2.10	3.5	E	20	617.8
	R4094	GT15-I012	TCS-I012-03	IF	104.17 - 104.27	95.24	44.28	2.15	4.5	E	20	445.6
	R4095	GT15-I013	TCS-I013-01	IF	26.21 - 26.31	94.90	44.84	2.12	4.0	D+	20	434.2
	Average											499
	R4092	GT15-I003	TCS-I003-06	QRIF	6.05 - 6.15	94.98	44.93	2.11	4.5	E	32	528.1
	R4096	GT15-I013	TCS-I013-03	IF	168.16 - 168.26	94.43	44.97	2.10	4.0	F	32	714.9
	R4097	GT15-I014	TCS-I014-01	IF	139.01 - 139.11	94.34	44.84	2.10	3.5	E	32	637.3
	Average											676
Quartz Rock (QR)	R4098	GT15-I001	TCS-I001-02	QR	68.61 - 68.71	95.14	45.12	2.11	4.0	E	10	661.4
	R4104	GT15-I007	TCS-I007-01	QR	161.35 - 161.45	95.24	44.96	2.12	3.5	E	10	608.7
	R4106	GT15-I008	TCS-I008-03	QR	155.92 - 156.02	94.40	44.91	2.10	4.5	E	10	550.1
	Average											607
	R4099	GT15-I003	TCS-I003-02	QR	117.79 - 117.89	95.38	44.99	2.12	4.0	E	20	679.4
	R4100	GT15-I003	TCS-I003-03	QR	97.49 - 97.59	94.79	44.96	2.11	5.5	D	20	445.1
	R4105	GT15-I008	TCS-I008-01	QR	56.33 - 56.43	95.22	44.95	2.12	3.5	E	20	628.3
	Average											584
	R4101	GT15-I003	TCS-I003-04	QR	92.53 - 92.63	94.54	44.95	2.10	5.0	E	32	894.9
	R4102	GT15-I003	TCS-I003-05	QR	71.08 - 71.18	93.97	44.77	2.10	4.5	D	32	830.7
	R4103	GT15-I006	TCS-I006-01	QR	143.57 - 143.67	94.07	45.10	2.09	3.0	E	32	683.7
	Average											803

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Notes: 1. Laboratory triaxial compressive strength testing carried out by AMEC's laboratory in Hamilton, Ontario (Appendix D).
2. AMMC Run Lithology based on data received on September 30, 2015.
3. Hardness as per ISRM (1981) field Hardness scale.
4. Degree of Alteration (DOA). DOA ratings: A = residual soil, B = completely altered, C = highly altered, D = moderately altered, E = slightly altered, F = fresh and unweathered.

TABLE C2
SUMMARY OF TRIAXIAL COMPRESSIVE STRENGTH TESTING RESULTS
PIT IRÈNE 2015 GEOTECHNICAL ASSESSMENT

TABLE C3
SUMMARY OF BRAZILIAN INDIRECT TENSILE STRENGTH TESTING RESULTS
PIT IRÈNE 2015 GEOTECHNICAL ASSESSMENT[1]

Geotechnical Unit	AMEC Sample ID	Drillhole ID	AMMC Sample ID	AMMC Lithology[2]	Depth From-To (m)	Thickness (mm)	Diameter (mm)	T/D Ratio	Hardness (R)[3]	DOA[4]	Tensile Strength (MPa)
Amphibolite (AMP)	R4107	GT15-I002A	BTS-I002A-03	AMP	125.03 - 125.06	25.41	45.08	0.56	4.5	E	11.28
	R4108	GT15-I003	BTS-I003-01	AMP	177.71 - 177.74	25.03	44.86	0.56	4.0	E	8.05
	R4109	GT15-I008	BTS-I008-01	AMP	97.57 - 97.60	25.23	44.82	0.56	3.5	E	14.75
	R4110	GT15-I010	BTS-I010-04	AMP	119.38 - 119.41	25.00	44.72	0.56	4.0	F	17.14
	R4111	GT15-I015	BTS-I015-01	AMP	50.25 - 50.28	25.83	44.68	0.58	3.5	E	13.24
	Average										13
Iron Formation (IF)	R4112	GT15-I001	BTS-I001-01	IF	33.51 - 33.54	26.35	45.11	0.58	3.5	E	11.35
	R4113	GT15-I002A	BTS-I002A-02	IF	74.31 - 74.34	26.94	45.10	0.60	4.0	D	12.94
	R4114	GT15-I010	BTS-I010-05	IF	25.90 - 25.93	25.39	44.64	0.57	3.5	D	7.41
	R4115	GT15-I013	BTS-I013-01	IF	33.22 - 33.25	25.97	44.86	0.58	4.0	E	13.83
	R4116	GT15-I013	BTS-I013-02	IF	170.03 - 170.06	24.98	44.93	0.56	4.0	F	10.95
	Average										11
Quartz Rock (QR)	R4117	GT15-I002A	BTS-I002A-01	QR	8.20 - 8.23	25.85	44.99	0.57	4.0	D	15.55
	R4118	GT15-I003	BTS-I003-02	QR	115.34 - 115.37	27.01	44.95	0.60	4.5	E	11.38
	R4119	GT15-I006	BTS-I006-01	QR	60.18 - 60.21	28.81	45.10	0.64	4.0	E	8.92
	R4120	GT15-I010	BTS-I010-01	QR	147.83 - 147.86	27.14	45.06	0.60	3.5	E-	11.61
	R4121	GT15-I012	BTS-I012-01	QR	130.51 - 130.54	27.81	44.75	0.62	3.0	D	9.21
	Average										11

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Notes: 1. Laboratory Brazilian indirect tensile strength testing carried out by AMEC's laboratory in Hamilton, Ontario (Appendix D).
2. AMMC Run Lithology based on data received on September 30, 2015.
3. Hardness as per ISRM (1981) field Hardness scale.
4. Degree of Alteration (DOA). DOA ratings: A = residual soil, B = completely altered, C = highly altered, D = moderately altered, E = slightly altered, F = fresh and unweathered.

TABLE C4
SUMMARY OF DIRECT SHEAR TESTING RESULTS
PIT IRÈNE 2015 GEOTECHNICAL ASSESSMENT[1]

Geotechnical Unit	AMEC Sample ID	AMMC Sample ID	Drillhole ID	Depth of Discontinuity (m)	Area (mm^2)	AMMC Run Lithology[2]	Hardness (R)[3]	DOA of Joint Surface[4]	Discontinuity Type	JC[5]	JRC[6]	JRC Friction Angle[7], ϕ_p'	Peak Friction Angle, ϕ_p' (°)	Peak Cohesion c_p' (kPa)	Residual Friction Angle, ϕ_r' (°)	Residual Cohesion c_r' (kPa)
Amphibolite (AMP)	R4122	DS-I002A-02	GT15-I002A	121.08	2173	AMP	4	E	JN	20	12	48	38.5	50	32.0	0
	R4123	DS-I003-01	GT15-I003	182.39	2551	AMP	3.5	E	FO	16	4	32	22.0	75	22.0	0
	R4124	DS-I003-02	GT15-I003	160.59	1907	AMP	3.5	E	JN	16	2	28	38.5	125	38.5	0
	R4125	DS-I009-01	GT15-I009	121.4	2102	AMP	2.5	D	JN	9	6	33	24.0	65	18.0	0
	R4126	DS-I014-02	GT15-I014	88.25	2354	AMP	3.5	F	JN	22	3	30	47.0	75	33.0	0
	35th Percentile											31	29.8	69	26.0	0
	Average											34	34.0	78	28.7	0
Iron Formation (IF)	R4127	DS-I005-01	GT15-I005	35.25	2261	IF	4.5	E	JN	24	12	49	39.0	75	35.0	0
	R4128	DS-I010-03	GT15-I010	28.63	1893	IF	3	D	JN	9	10	41	36.0	100	34.0	0
	R4129	DS-I010-04	GT15-I010	23.72	1836	IF	3	D	JN	14	2	28	42.0	100	37.0	0
	R4130	DS-I013-02	GT15-I013	54.12	2703	IF	4	E	JN	20	8	40	40.0	75	36.0	25
	R4131	DS-I014-01	GT15-I014	147.07	3057	IF	4	E	JN	20	5	34	42.0	100	39.0	0
	35th Percentile											37	39.4	85	35.4	0
	Average											38	39.8	90	36.2	5
Quartz Rock (QR)	R4132	DS-I002A-01	GT15-I002A	59.68	2987	QR	4	E	JN	20	6	36	41.0	50	36.0	0
	R4133	DS-I007-01	GT15-I007	162.87	2339	QR	3	D	JN	16	9	39	42.0	75	34.0	0
	R4135	DS-I008-02	GT15-I008	126.02	2797	QR	3.5	E	JN	22	10	42	45.0	125	30.0	50
	R4134	DS-I010-01	GT15-I010	147.46	1659	QR	3.5	E-	JN	18	8	39	40.0	75	20.0	0
	R4136	DS-I012-01	GT15-I012	123.34	1854	QR	3	C	JN	16	2	28	35.0	63	32.0	0
	35th Percentile											37	40.4	68	30.8	0
	Average											37	40.6	78	30.4	10
All Units Combined	35th Percentile											33	38.5	75	32.0	0
	Average											37	38.1	82	31.8	5

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Notes: 1. Laboratory direct shear testing carried out by AMEC's laboratory in Hamilton, Ontario (Appendix D).
2. AMMC Run Lithology based on data received on September 30, 2015.
3. Hardness as per ISRM (1981) field Hardness scale.
4. Degree of Alteration (DOA). DOA ratings: A = residual soil, B = completely altered. C = highly altered, D = moderately altered, E = slightly altered, F = fresh and unweathered.
5. Joint Condition (JC) after Bieniawski (1976).
6. Joint Roughness Coefficient (JRC) after Barton and Choubey (1977).
7. JRC friction angle calculated according to Barton and Choubey (1977) assuming a basic friction angle of 25° and normal stress of 1 MPa.

TABLE C5
SUMMARY OF LAB SAMPLE DENSITIES
PIT IRÈNE 2015 GEOTECHNICAL ASSESSMENT[1]

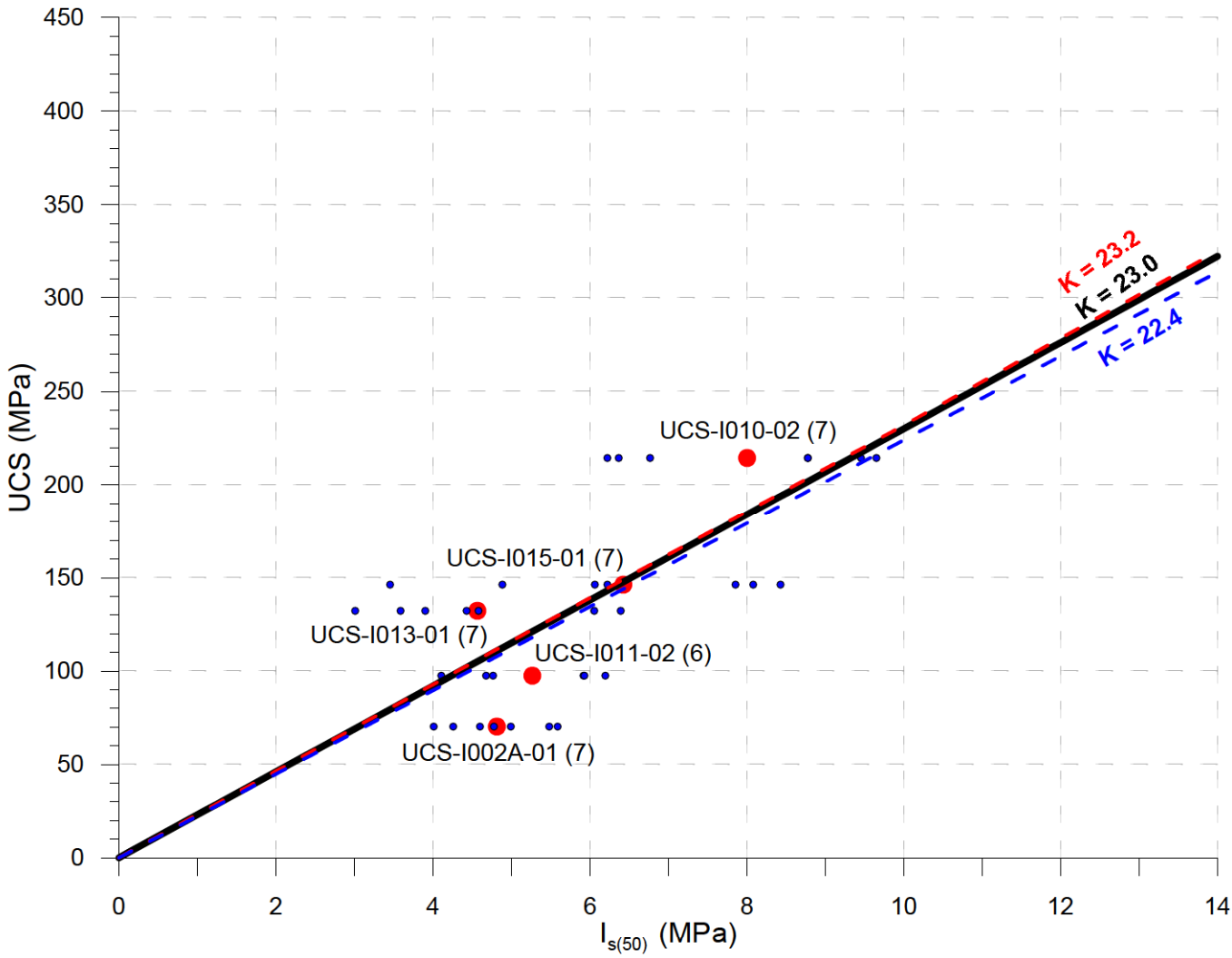
AMEC Sample ID	Test	Drillhole ID	AMMC Sample ID	AMMC Lithology[2]	Depth from	Depth to	Height	Diameter	H/D Ratio	Mass Dry	Density	Average Density	Average Unit Weight
							(mm)	(mm)		(gm)	(kg/m^3)	(kg/m^3)	(kN/m^3)
R4065	UCS	GT15-I002A	UCS-I002A-01	AMP	114.63	114.73	94.85	45.05	2.11	462.7	3060		
R4066	UCS	GT15-I010	UCS-I010-02	AMP	99.55	99.65	94.84	44.75	2.12	468.2	3139		
R4067	UCS	GT15-I011	UCS-I011-02	AMP	102.71	102.81	94.62	44.69	2.12	453.4	3055		
R4068	UCS	GT15-I013	UCS-I013-01	AMP	117.30	117.40	94.84	44.92	2.11	460.1	3061		
R4069	UCS	GT15-I015	UCS-I015-01	AMP	114.61	114.71	94.84	45.09	2.10	464.7	3069		
R4080	TCS	GT15-I001	TCS-I001-04	AMP	102.45	102.55	95.02	44.88	2.12	459.4	3056		
R4081	TCS	GT15-I002A	TCS-I002A-02	AMP	128.70	128.80	94.95	45.07	2.11	465.4	3072		
R4082	TCS	GT15-I008	TCS-I008-02	AMP	96.39	96.49	95.17	44.77	2.13	463.3	3092		
R4083	TCS	GT15-I010	TCS-I010-02	AMP	122.09	122.19	95.49	44.79	2.13	462.8	3076		
R4084	TCS	GT15-I011	TCS-I011-01	AMP	101.94	102.04	94.95	44.77	2.12	457.9	3063	**3066**	**30.08**
R4085	TCS	GT15-I012	TCS-I012-01	AMP	142.96	143.06	94.39	44.90	2.10	457.2	3059		
R4086	TCS	GT15-I013	TCS-I013-04	AMP	194.33	194.43	95.17	44.93	2.12	461.3	3057		
R4087	TCS	GT15-I014	TCS-I014-02	AMP	53.33	53.43	95.19	44.89	2.12	457.6	3037		
R4088	TCS	GT15-I015	TCS-I015-01	AMP	50.72	50.82	95.06	44.70	2.13	455.1	3051		
R4107	BTS	GT15-I002A	BTS-I002A-03	AMP	125.03	125.06	25.41	45.08	0.56	123.2	3038		
R4108	BTS	GT15-I003	BTS-I003-01	AMP	177.71	177.74	25.03	44.86	0.56	121.2	3064		
R4109	BTS	GT15-I008	BTS-I008-01	AMP	97.57	97.60	25.23	44.82	0.56	122.2	3070		
R4110	BTS	GT15-I010	BTS-I010-04	AMP	119.38	119.41	25.00	44.72	0.56	121.0	3081		
R4111	BTS	GT15-I015	BTS-I015-01	AMP	50.25	50.28	25.83	44.68	0.58	123.7	3054		
R4225	UCS	GT15-I007	UCS-I007-12	GN	26.21	26.31	95.95	44.91	2.14	403.7	2656		
R4226	UCS	GT15-I007	UCS-I007-14	GN	62.85	62.95	95.32	44.97	2.12	463.9	3064		
R4227	UCS	GT15-I008	UCS-I008-12	GN	24.55	24.65	95.21	44.82	2.12	404.9	2695	**2835**	**27.82**
R4228	UCS	GT15-I008	UCS-I008-13	GN	36.50	36.60	95.01	44.67	2.13	454.1	3050		
R4229	UCS	GT15-I007	UCS-I007-11	GN	12.65	12.75	95.97	44.85	2.14	411.2	2712		
R4070	UCS	GT15-I001	UCS-I001-01	IF	31.13	31.23	95.06	45.07	2.11	572.1	3772		
R4071	UCS	GT15-I005	UCS-I005-01	IF	75.70	75.80	94.92	44.93	2.11	557.3	3703		
R4072	UCS	GT15-I009	UCS-I009-01	IF	13.81	13.91	94.46	44.57	2.12	758.3	5145		
R4073	UCS	GT15-I011	UCS-I011-01	IF	55.09	55.19	94.72	44.95	2.11	485.3	3229		
R4074	UCS	GT15-I012	UCS-I012-01	IF	110.39	110.49	95.23	44.71	2.13	461.6	3087		
R4089	TCS	GT15-I001	TCS-I001-01	IF	35.31	35.41	94.74	45.03	2.10	511.6	3391		
R4090	TCS	GT15-I001	TCS-I001-03	IF	91.18	91.28	94.84	44.97	2.11	524.4	3481		
R4091	TCS	GT15-I002A	TCS-I002A-01	IF	75.89	75.99	94.52	45.10	2.10	494.2	3273		
R4092	TCS	GT15-I003	TCS-I003-06	IF	6.05	6.15	94.98	44.93	2.11	531.6	3530		
R4093	TCS	GT15-I004	TCS-I004-01	IF	98.38	98.48	95.00	44.65	2.13	646.4	4346	**3583**	**35.15**
R4094	TCS	GT15-I012	TCS-I012-03	IF	104.17	104.27	95.24	44.28	2.15	504.9	3443		
R4095	TCS	GT15-I013	TCS-I013-01	IF	26.21	s	94.90	44.84	2.12	782.2	5220		
R4096	TCS	GT15-I013	TCS-I013-03	IF	168.16	168.26	94.43	44.97	2.10	495.7	3305		
R4097	TCS	GT15-I014	TCS-I014-01	IF	139.01	139.11	94.34	44.84	2.10	523.2	3512		
R4112	BTS	GT15-I001	BTS-I001-01	IF	33.51	33.54	26.35	45.11	0.58	140.5	3336		
R4113	BTS	GT15-I002A	BTS-I002A-02	IF	74.31	74.34	26.94	45.10	0.60	120.7	2805		
R4114	BTS	GT15-I010	BTS-I010-05	IF	25.9	25.93	25.39	44.64	0.57	128.0	3221		
R4115	BTS	GT15-I013	BTS-I013-01	IF	33.22	33.25	25.97	44.86	0.58	129.2	3148		
R4116	BTS	GT15-I013	BTS-I013-02	IF	170.03	170.06	24.98	44.93	0.56	124.2	3136		
R4075	UCS	GT15-I003	UCS-I003-01	QR	98.25	98.35	94.71	44.97	2.11	401.2	2667		
R4076	UCS	GT15-I006	UCS-I006-01	QR	113.60	113.70	94.48	45.02	2.10	397.4	2642		
R4077	UCS	GT15-I007	UCS-I007-01	QR	177.72	177.82	94.21	44.91	2.10	394.2	2641		
R4078	UCS	GT15-I008	UCS-I008-01	QR	109.18	109.28	94.32	44.93	2.10	396.0	2648		
R4079	UCS	GT15-I011	UCS-I011-03	QR	131.97	132.07	92.83	44.93	2.07	386.4	2625		
R4098	TCS	GT15-I001	TCS-I001-02	QR	68.61	68.71	95.14	45.12	2.11	401.0	2636		
R4099	TCS	GT15-I003	TCS-I003-02	QR	117.79	117.89	95.38	44.99	2.12	401.3	2647		
R4100	TCS	GT15-I003	TCS-I003-03	QR	97.49	97.59	94.79	44.96	2.11	403.0	2678		
R4101	TCS	GT15-I003	TCS-I003-04	QR	92.53	92.63	94.54	44.95	2.10	399.6	2664		
R4102	TCS	GT15-I003	TCS-I003-05	QR	71.08	71.18	93.97	44.77	2.10	392.2	2651	**2651**	**26.01**
R4103	TCS	GT15-I006	TCS-I006-01	QR	143.57	143.67	94.07	45.10	2.09	398.4	2651		
R4104	TCS	GT15-I007	TCS-I007-01	QR	161.35	161.45	95.24	44.96	2.12	399.6	2643		
R4105	TCS	GT15-I008	TCS-I008-01	QR	56.33	56.43	95.22	44.95	2.12	416.6	2757		
R4106	TCS	GT15-I008	TCS-I008-03	QR	155.92	156.02	94.40	44.91	2.10	396.0	2648		
R4117	BTS	GT15-I002A	BTS-I002A-01	QR	8.20	8.23	25.85	44.99	0.57	109.0	2652		
R4118	BTS	GT15-I003	BTS-I003-02	QR	115.34	115.37	27.01	44.95	0.60	111.6	2604		
R4119	BTS	GT15-I006	BTS-I006-01	QR	60.18	60.21	28.81	45.10	0.64	122.3	2657		
R4120	BTS	GT15-I010	BTS-I010-01	QR	147.83	147.86	27.14	45.06	0.60	114.1	2636		
R4121	BTS	GT15-I012	BTS-I012-01	QR	130.51	130.54	27.81	44.75	0.62	114.8	2625		
R4220	UCS	GT15-I001	UCS-I001-11	QRMS	40.77	40.87	95.21	45.09	2.11	412.2	2711		
R4221	UCS	GT15-I002A	UCS-I002A-11	QRMS	29.28	29.38	95.33	45.07	2.12	402.6	2647		
R4222	UCS	GT15-I002A	UCS-I002A-12	QRMS	36.94	37.04	95.73	45.08	2.12	407.4	2666	**2674**	**26.23**
R4223	UCS	GT15-I002A	UCS-I002A-13	QRMS	38.28	38.38	95.34	45.02	2.12	403.3	2657		
R4224	UCS	GT15-I008	UCS-I008-11	QRMS	89.97	90.07	95.42	44.96	2.12	407.2	2688		

H:\Project\1846\2015-06 slope design updates\Testing\[Density.xlsx]Summary

Notes: 1. Laboratory density measurements carried out by AMEC's laboratory in Hamilton, Ontario (Appendix D).
2. AMMC Run Lithology based on data received on September 30, 2015.

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AMPHIBOLITE (AMP)



LEGEND

- Individual $I_{s(50)}$ Test Value
- Avg. $I_{s(50)}$ +/- 5m
- UCS-016-01(3) Test ID (Number of PLI Tests)
- Approx. range from ISRM
- Fit of Avg. PLI +/- 5m
- Fit of Individual PLI Tests
- Design K Value

Notes:

1. $I_{S(50)}$ values shown for valid diametral PLI tests according to ISRM (1985).
2. Correlation coefficient (K) is based on a linear best fit of UCS versus $I_{S(50)}$ values.
3. Average $I_{S(50)}$ calculated from the remaining 6 or 7 valid PLI tests after deleting the highest and lowest values.

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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

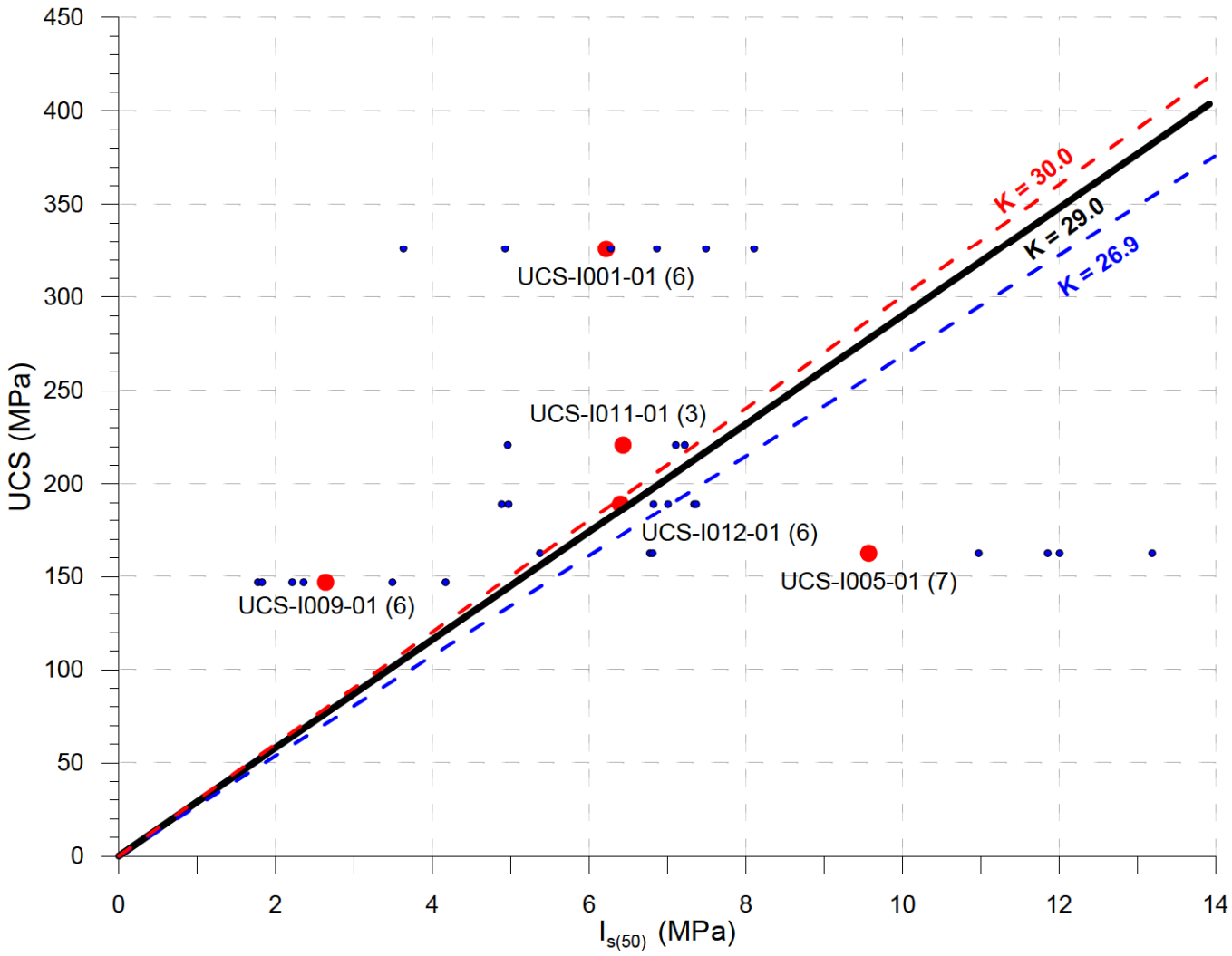
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CORRELATION OF UNIAXIAL COMPRESSIVE STRENGTH VERSUS AVERAGE POINT LOAD INDEX $I_{S(50)}$ FOR THE AMPHIBOLITE GEOTECHNICAL UNIT

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C1

H:\Project\184612015-06 slope design updates\Testing\PLT\PLI_k_factor_IF.grf

IRON FORMATION (IF)



LEGEND

- Individual $I_{s(50)}$ Test Value
- Avg. $I_{s(50)}$ +/- 5m
- UCS-028-02(3) Test ID (Number of PLI Tests)
- Approx. range from ISRM
- Fit of Avg. PLI +/- 5m
- Fit of Individual PLI Tests
- Design K Value

Notes:

1. $I_{S(50)}$ values shown for valid diametral PLI tests according to ISRM (1985).
2. Correlation coefficient (K) is based on a linear best fit of UCS versus $I_{S(50)}$ values.
3. Average $I_{S(50)}$ calculated from the remaining 6 or 7 valid PLI tests after deleting the highest and lowest values.

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2015 GEOTECHNICAL ASSESSMENT

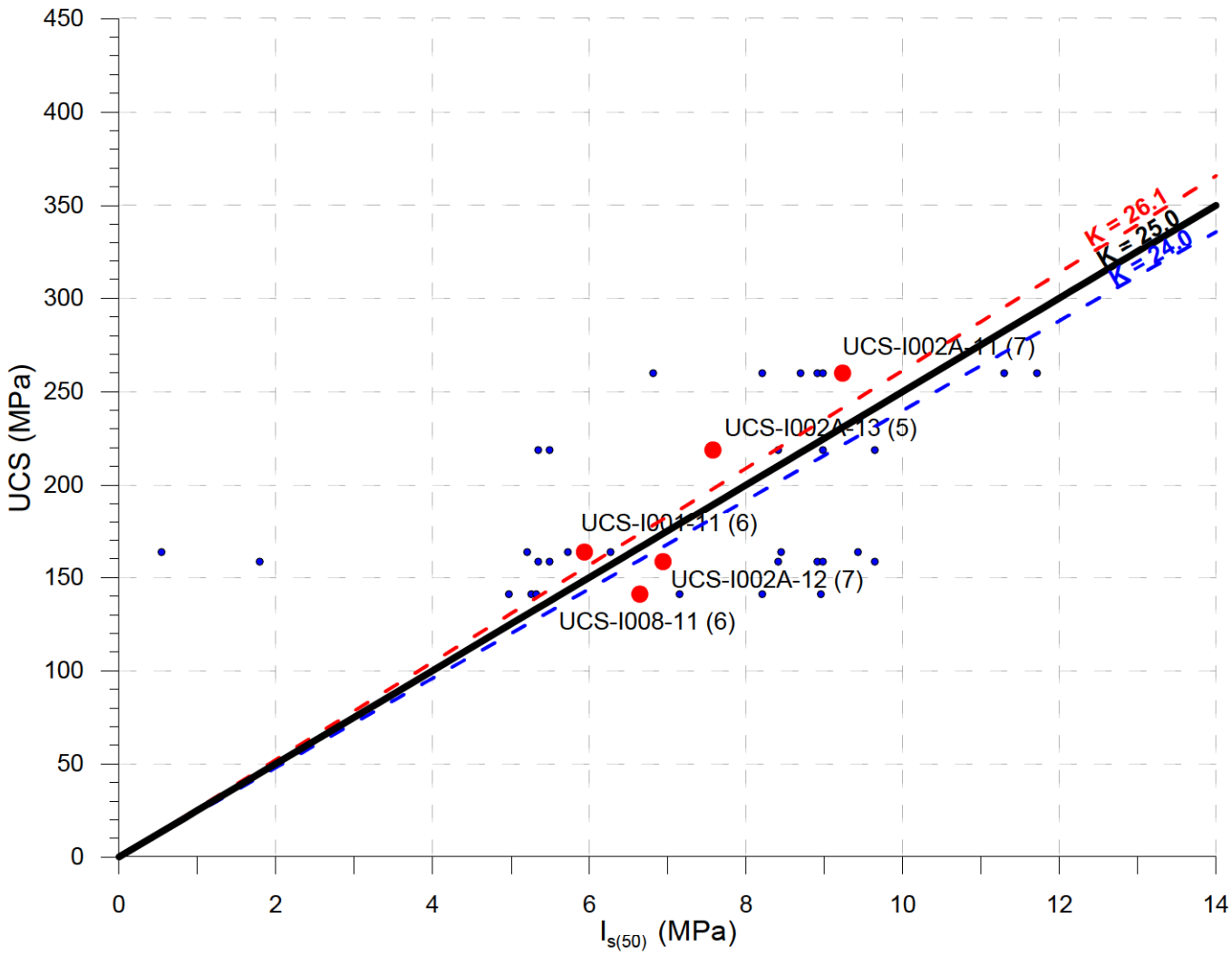
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CORRELATION OF UNIAXIAL COMPRESSIVE STRENGTH VERSUS AVERAGE POINT LOAD INDEX $I_{S(50)}$ FOR THE IRON FORMATION GEOTECHNICAL UNIT

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C2

H:\Project\1846\2015-06 slope design updates\Testing\PLT\PLI_k_factor_QRMS.grf

QUARTZ ROCK MICA SCHIST (QRMS)



LEGEND

- Individual $I_{s(50)}$ Test Value
- Avg. $I_{s(50)}$ +/- 5m
- UCS-I003-01 (9) Test ID (Number of PLI Tests)
- Approx. range from ISRM
- Fit of Avg. PLI +/- 5m
- Fit of Individual PLI Tests
- Design K Value

Notes:

1. $I_{s(50)}$ values shown for valid diametral PLI tests according to ISRM (1985).
2. Correlation coefficient (K) is based on a linear best fit of UCS versus $I_{s(50)}$ values.
3. Average $I_{s(50)}$ calculated from the remaining 6 or 7 valid PLI tests after deleting the highest and lowest values.

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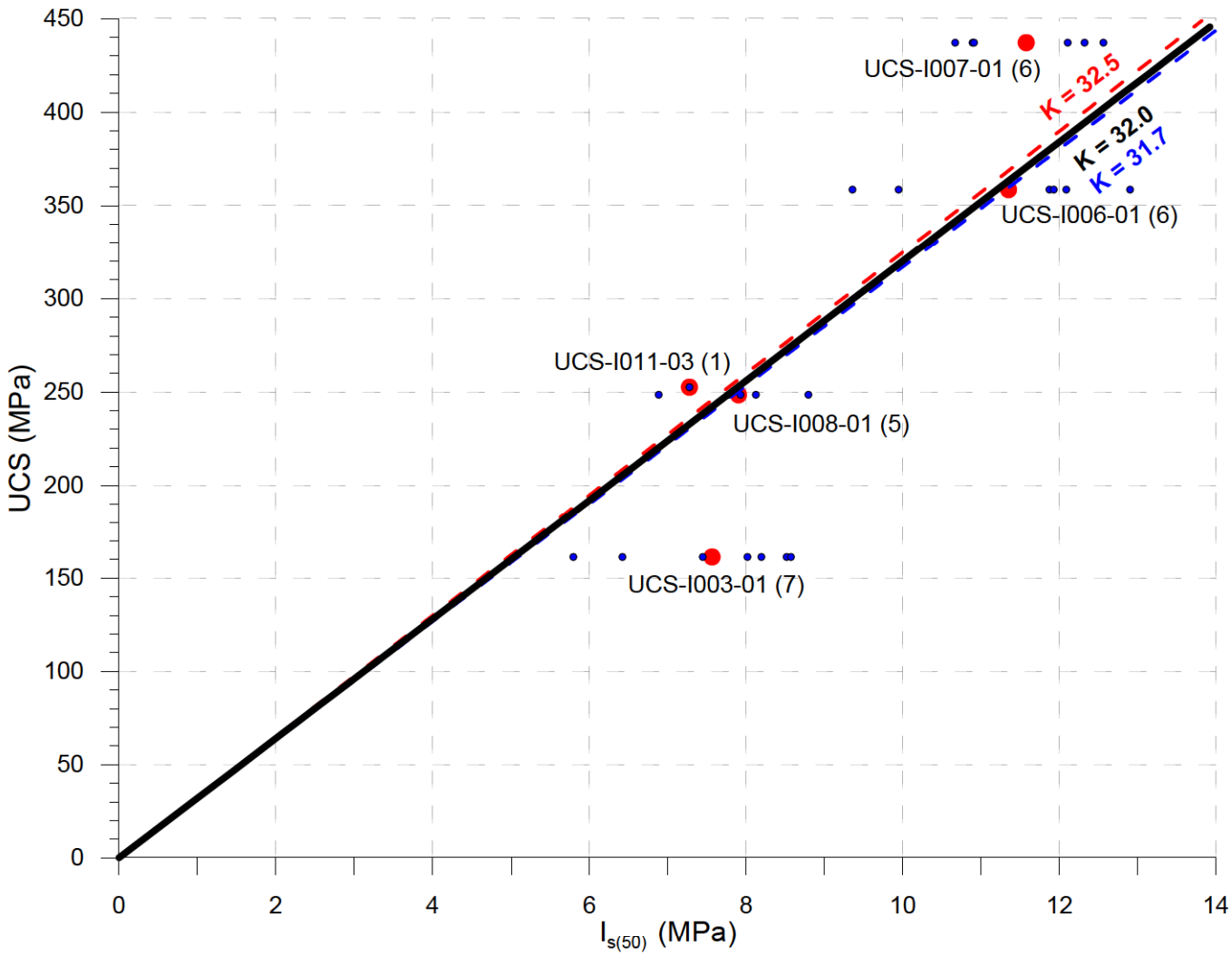
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CORRELATION OF UNIAXIAL COMPRESSIVE STRENGTH VERSUS AVERAGE POINT LOAD INDEX $I_{S(50)}$ FOR THE QUARTZ MICA SCHIST ROCK GEOTECHNICAL UNIT

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C3

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QUARTZ ROCK (QR)



LEGEND

- Individual $I_{s(50)}$ Test Value
- Avg. $I_{s(50)}$ +/- 5m
- UCS-I003-01 (9) Test ID (Number of PLI Tests)
- Approx. range from ISRM
- Fit of Avg. PLI +/- 5m
- Fit of Individual PLI Tests
- Design K Value

Notes:

1. $I_{s(50)}$ values shown for valid diametral PLI tests according to ISRM (1985).
2. Correlation coefficient (K) is based on a linear best fit of UCS versus $I_{s(50)}$ values.
3. Average $I_{s(50)}$ calculated from the remaining 6 or 7 valid PLI tests after deleting the highest and lowest values.

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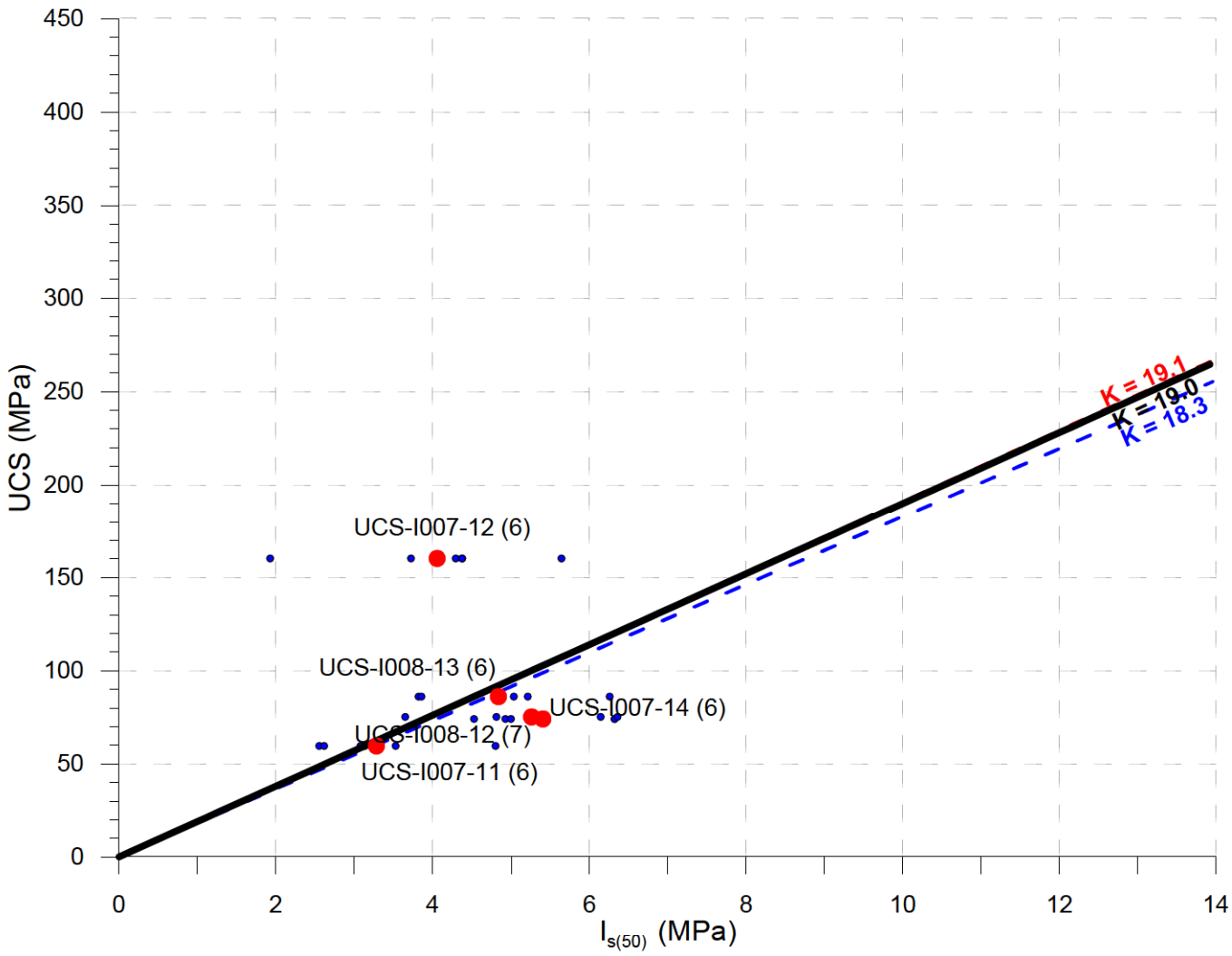
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CORRELATION OF UNIAXIAL COMPRESSIVE STRENGTH VERSUS AVERAGE POINT LOAD INDEX $I_{S(50)}$ FOR THE QUARTZ ROCK GEOTECHNICAL UNIT

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C4

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GNEISS (GN)



LEGEND

- Individual $I_{s(50)}$ Test Value
- Avg. $I_{s(50)}$ +/- 5m
- UCS-I003-01 (9) Test ID (Number of PLI Tests)
- Approx. range from ISRM
- Fit of Avg. PLI +/- 5m
- Fit of Individual PLI Tests
- Design K Value

Notes:

1. $I_{S(50)}$ values shown for valid diametral PLI tests according to ISRM (1985).
2. Correlation coefficient (K) is based on a linear best fit of UCS versus $I_{S(50)}$ values.
3. Average $I_{S(50)}$ calculated from the remaining 6 or 7 valid PLI tests after deleting the highest and lowest values.

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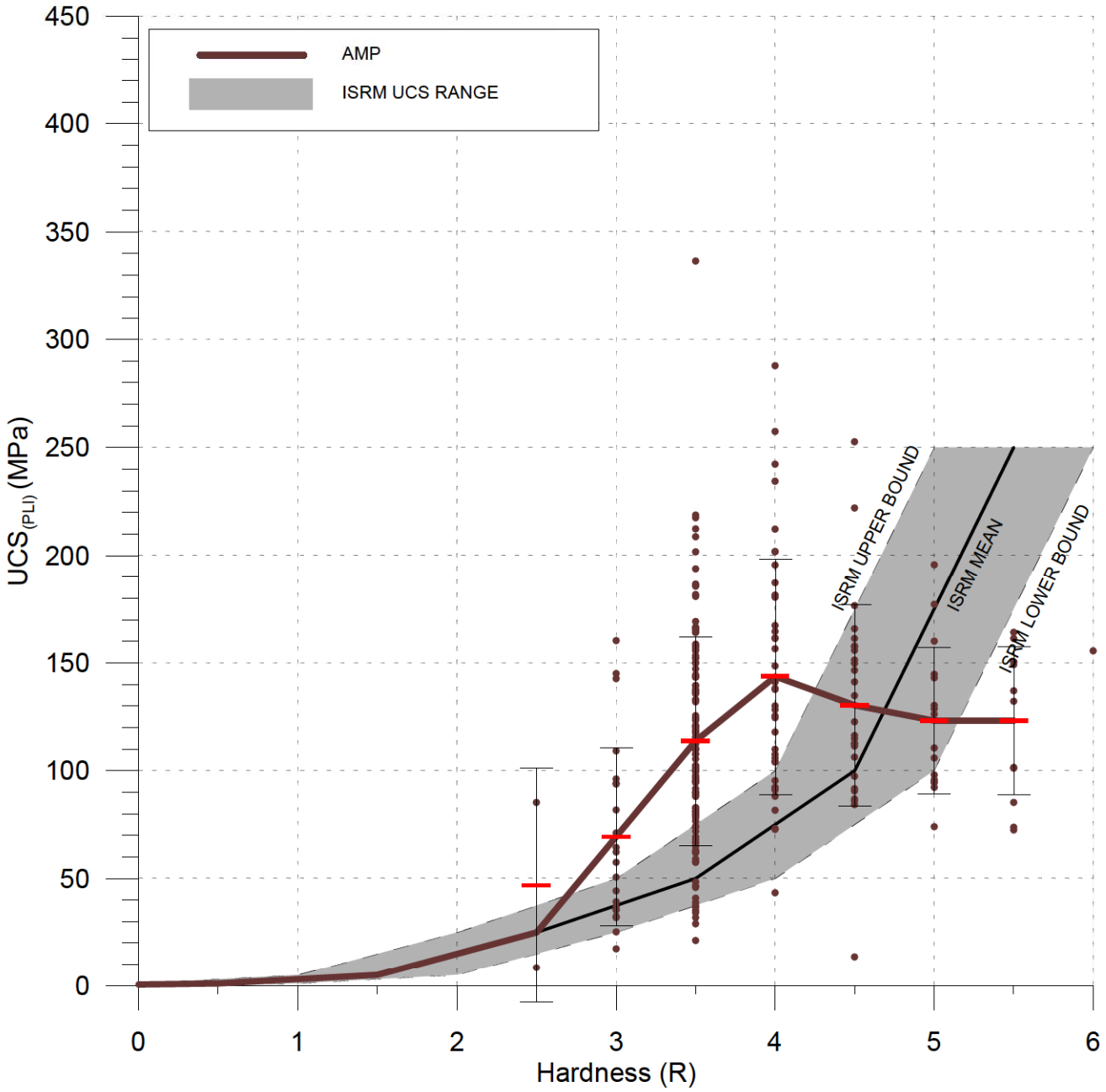
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CORRELATION OF UNIAXIAL COMPRESSIVE STRENGTH VERSUS AVERAGE POINT LOAD INDEX $I_{S(50)}$ FOR THE GNEISS ROCK GEOTECHNICAL UNIT

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C5

H:\Project\1846\2015-06 slope design updates\Testing\PLT\Fig_UCS-PLI_AMP.grf



Notes:

1. Range of UCS shown in grey shading based on ISRM (1981).
2. Hardness estimates and PLI results plotted for core runs retrieved during the 2015 Pit Irène drilling program.
3. UCS derived from PLI tests based on a correlation factor (K) of 23 determined by correlation of UCS vs $I_{s(50)}$.
4. Vertical error bars shown for each Hardness category (red dashes indicate category average, black dashes indicate standard deviations).

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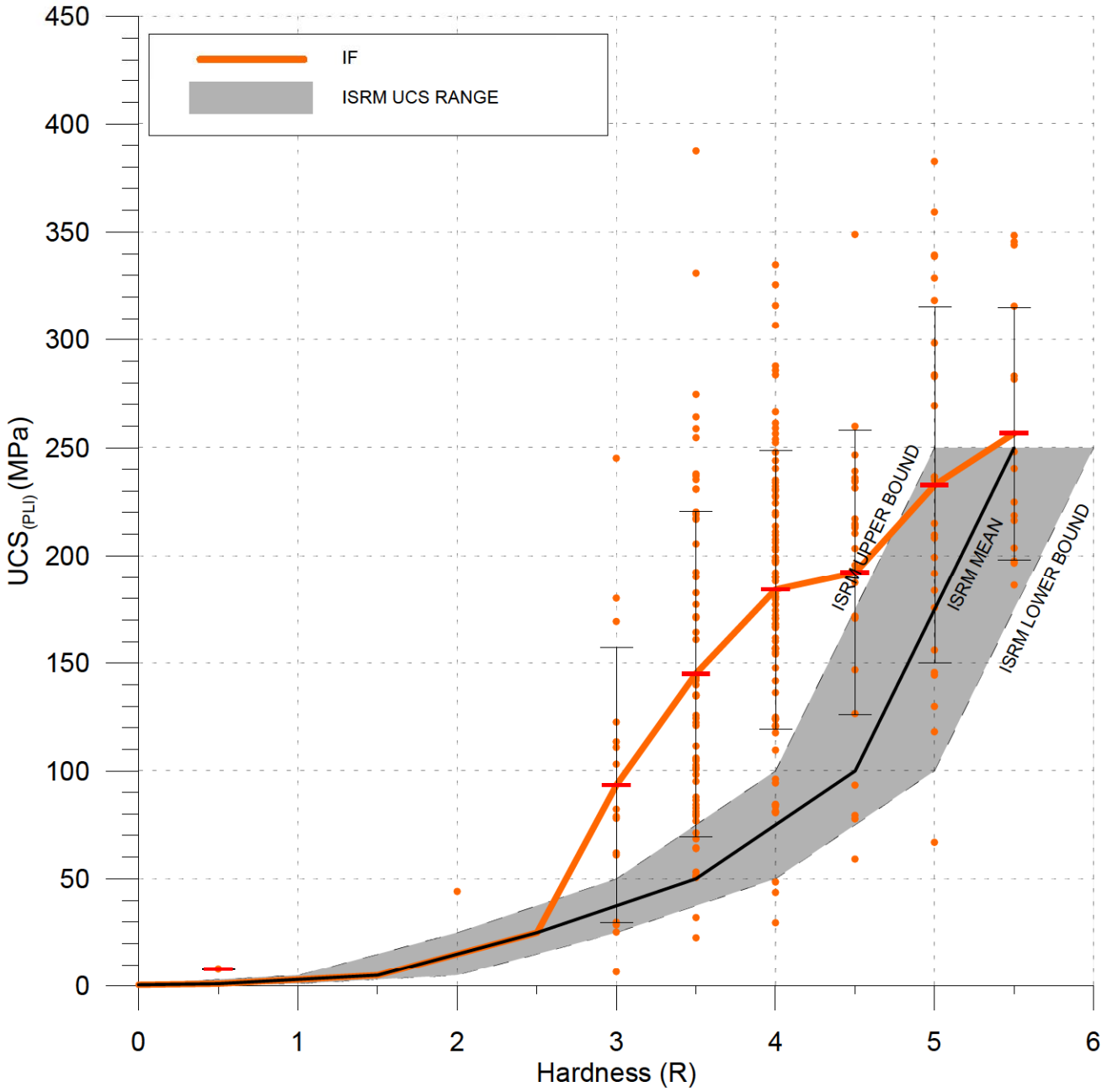
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$UCS_{(PLI)}$ VERSUS HARDNESS FOR THE AMPHIBOLITE GEOTECHNICAL UNIT POINT LOAD INDEX DATABASE

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C6

H:\Project\1846\2015-06 slope design updates\Testing\PLTFig_UCS-PLI_IF.grf



Notes:

1. Range of UCS shown in grey shading based on ISRM (1981).
2. Hardness estimates and PLI results plotted for core runs retrieved during the 2015 Pit Irène drilling program.
3. UCS derived from PLI tests based on a correlation factor (K) of 29 determined by correlation of UCS vs $I_{s(50)}$.
4. Vertical error bars shown for each Hardness category (red dashes indicate category average, black dashes indicate standard deviations).

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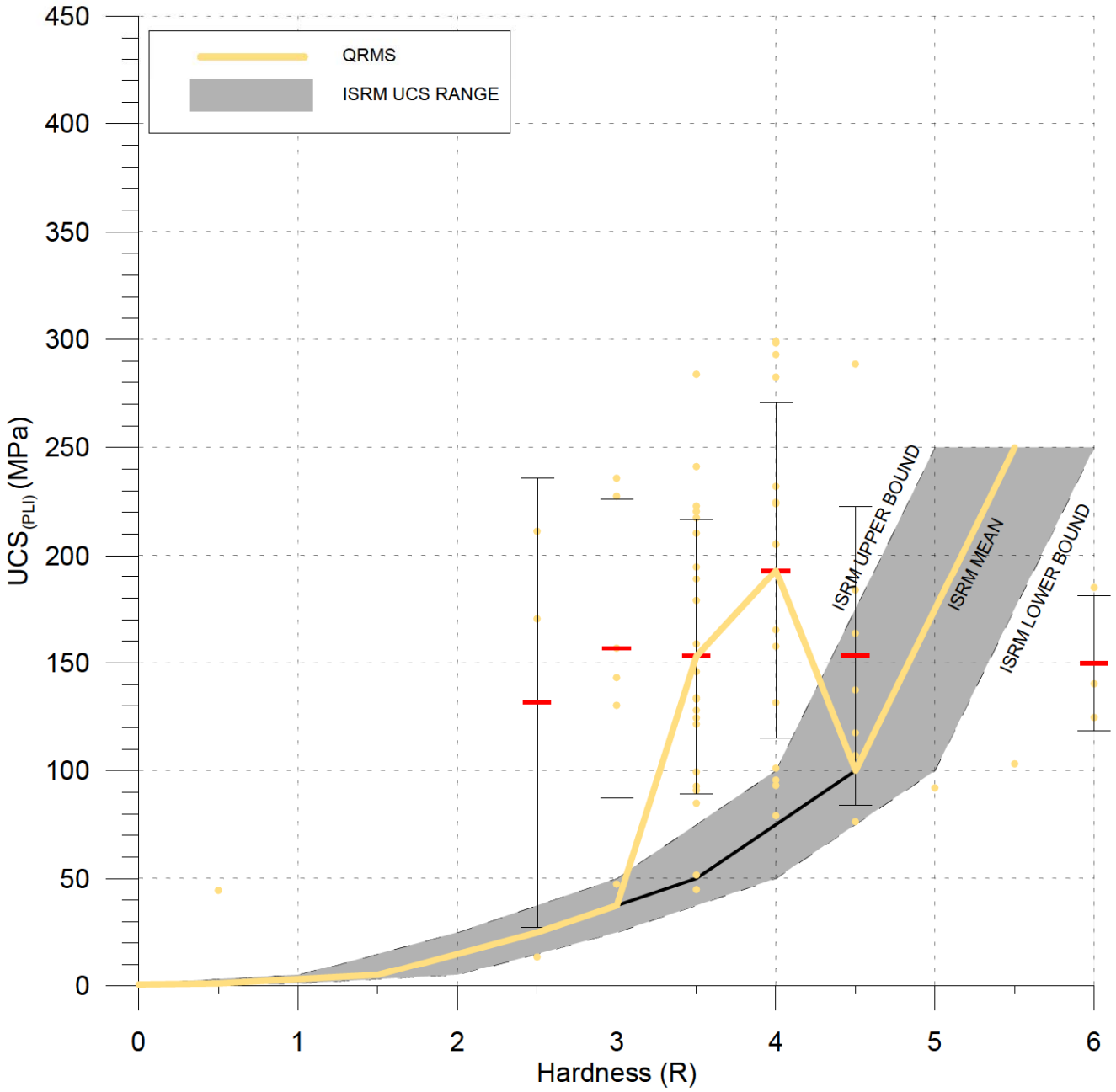
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$UCS_{(PLI)}$ VERSUS HARDNESS FOR THE IRON FORMATION GEOTECHNICAL UNIT POINT LOAD INDEX DATABASE

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C7

H:\Project\1846\2015-06 slope design updates\Testing\PLT\Fig_UCS-PLI_QRMS.grf



Notes:

1. Range of UCS shown in grey shading based on ISRM (1981).
2. Hardness estimates and PLI results plotted for core runs retrieved during the 2015 Pit Irène drilling program.
3. UCS derived from PLI tests based on a correlation factor (K) of 25 determined by correlation of UCS vs $I_{s(50)}$.
4. Vertical error bars shown for each Hardness category (red dashes indicate category average, black dashes indicate standard deviations).

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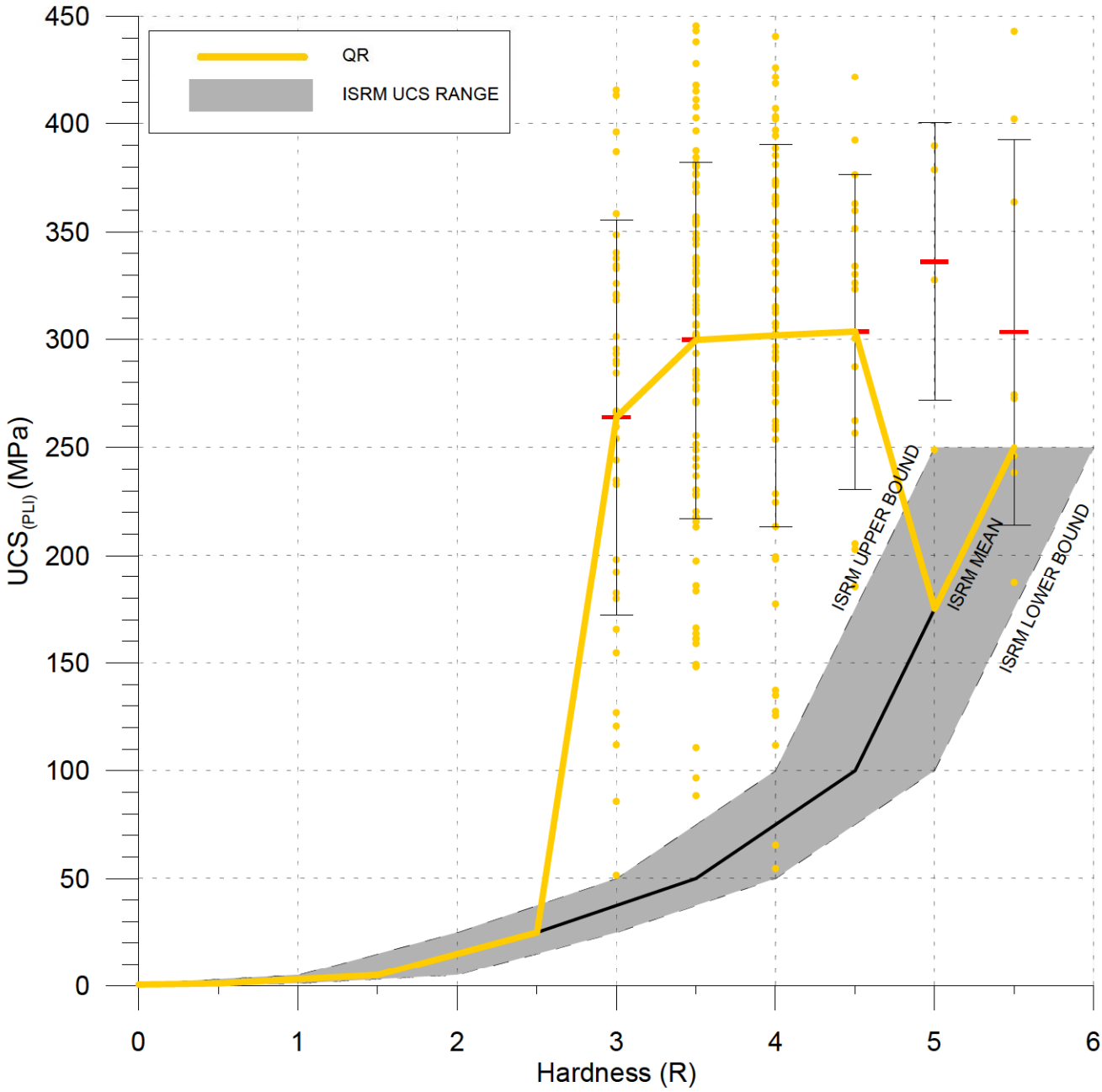
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$UCS_{(PLI)}$ VERSUS HARDNESS FOR THE QUARTZ ROCK MICA SCHIST GEOTECHNICAL UNIT POINT LOAD INDEX DATABASE

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C8

H:\Project\1846\2015-06 slope design updates\Testing\PLT\Fig_UCS-PLI_QR.grf



Notes:

1. Range of UCS shown in grey shading based on ISRM (1981).
2. Hardness estimates and PLI results plotted for core runs retrieved during the 2015 Pit Irène drilling program.
3. UCS derived from PLI tests based on a correlation factor (K) of 32 determined by correlation of UCS vs $I_{s(50)}$.
4. Vertical error bars shown for each Hardness category (red dashes indicate category average, black dashes indicate standard deviations).

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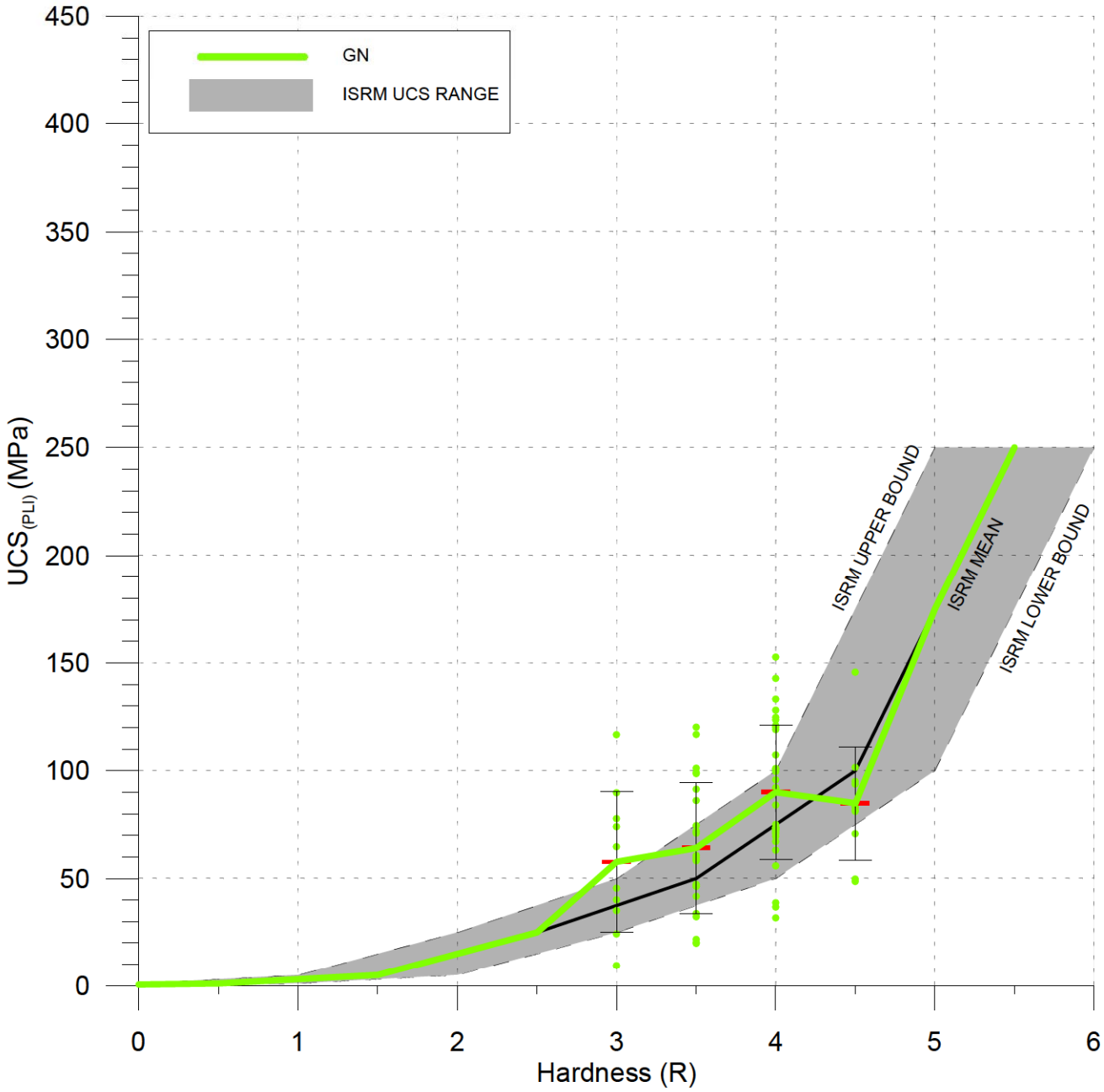
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$UCS_{(PLI)}$ VERSUS HARDNESS FOR THE QUARTZ ROCK GEOTECHNICAL UNIT POINT LOAD INDEX DATABASE

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C9

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Notes:

1. Range of UCS shown in grey shading based on ISRM (1981).
2. Hardness estimates and PLI results plotted for core runs retrieved during the 2015 Pit Irène drilling program.
3. UCS derived from PLI tests based on a correlation factor (K) of 19 determined by correlation of UCS vs $I_{s(50)}$.
4. Vertical error bars shown for each Hardness category (red dashes indicate category average, black dashes indicate standard deviations).

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2015 GEOTECHNICAL ASSESSMENT

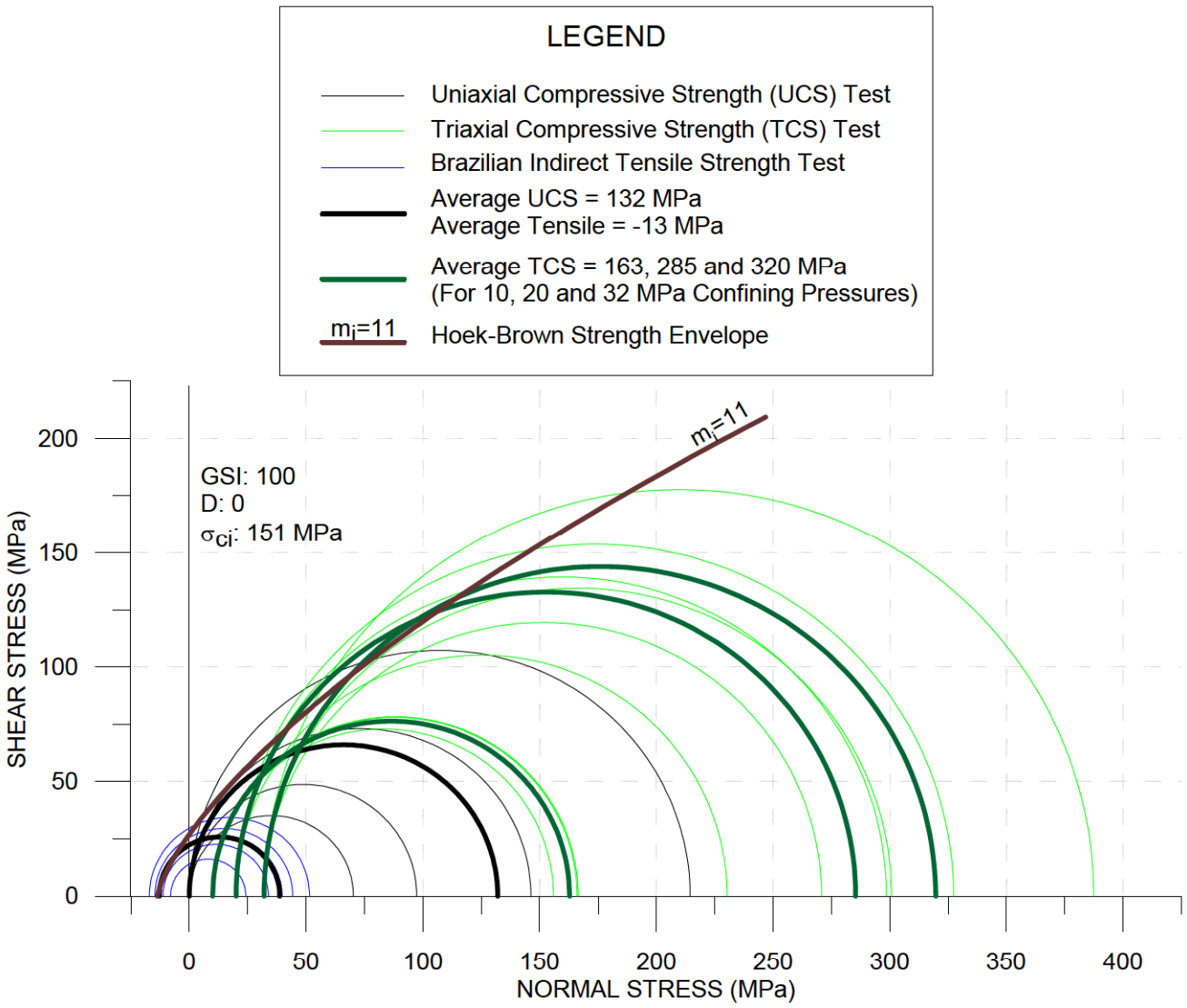
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$UCS_{(PLI)}$ VERSUS HARDNESS FOR THE GNEISS GEOTECHNICAL UNIT
POINT LOAD INDEX DATABASE

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C10

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AMPHIBOLITE (AMP)



Notes:
1. Laboratory testing carried out by AMEC's laboratory in Hamilton, Ontario (Appendix D).
2. Refer to Tables C1 to C3 for summary of testing results.
3. Bolded black Mohr circles show averages of UCS and Brazilian strength testing.
4. Bolded green Mohr circles show averages of TCS strength testing for confining pressures of 10, 20 and 32 MPa.

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2015 GEOTECHNICAL ASSESSMENT

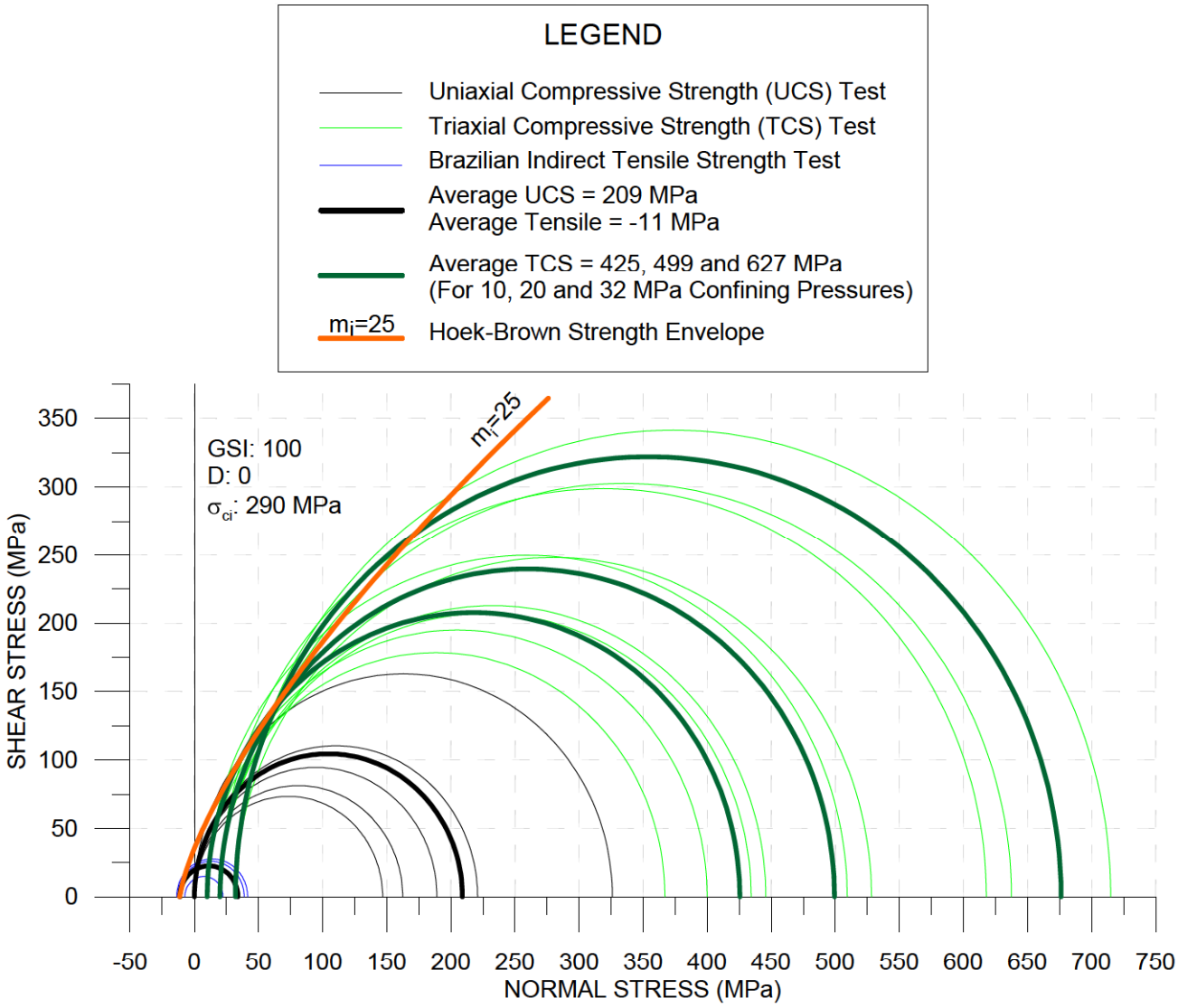
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PLOT OF MOHR CIRCLES FROM UCS, TRIAXIAL, AND BRAZILIAN TENSILE STRENGTH LABORATORY TESTING DATA FOR THE AMPHIBOLITE GEOTECHNICAL UNIT

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C11

H:\Project\1846\2015-06 slope design updates\Testing\Mohr Circles\Mohr_IF_Portrait.grf

IRON FORMATION (IF)



Notes:
1. Laboratory testing carried out by AMEC's laboratory in Hamilton, Ontario (Appendix D).
2. Refer to Tables C1 to C3 for summary of testing results.
3. Bolded black Mohr circles show averages of UCS and Brazilian strength testing.
4. Bolded green Mohr circles show averages of TCS strength testing for confining pressures of 10, 20 and 32 MPa.

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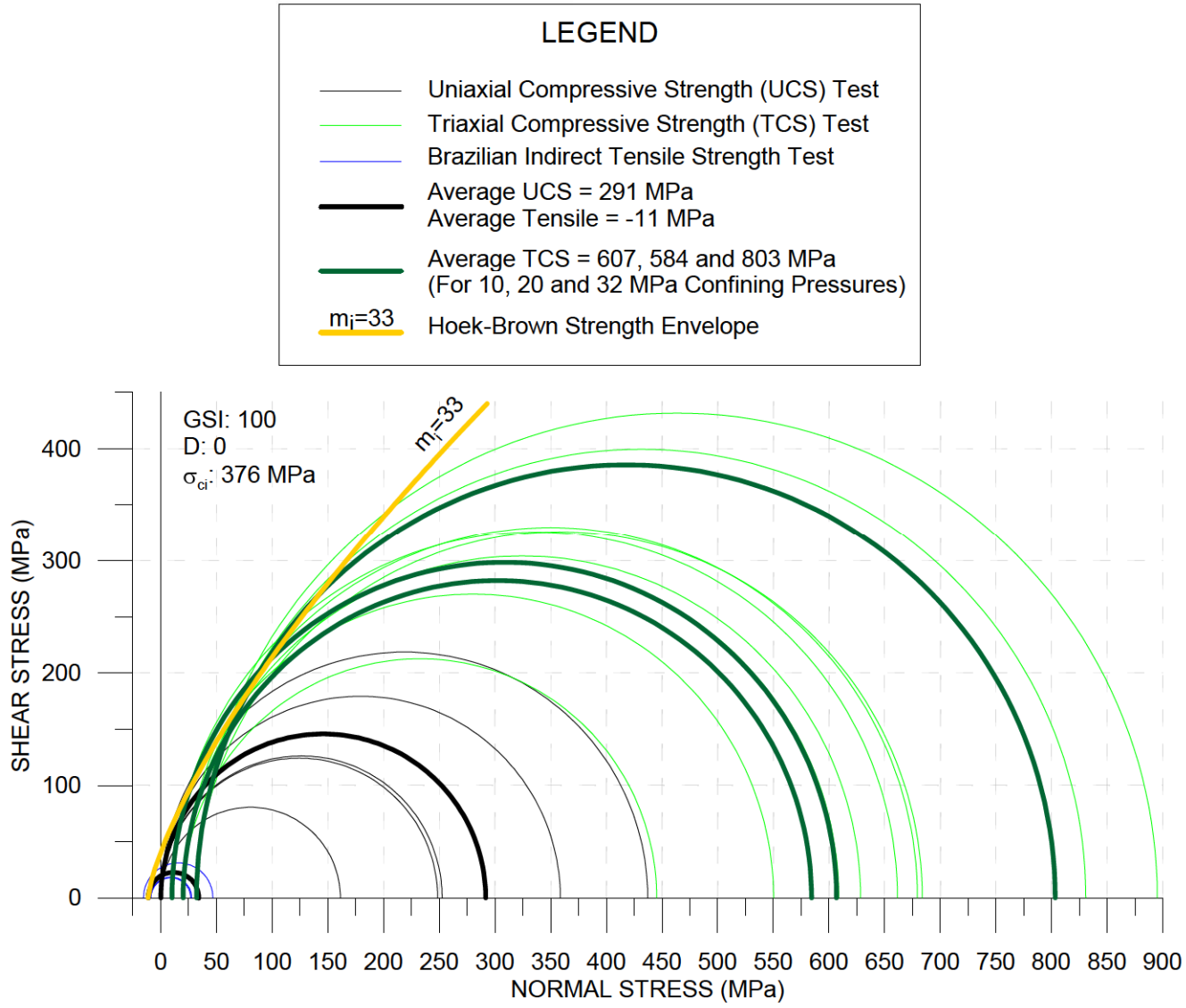
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PLOT OF MOHR CIRCLES FROM UCS, TRIAXIAL, AND BRAZILIAN TENSILE STRENGTH LABORATORY TESTING DATA FOR THE IRON FORMATION GEOTECHNICAL UNIT

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C12

H:\Project\1846\2015-06 slope design updates\Testing\Mohr Circles\Mohr_QR_Portrait.grf

QUARTZ ROCK (QR)



Notes:
1. Laboratory testing carried out by AMEC's laboratory in Hamilton, Ontario (Appendix D).
2. Refer to Tables C1 to C3 for summary of testing results.
3. Bolded black Mohr circles show averages of UCS and Brazilian strength testing.
4. Bolded green Mohr circles show averages of TCS strength testing for confining pressures of 10, 20 and 32 MPa.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

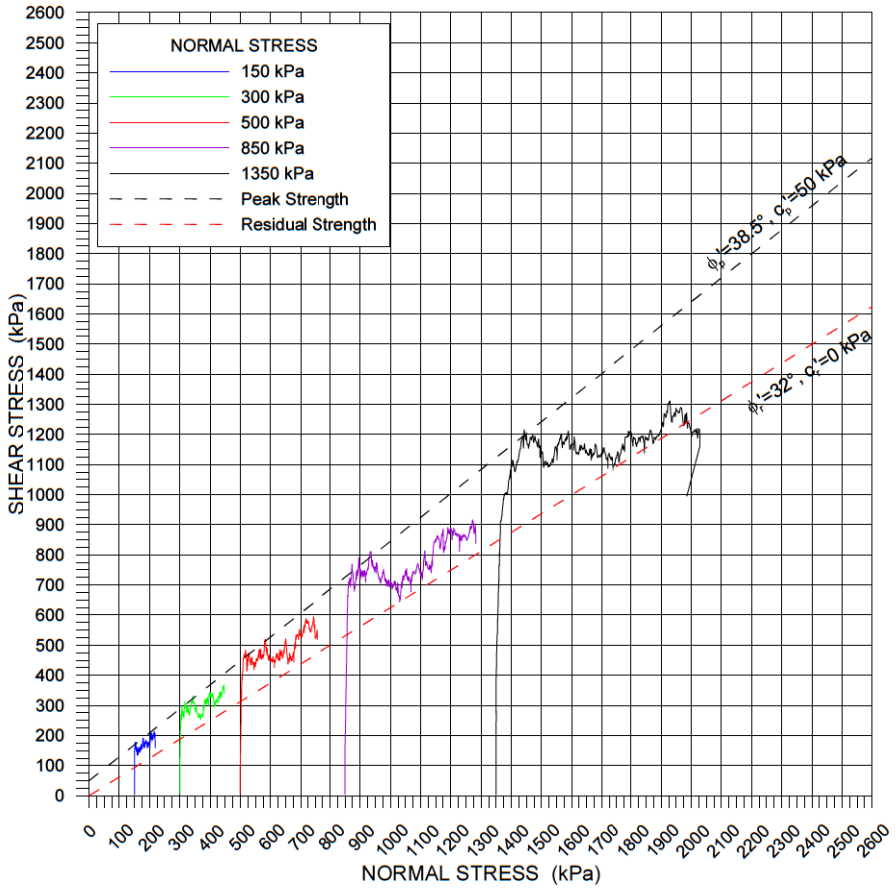
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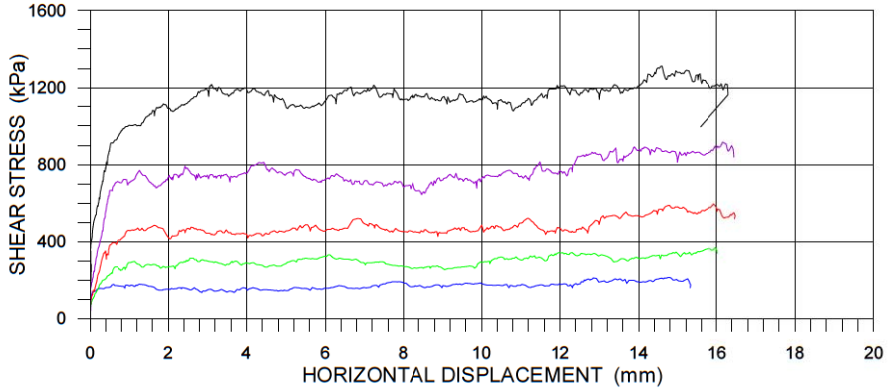
PLOT OF MOHR CIRCLES FROM UCS, TRIAXIAL, AND BRAZILIAN TENSILE STRENGTH LABORATORY TESTING DATA FOR THE QUARTZ ROCK GEOTECHNICAL UNIT

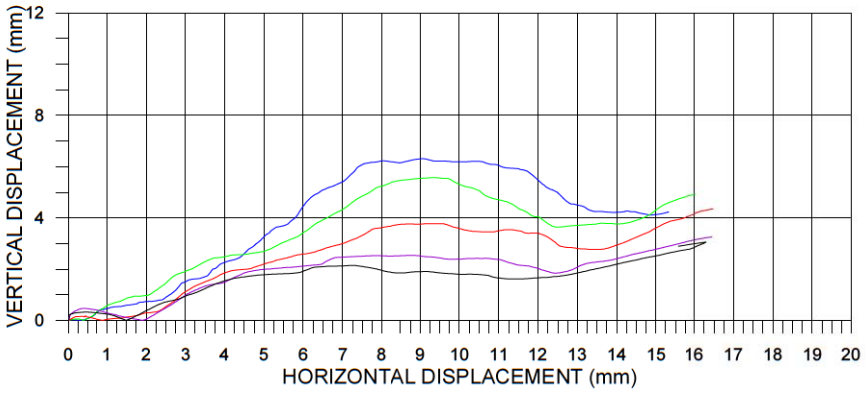
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C13

H:\Project\1846\2015-06 slope design updates\Testing\DS\AMP_DS-I002A-02_combined.grf

DS-I002A-02
AMPHIBOLITE







Note:
1. Normal and shear stresses corrected for changes in area during testing.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

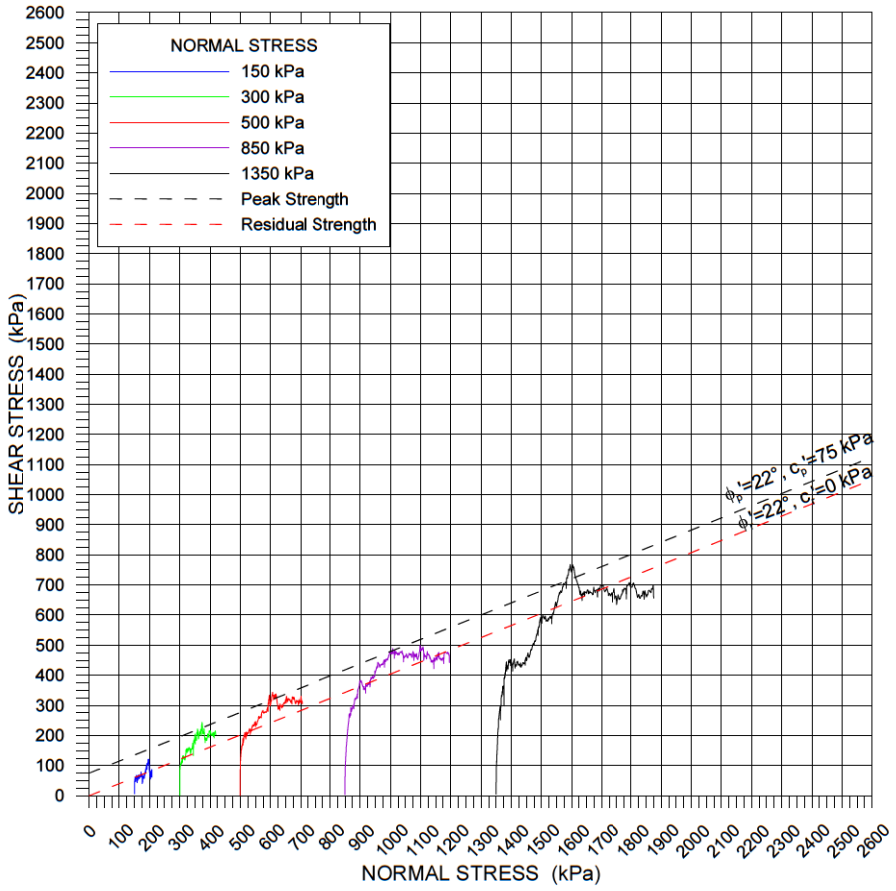
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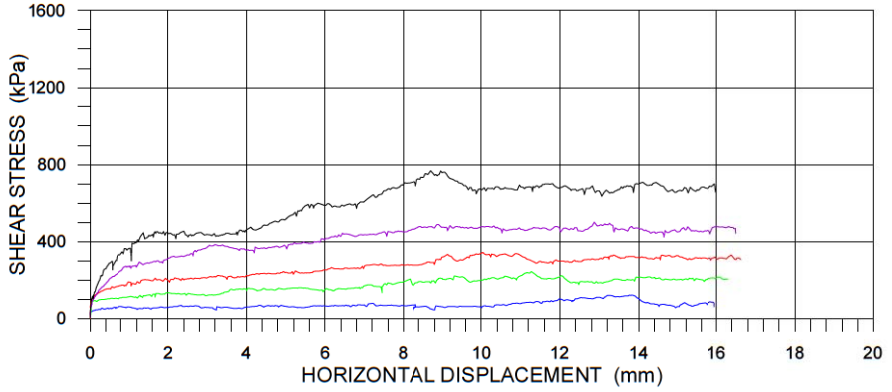
2015 DIRECT SHEAR TESTING ON JOINT
AMPHIBOLITE
SAMPLE DS-I002A-02

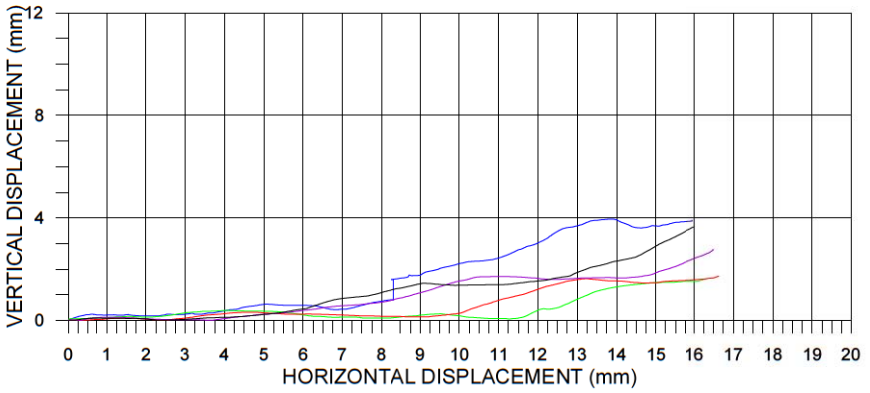
BY: JL | DATE: NOV 15
APPROVED: GG | FIG: C14

H:\Project\1846\2015-06 slope design updates\Testing\DS\AMP_DS-I003-01_combined.grf

DS-I003-01
AMPHIBOLITE







Note:
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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

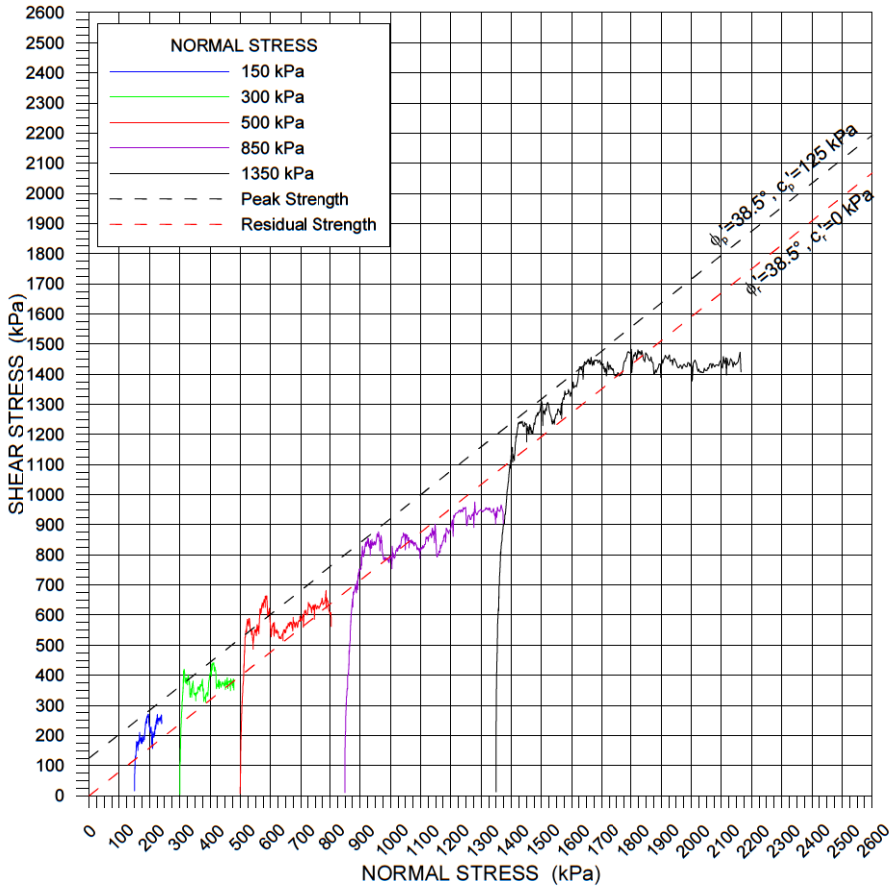
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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

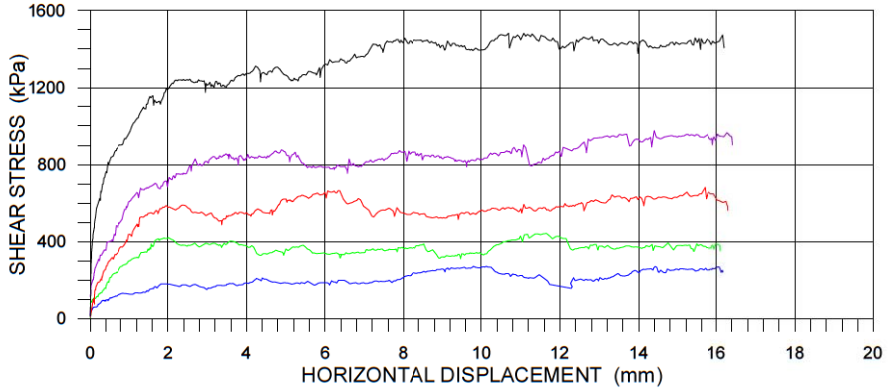
2015 DIRECT SHEAR TESTING ON BEDDING JOINT
AMPHIBOLITE
SAMPLE DS-I003-01

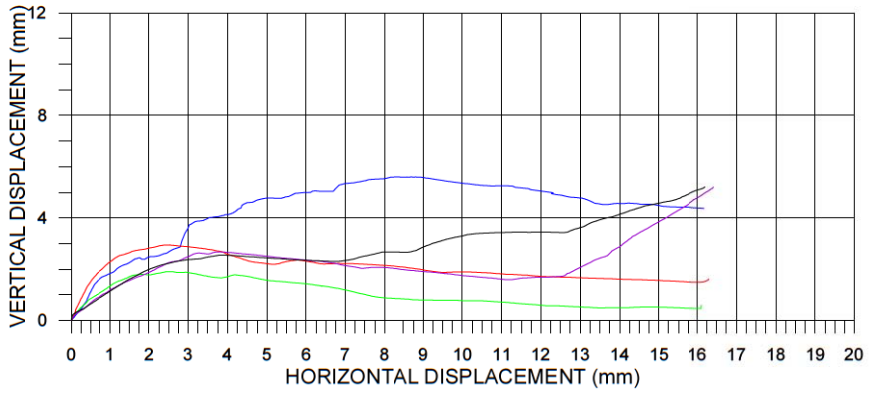
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C15

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DS-I003-02
AMPHIBOLITE







Note:
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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

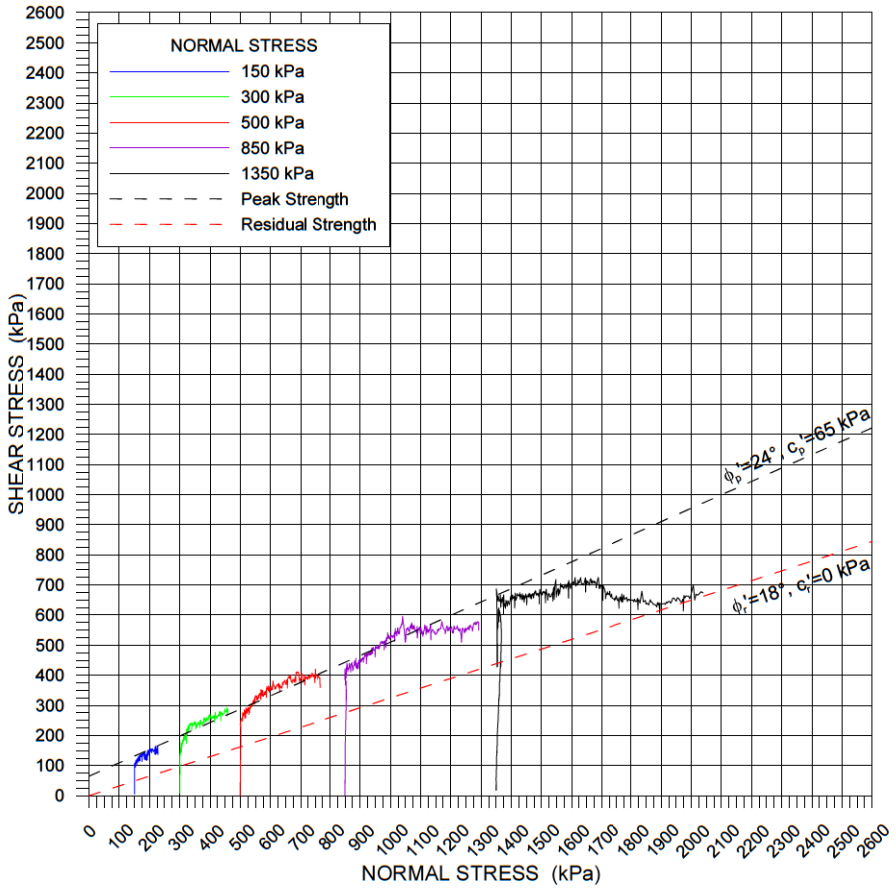
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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

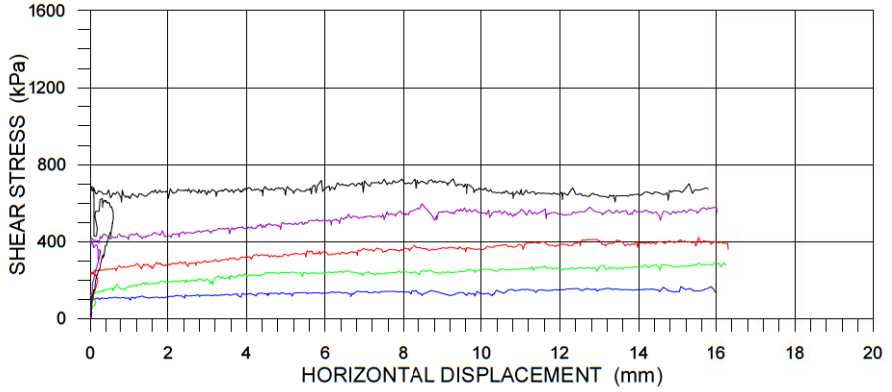
2015 DIRECT SHEAR TESTING ON JOINT
AMPHIBOLITE
SAMPLE DS-I003-02

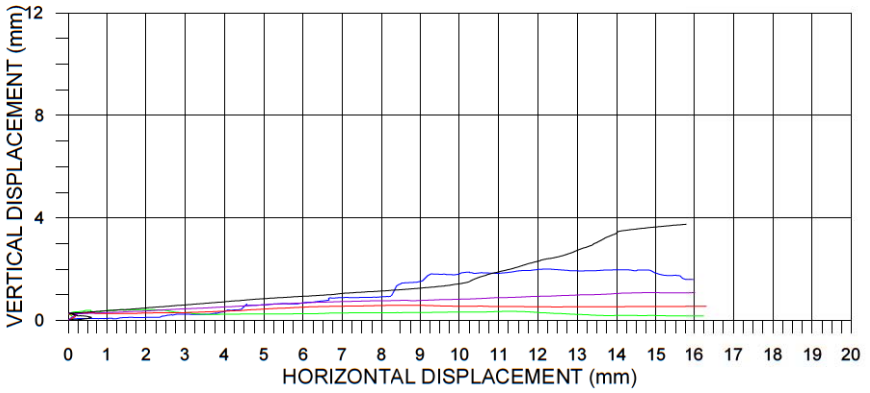
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C16

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DS-I009-01
AMPHIBOLITE







Note:
1. Normal and shear stresses corrected for changes in area during testing.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

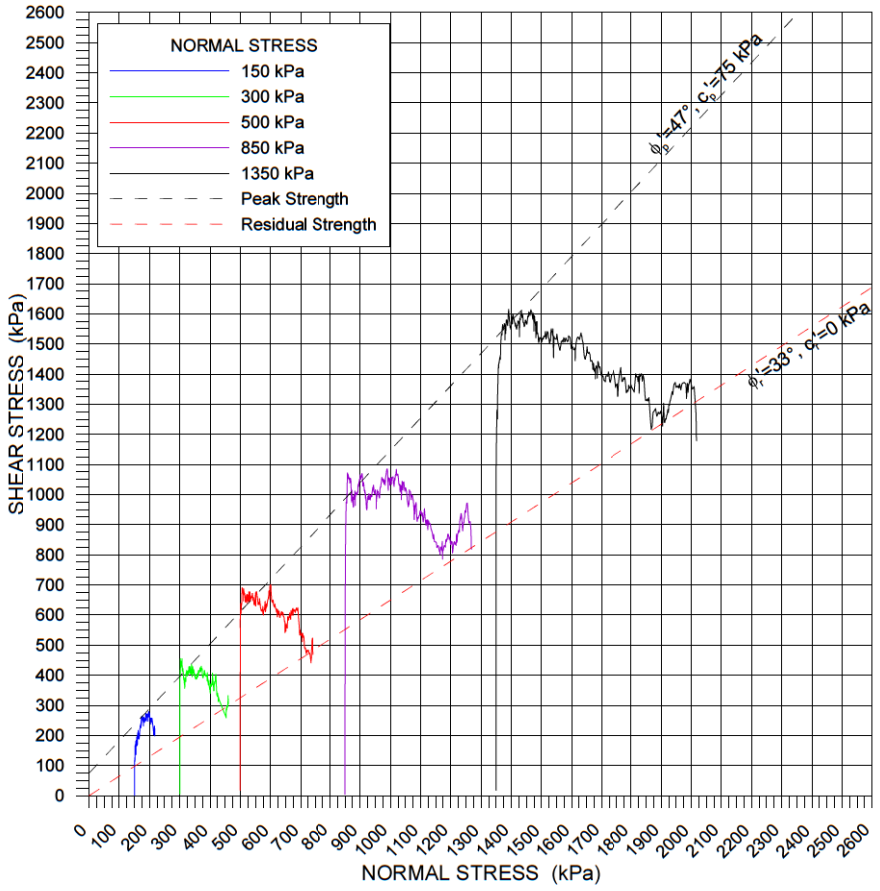
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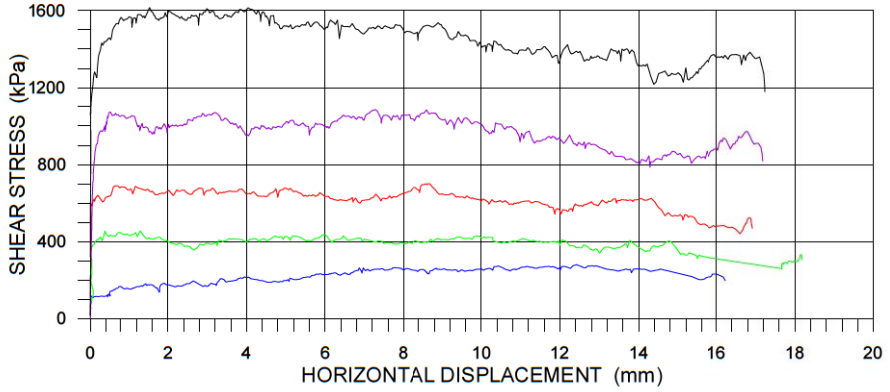
2015 DIRECT SHEAR TESTING ON JOINT
AMPHIBOLITE
SAMPLE DS-I009-01

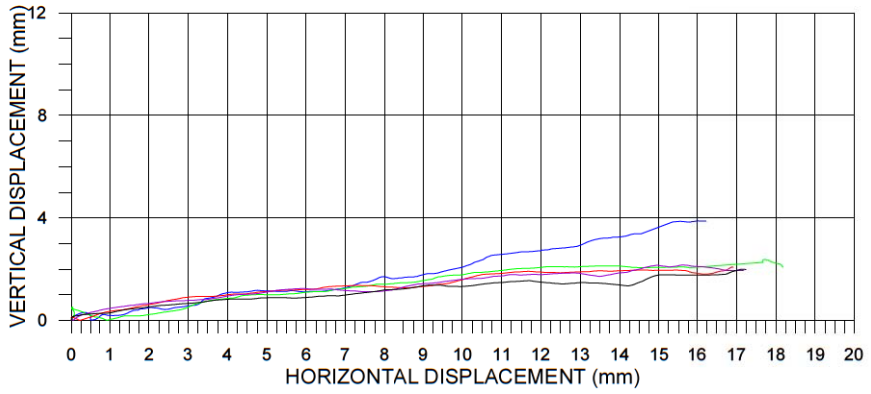
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C17

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DS-I014-02
AMPHIBOLITE







Note:
1. Normal and shear stresses corrected for changes in area during testing.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

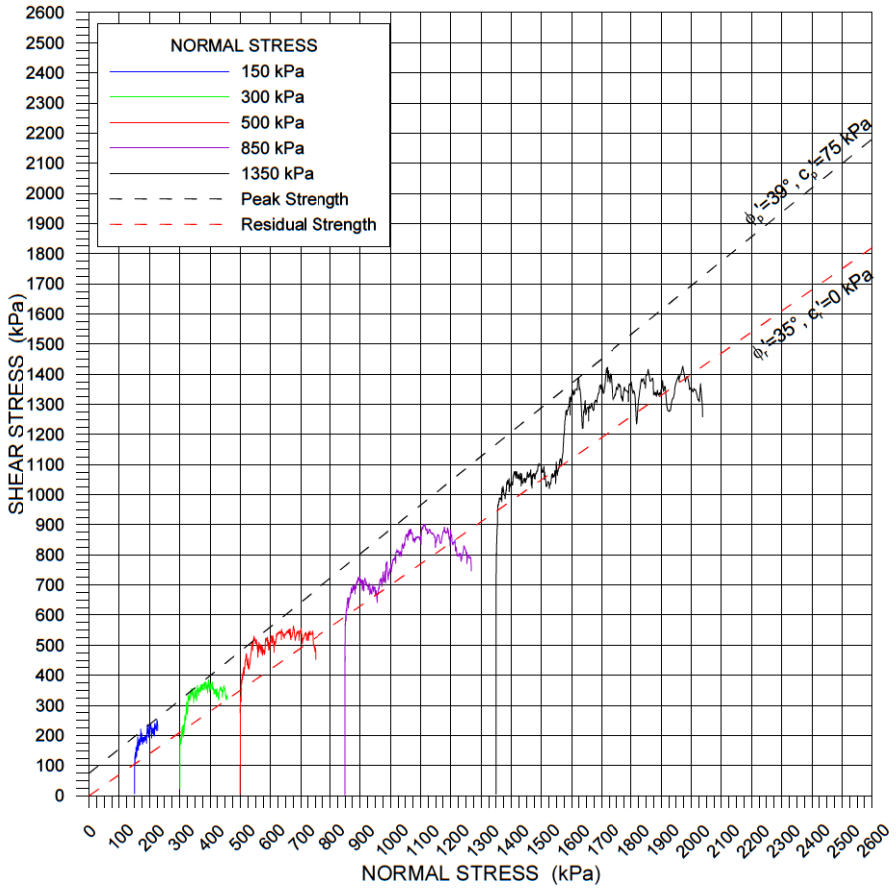
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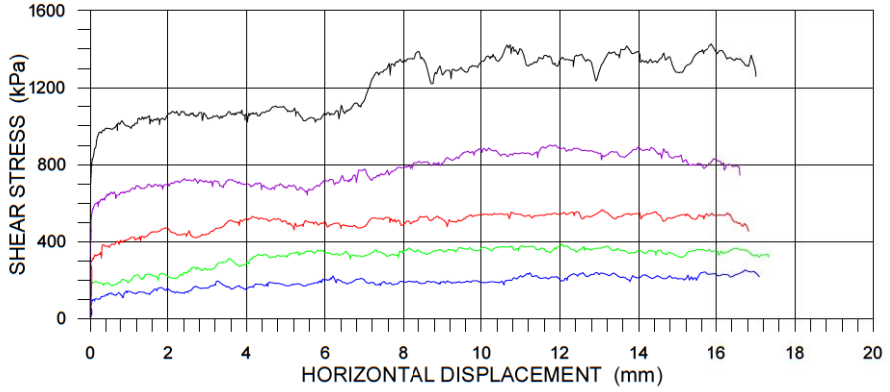
2015 DIRECT SHEAR TESTING ON JOINT
AMPHIBOLITE
SAMPLE DS-I014-02

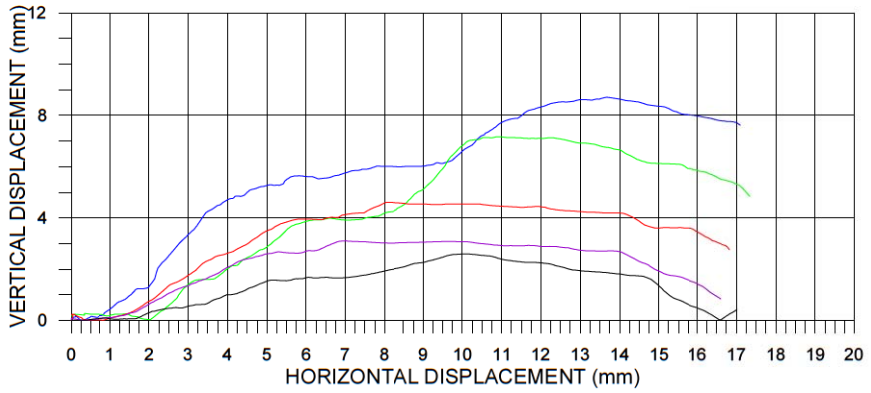
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C18

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DS-I005-01
IRON FORMATION







Note:
1. Normal and shear stresses corrected for changes in area during testing.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

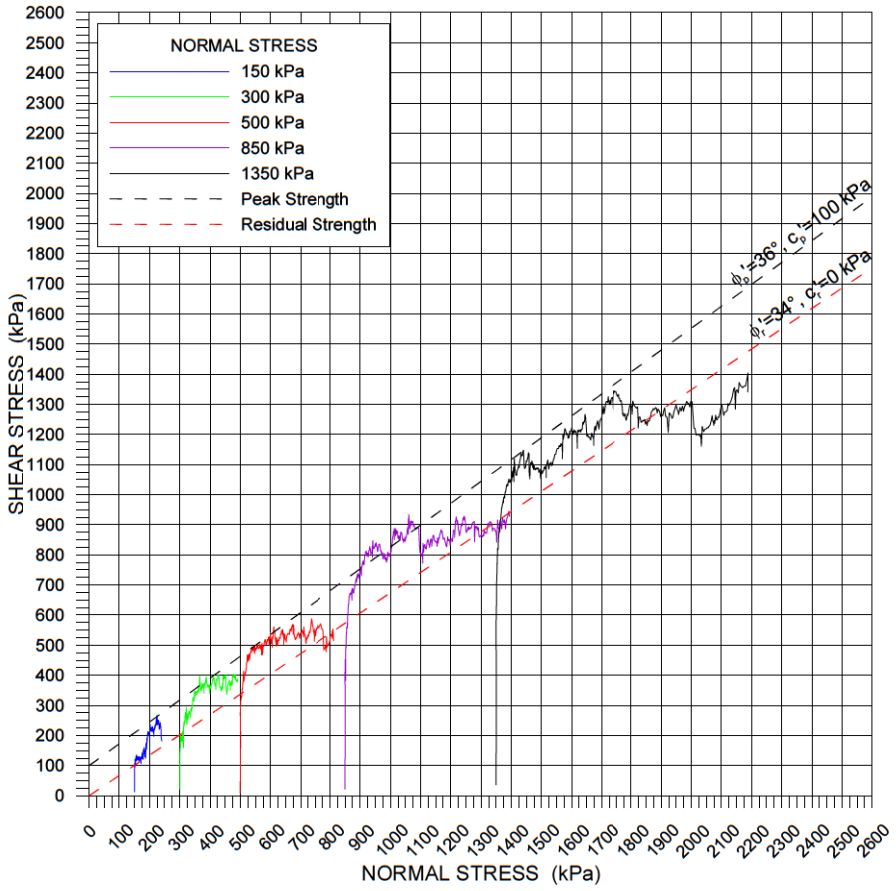
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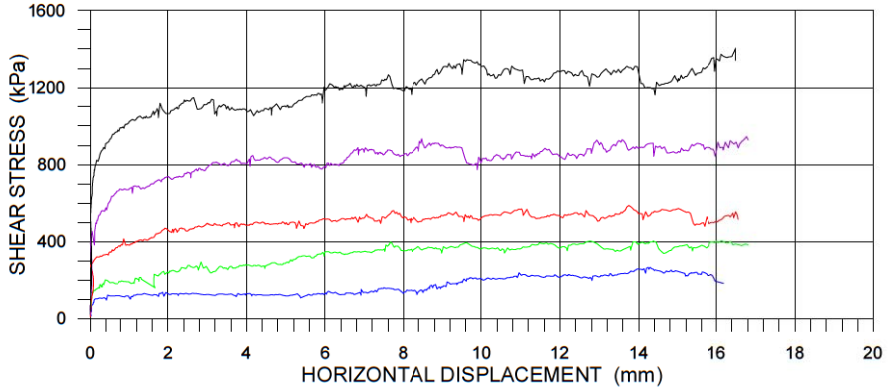
2015 DIRECT SHEAR TESTING ON JOINT
IRON FORMATION
SAMPLE DS-I005-01

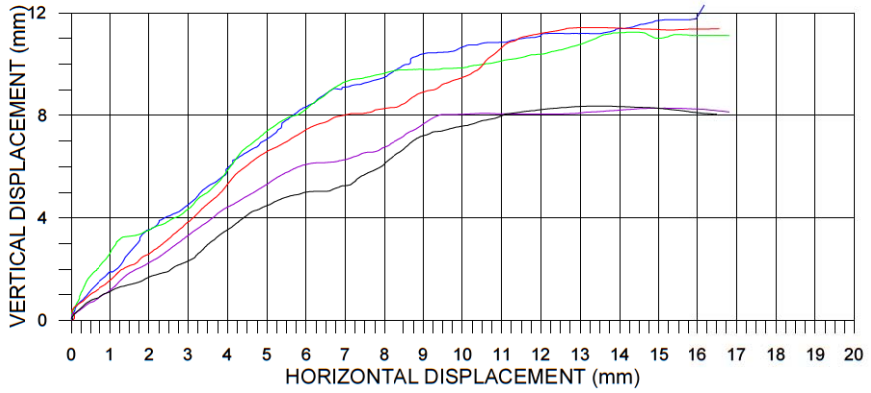
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C19

H:\Project\1846\2015-06 slope design updates\Testing\DS\IF_DS-I010-03_combined.grf

DS-I010-03
IRON FORMATION







Note:
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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

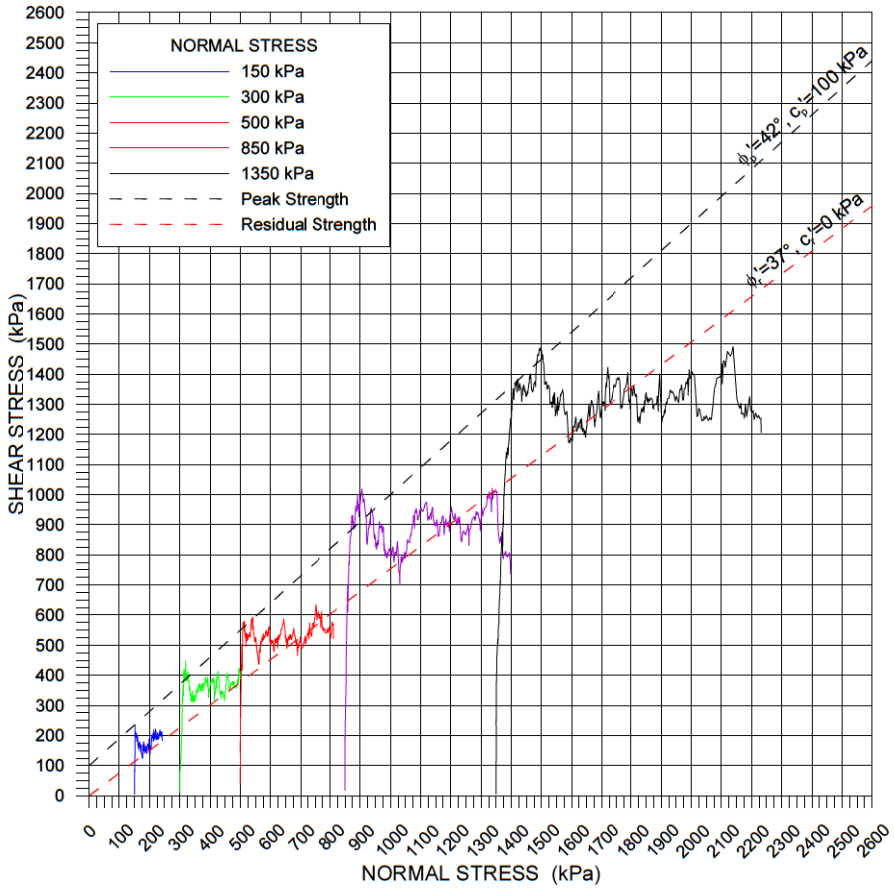
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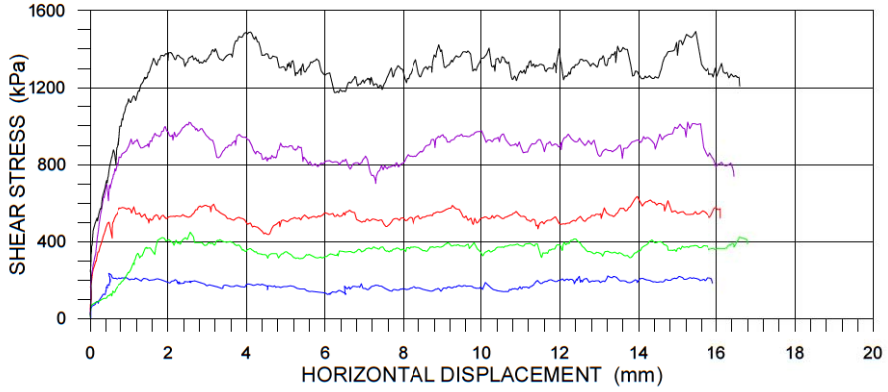
2015 DIRECT SHEAR TESTING ON JOINT
IRON FORMATION
SAMPLE DS-I010-03

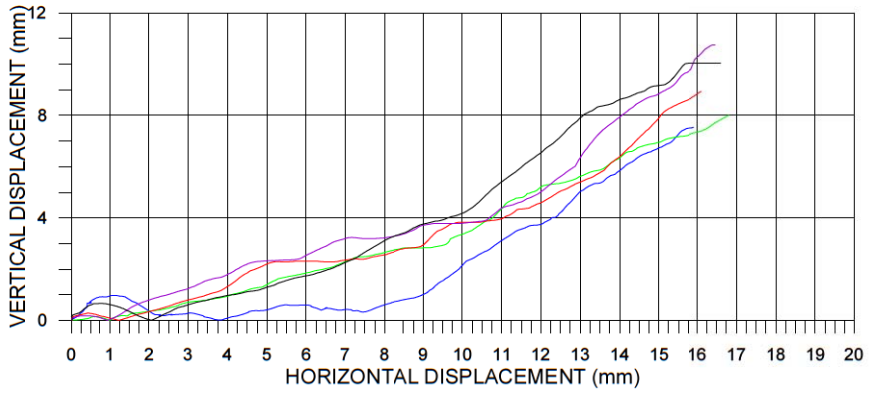
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C20

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DS-I010-04
IRON FORMATION







Note:
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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

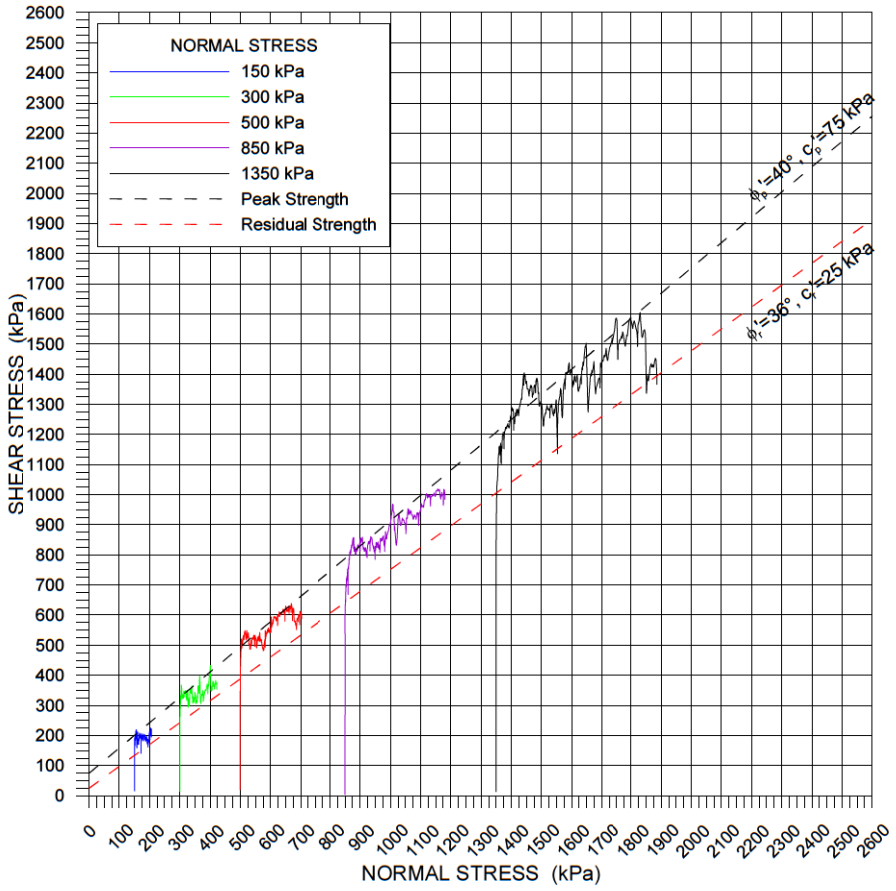
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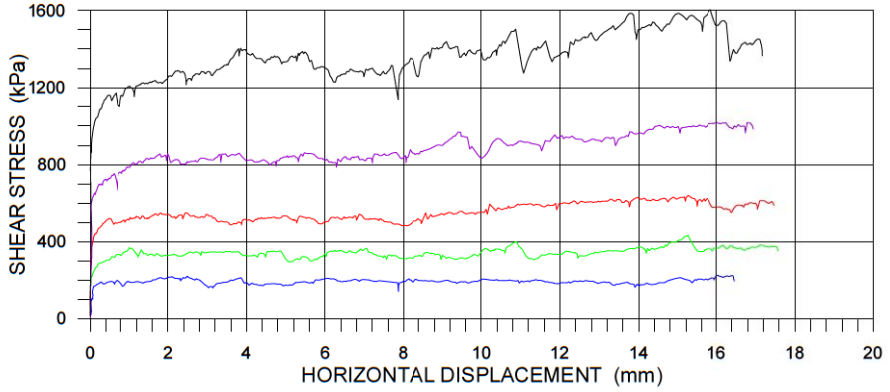
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IRON FORMATION
SAMPLE DS-I010-04

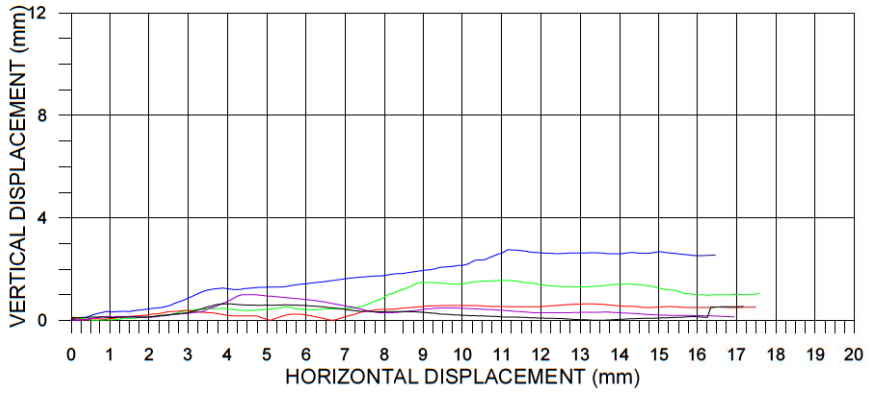
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C21

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DS-I013-02
IRON FORMATION







Note:
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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

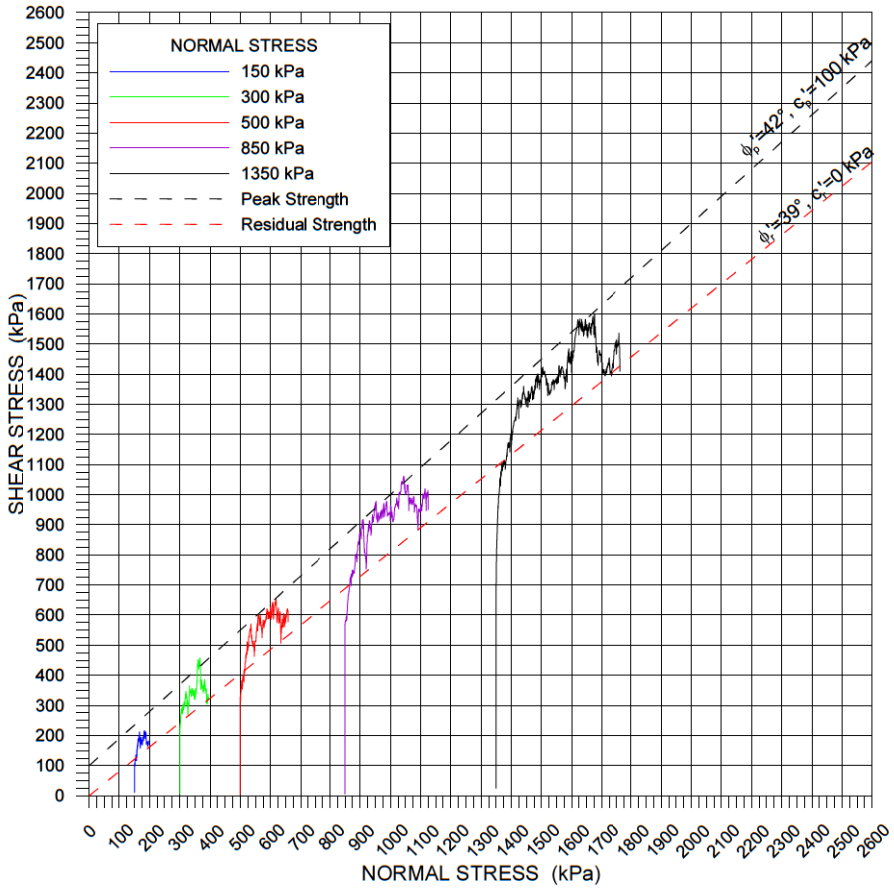
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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

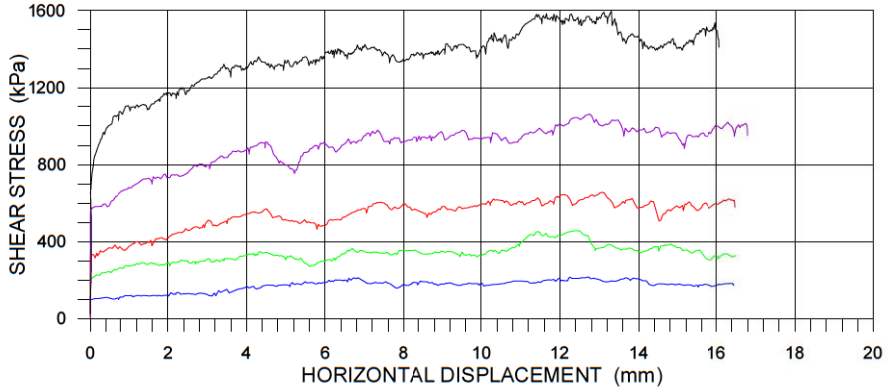
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IRON FORMATION
SAMPLE DS-I013-02

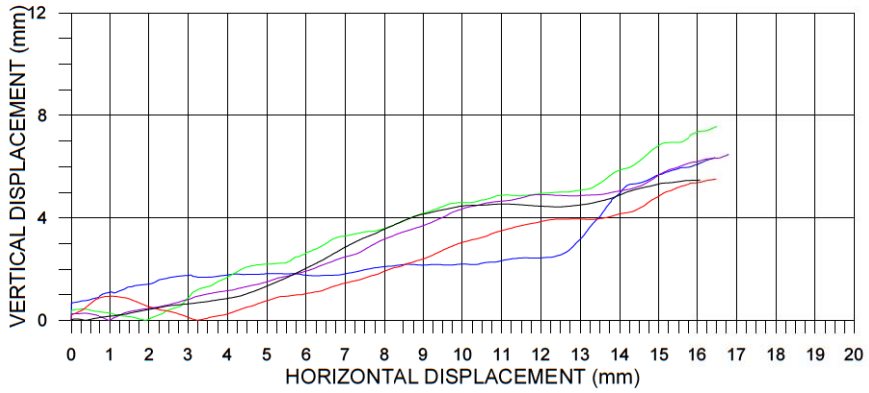
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C22

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DS-I014-01
IRON FORMATION







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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

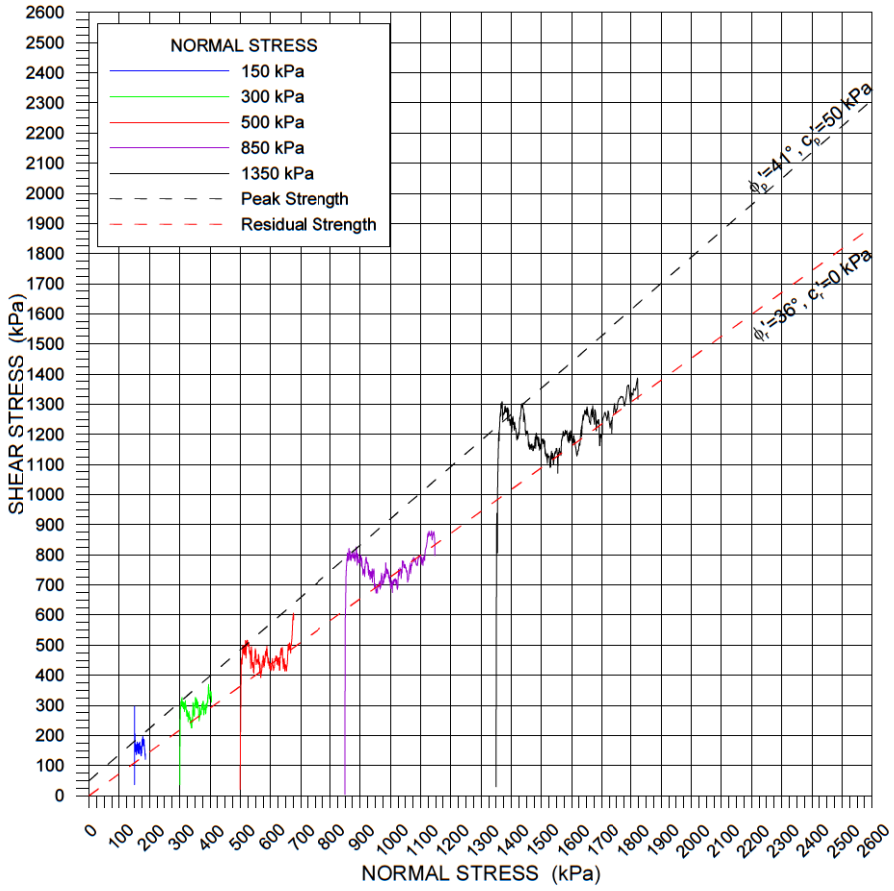
PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

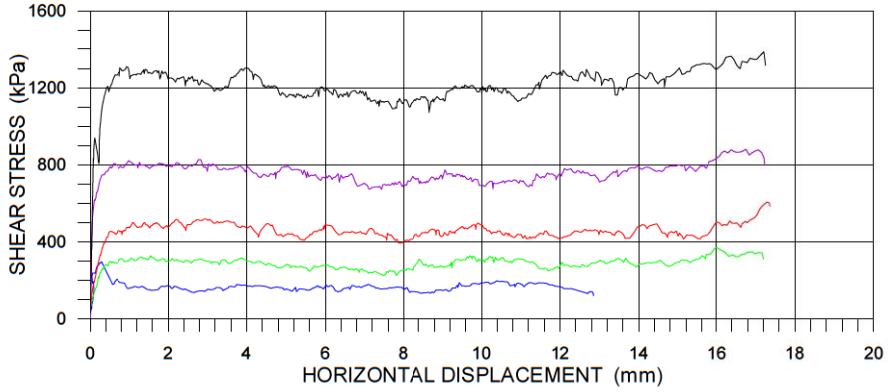
2015 DIRECT SHEAR TESTING ON JOINT
IRON FORMATION
SAMPLE DS-I014-01

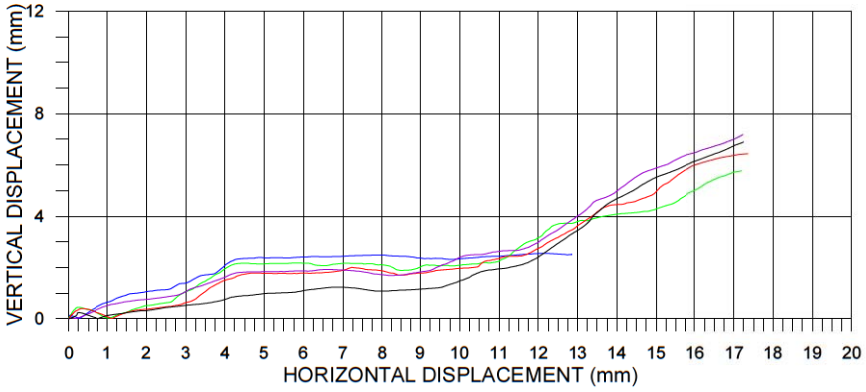
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C23

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DS-I002A-01
QUARTZ ROCK







Note:
1. Normal and shear stresses corrected for changes in area during testing.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

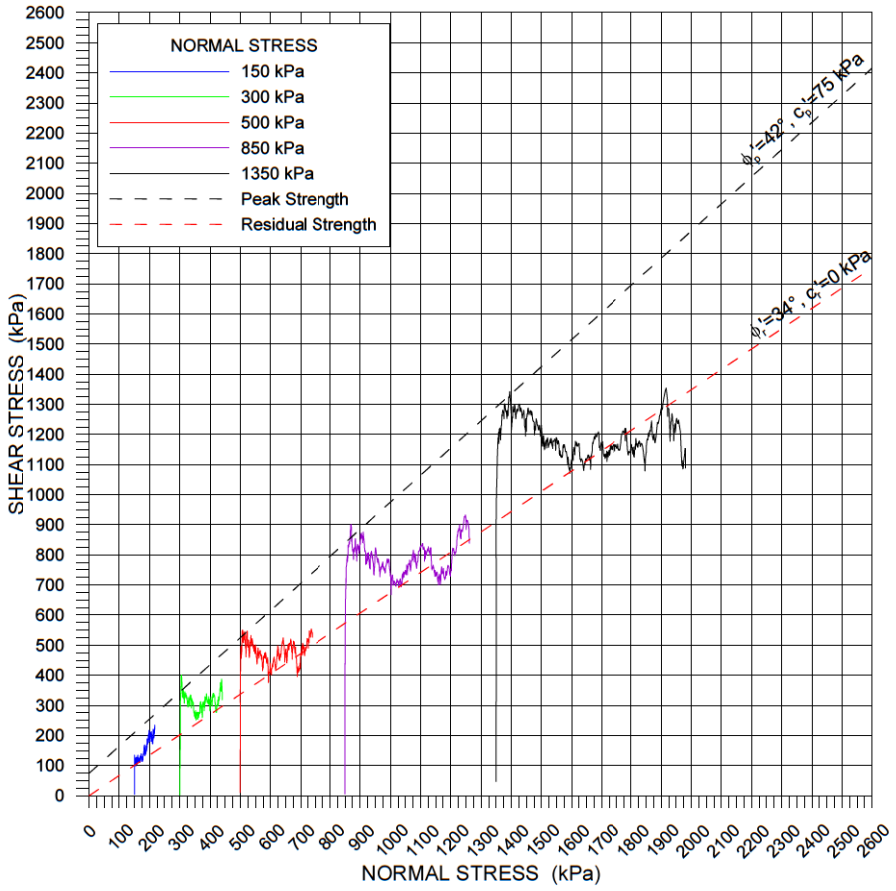
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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

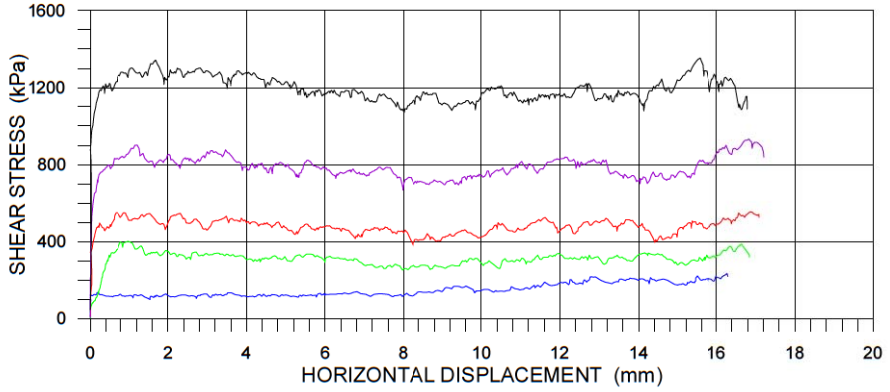
2015 DIRECT SHEAR TESTING ON JOINT
QUARTZ ROCK
SAMPLE DS-I002A-01

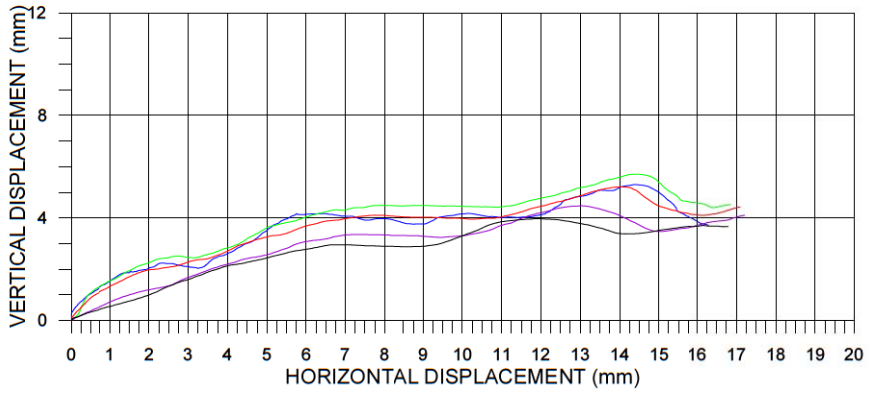
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C24

H:\Project\1846\2015-06 slope design updates\Testing\DS\QR_DS-I007-01_combined.grf

DS-I007-01
QUARTZ ROCK







Note:
1. Normal and shear stresses corrected for changes in area during testing.

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

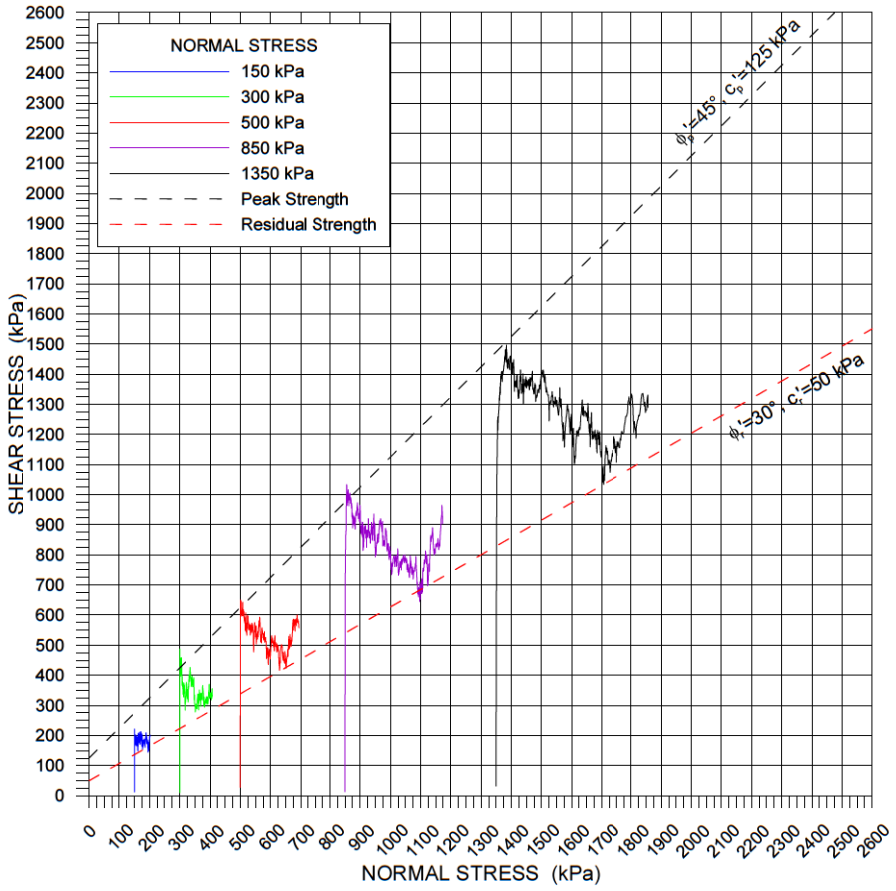
PITEAU ASSOCIATES
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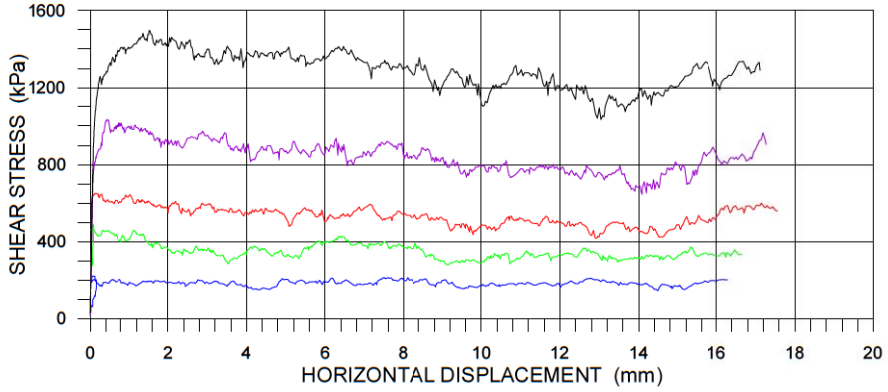
2015 DIRECT SHEAR TESTING ON JOINT
QUARTZ ROCK
SAMPLE DS-I007-01

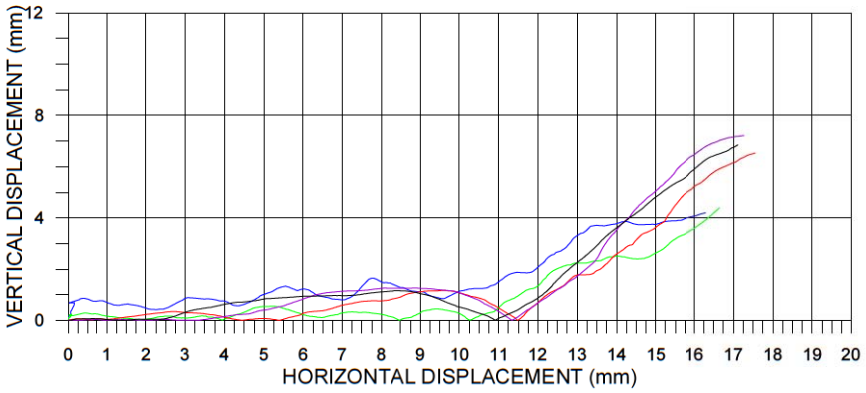
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C25

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DS-I008-02
QUARTZ ROCK







Note:
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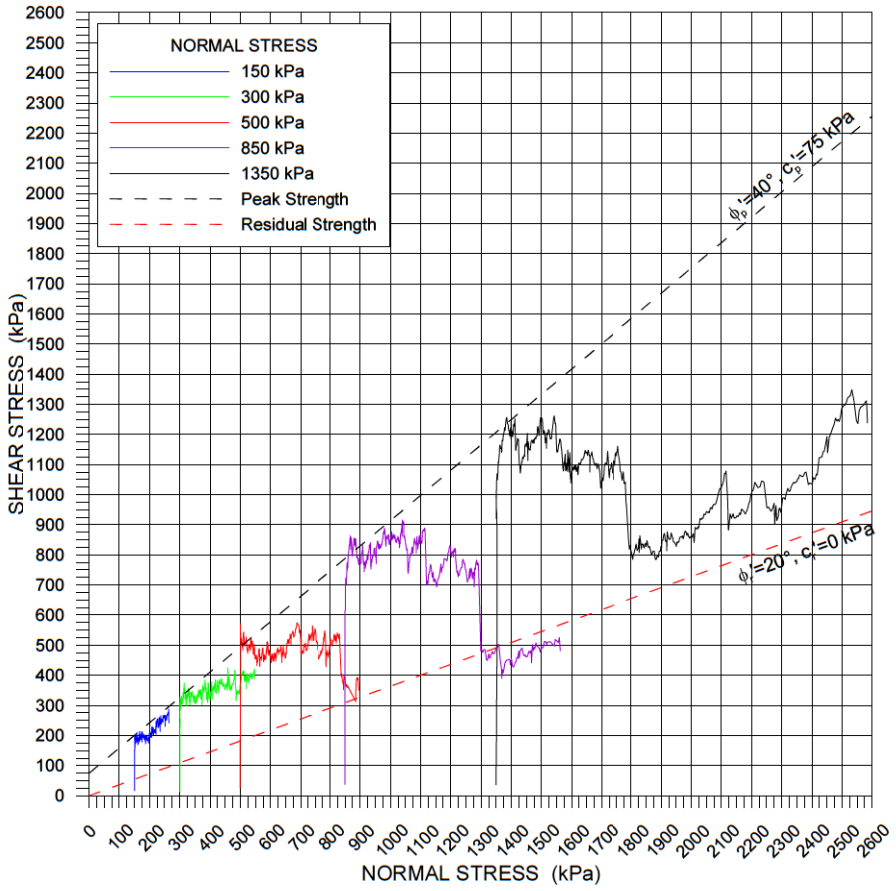
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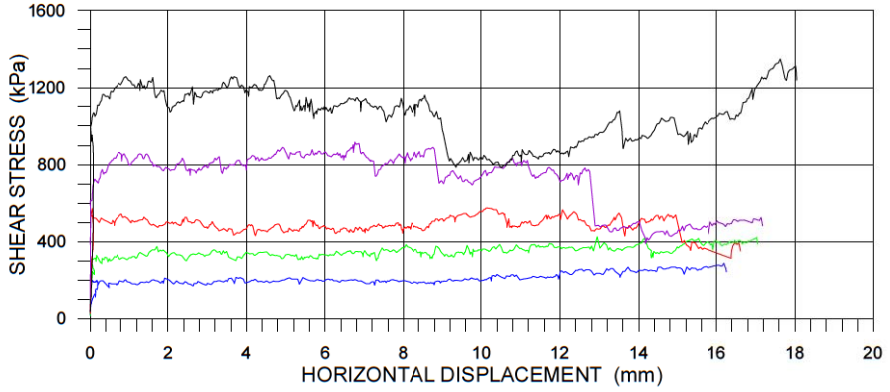
2015 DIRECT SHEAR TESTING ON JOINT
QUARTZ ROCK
SAMPLE DS-I008-02

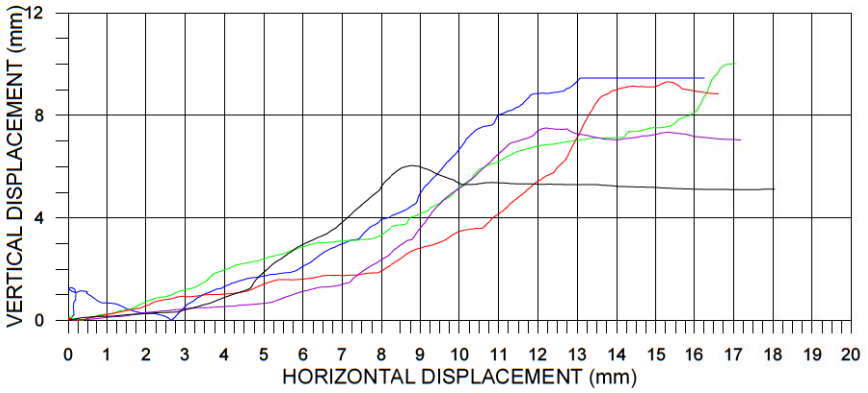
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C26

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DS-I010-01
QUARTZ ROCK







Note:
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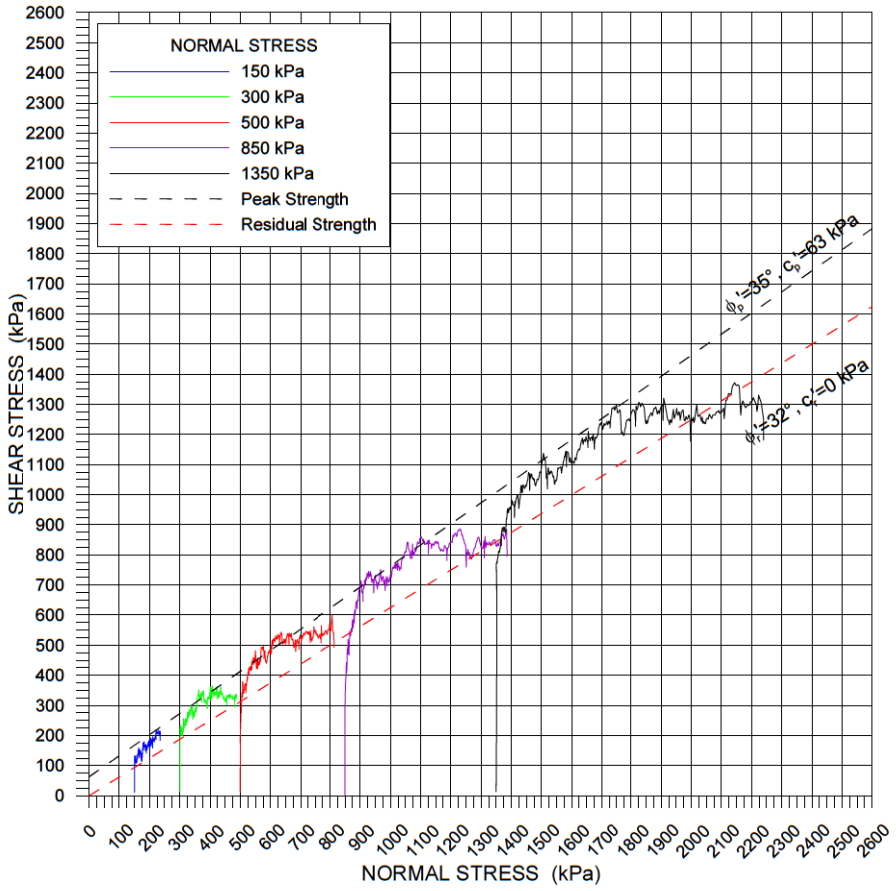
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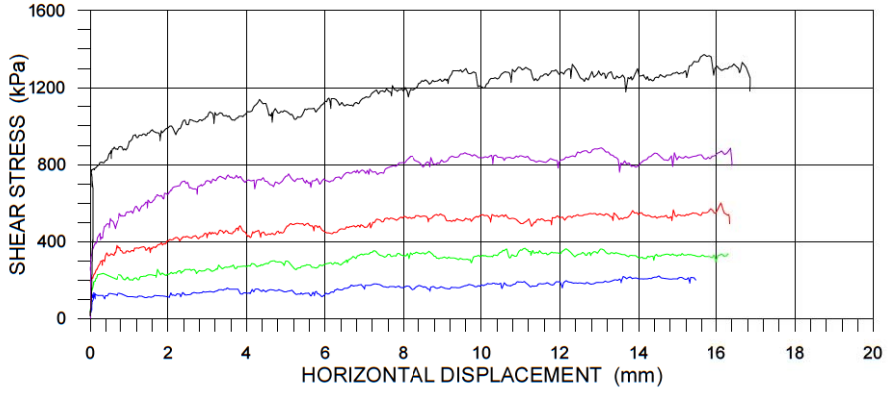
2015 DIRECT SHEAR TESTING ON JOINT
QUARTZ ROCK
SAMPLE DS-I010-01

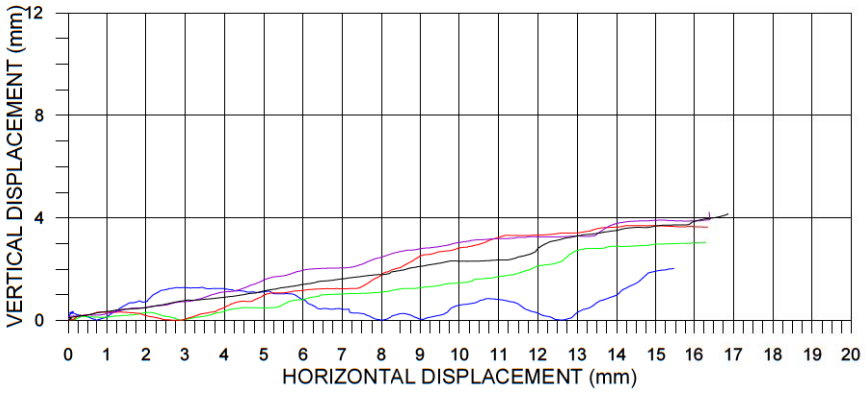
BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C27

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DS-I012-01
QUARTZ ROCK







Note:
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2015 DIRECT SHEAR TESTING ON JOINT
QUARTZ ROCK
SAMPLE DS-I012-01

BY:	DATE:
JL	NOV 15
APPROVED:	FIG:
GG	C28

APPENDIX D

AMEC FOSTER WHEELER
LABORATORY ROCK STRENGTH TESTING REPORT

30 October 2015

File: TB152053

Piteau Associates
Suite 300 – 788 Copping Street
North Vancouver, British Columbia
V7M 3G6

Attention: Ms. Lesley Sandve, B.A.Sc., E.I.T. (BC)

Re: LABORATORY TESTING OF ROCK CORE

This report summarizes laboratory testing conducted by Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler), on rock core samples received in the Amec Foster Wheeler rock mechanics laboratory in Hamilton, Ontario. The test results reported here include unconfined and confined compressive strengths, splitting tensile strength and direct shear strength.

A total of seventy-two (72) test specimens were prepared and tested from one-hundred-one (101) core samples received in the Amec Foster Wheeler laboratory. Core samples were NQ3 drill size, nominally 45.0mm diameter. Testing was conducted in accordance with ASTM D3967, "Standard Test Method for Splitting Tensile Strength of Intact Rock Core Specimens", ASTM D7012, "Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures", and ASTM D5607, "Performing Laboratory Direct Shear Strength Tests of Rock Specimens Under Constant Normal Force". Summary tables of the test results are attached as are the pre-test and post-test photographs.

In some direct shear samples, a well-defined peak and residual shear stress was difficult to determine as the peak and residual stresses tended to rise and fall throughout the test. This could be caused by factors such as a build-up of joint material, undulations within the joint plane and inconsistencies in the nature of joint face asperities at various displacements. As such, the selection of the peak and residual shear stress is subject to interpretation. The displacement/shear stress plots are included in the report attachments and all raw data will be provided to aid in analysis should alternative peak and residual stress values be selected.

We trust that this information meets your current requirements. If you would like to discuss any portion of the above, please contact this office at your convenience.

Respectfully Submitted,

AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE

Reviewed by,

Kellen Shenton, B.Sc.
Project Scientist

Barry Shenton
Senior Materials Technologist

Amec Foster Wheeler Environment & Infrastructure
A Division of Amec Foster Wheeler Americas
505 Woodward Avenue, Unit #1
Hamilton, Ontario L8H 6N6
Tel +1 905 312-0700
Fax +1 905 312-0771
www.amec.com

Amec Foster Wheeler Environment & Infrastructure
Hamilton Rock Mechanics Lab
Test Data Summary

Sample #	Test	borehole #	Sample ID	Lithology Code	Depth from	Depth to	Length	Diameter	L/D	Mass dry	Density	load	UCS/TCS	Sigma 3	Splitting Tensile	Comments
							(mm)	(mm)		(gm)	(kg/m^3)	(kN)	(MPa)	(MPa)	(MPa)	
R4065	UCS	GT15-I002A	UCS-I002A-01	AMP	114.63	114.73	94.85	45.05	2.11	462.7	3060	111.9	70.2			Brittle failure along foliation plane.
R4066	UCS	GT15-I010	UCS-I010-02	AMP	99.55	99.65	94.84	44.75	2.12	468.2	3139	337.2	214.4			Brittle failure through intact rock.
R4067	UCS	GT15-I011	UCS-I011-02	AMP	102.71	102.81	94.62	44.69	2.12	453.4	3055	152.7	97.3			Brittle failure through intact rock.
R4068	UCS	GT15-I013	UCS-I013-01	AMP	117.30	117.40	94.84	44.92	2.11	460.1	3061	209.4	132.1			Brittle failure partially along healed joint.
R4069	UCS	GT15-I015	UCS-I015-01	AMP	114.61	114.71	94.84	45.09	2.10	464.7	3069	233.4	146.2			Brittle failure through intact rock.
R4070	UCS	GT15-I001	UCS-I001-01	IF	31.13	31.23	95.06	45.07	2.11	572.1	3772	519.9	325.9			Brittle failure through intact rock.
R4071	UCS	GT15-I005	UCS-I005-01	IF	75.70	75.80	94.92	44.93	2.11	557.3	3703	257.4	162.3			Brittle failure through intact rock.
R4072	UCS	GT15-I009	UCS-I009-01	IF	13.81	13.91	94.46	44.57	2.12	758.3	5145	228.9	146.7			Brittle failure through intact rock.
R4073	UCS	GT15-I011	UCS-I011-01	IF	55.09	55.19	94.72	44.95	2.11	485.3	3229	350.3	220.7			Brittle failure through intact rock.
R4074	UCS	GT15-I012	UCS-I012-01	IF	110.39	110.49	95.23	44.71	2.13	461.6	3087	296.8	189.0			Brittle failure partially along foliation plane.
R4075	UCS	GT15-I003	UCS-I003-01	QR	98.25	98.35	94.71	44.97	2.11	401.2	2667	255.9	161.1			Brittle failure through intact rock.
R4076	UCS	GT15-I006	UCS-I006-01	QR	113.60	113.70	94.48	45.02	2.10	397.4	2642	570.7	358.5			Brittle failure through intact rock.
R4077	UCS	GT15-I007	UCS-I007-01	QR	177.72	177.82	94.21	44.91	2.10	394.2	2641	692.3	437.0			Brittle failure through intact rock.
R4078	UCS	GT15-I008	UCS-I008-01	QR	109.18	109.28	94.32	44.93	2.10	396.0	2648	393.8	248.4			Brittle failure through intact rock.
R4079	UCS	GT15-I011	UCS-I011-03	QR	131.97	132.07	92.83	44.93	2.07	386.4	2625	400.2	252.4			Brittle failure through intact rock.
R4080	TCS	GT15-I001	TCS-I001-04	AMP	102.45	102.55	95.02	44.88	2.12	459.4	3056	262.5	165.9	10.0		Brittle failure along foliation plane.
R4081	TCS	GT15-I002A	TCS-I002A-02	AMP	128.70	128.80	94.95	45.07	2.11	465.4	3072	476.2	298.5	20.0		Brittle failure through intact rock.
R4082	TCS	GT15-I008	TCS-I008-02	AMP	96.39	96.49	95.17	44.77	2.13	463.3	3092	262.0	166.4	10.0		Brittle failure through intact rock.
R4083	TCS	GT15-I010	TCS-I010-02	AMP	122.09	122.19	95.49	44.79	2.13	462.8	3076	610.3	387.3	32.0		Brittle failure through intact rock.
R4084	TCS	GT15-I011	TCS-I011-01	AMP	101.94	102.04	94.95	44.77	2.12	457.9	3063	362.4	230.2	20.0		Brittle failure through intact rock.
R4085	TCS	GT15-I012	TCS-I012-01	AMP	142.96	143.06	94.39	44.90	2.10	457.2	3059	476.1	300.7	32.0		Brittle failure through intact rock.
R4086	TCS	GT15-I013	TCS-I013-04	AMP	194.33	194.43	95.17	44.93	2.12	461.3	3057	429.2	270.7	32.0		Brittle failure through intact rock.
R4087	TCS	GT15-I014	TCS-I014-02	AMP	53.33	53.43	95.19	44.89	2.12	457.6	3037	246.6	155.8	10.0		Brittle failure along foliation plane.
R4088	TCS	GT15-I015	TCS-I015-01	AMP	50.72	50.82	95.06	44.70	2.13	455.1	3051	513.6	327.3	20.0		Brittle failure through intact rock.
R4089	TCS	GT15-I001	TCS-I001-01	IF	35.31	35.41	94.74	45.03	2.10	511.6	3391	983.9	617.8	20.0		Brittle failure through intact rock.
R4090	TCS	GT15-I001	TCS-I001-03	IF	91.18	91.28	94.84	44.97	2.11	524.4	3481	808.7	509.2	10.0		Brittle failure partially along foliation plane.
R4091	TCS	GT15-I002A	TCS-I002A-01	IF	75.89	75.99	94.52	45.10	2.10	494.2	3273	638.7	399.8	10.0		Brittle failure through intact rock.
R4092	TCS	GT15-I003	TCS-I003-06	IF	6.05	6.15	94.98	44.93	2.11	531.6	3530	837.3	528.1	32.0		Brittle failure through intact rock.
R4093	TCS	GT15-I004	TCS-I004-01	IF	98.38	98.48	95.00	44.65	2.13	646.4	4346	574.4	366.8	10.0		Brittle failure through intact rock.
R4094	TCS	GT15-I012	TCS-I012-03	IF	104.17	104.27	95.24	44.28	2.15	504.9	3443	686.2	445.6	20.0		Brittle failure through intact rock.
R4095	TCS	GT15-I013	TCS-I013-01	IF	26.21	26.31	94.90	44.84	2.12	782.2	5220	685.6	434.2	20.0		Brittle failure through intact rock.
R4096	TCS	GT15-I013	TCS-I013-03	IF	168.16	168.26	94.43	44.97	2.10	495.7	3305	1135.5	714.9	32.0		Brittle failure partially along foliation plane.
R4097	TCS	GT15-I014	TCS-I014-01	IF	139.01	139.11	94.34	44.84	2.10	523.2	3512	1006.4	637.3	32.0		Brittle failure partially along foliation plane.
R4098	TCS	GT15-I001	TCS-I001-02	QR	68.61	68.71	95.14	45.12	2.11	401.0	2636	1057.5	661.4	10.0		Brittle failure through intact rock.
R4099	TCS	GT15-I003	TCS-I003-02	QR	117.79	117.89	95.38	44.99	2.12	401.3	2647	1080.0	679.4	20.0		Brittle failure through intact rock.
R4100	TCS	GT15-I003	TCS-I003-03	QR	97.49	97.59	94.79	44.96	2.11	403.0	2678	706.6	445.1	20.0		Brittle failure through intact rock.
R4101	TCS	GT15-I003	TCS-I003-04	QR	92.53	92.63	94.54	44.95	2.10	399.6	2664	1420.1	894.9	32.0		Brittle failure through intact rock.
R4102	TCS	GT15-I003	TCS-I003-05	QR	71.08	71.18	93.97	44.77	2.10	392.2	2651	1307.7	830.7	32.0		Brittle failure through intact rock.
R4103	TCS	GT15-I006	TCS-I006-01	QR	143.57	143.67	94.07	45.10	2.09	398.4	2651	1092.2	683.7	32.0		Brittle failure through intact rock.
R4104	TCS	GT15-I007	TCS-I007-01	QR	161.35	161.45	95.24	44.96	2.12	399.6	2643	966.3	608.7	10.0		Brittle failure through intact rock.
R4105	TCS	GT15-I008	TCS-I008-01	QR	56.33	56.43	95.22	44.95	2.12	416.6	2757	997.0	628.3	20.0		Brittle failure through intact rock.
R4106	TCS	GT15-I008	TCS-I008-03	QR	155.92	156.02	94.40	44.91	2.10	396.0	2648	871.4	550.1	10.0		Brittle failure through intact rock.

Amec Foster Wheeler Environment & Infrastructure
Hamilton Rock Mechanics Lab
Test Data Summary

Sample #	Test	borehole #	Sample ID	Lithology Code	Depth from	Depth to	Length	Diameter	L/D	Mass dry	Density	load	UCS/TCS	Sigma 3	Splitting Tensile	Comments
							(mm)	(mm)		(gm)	(kg/m^3)	(kN)	(MPa)	(MPa)	(MPa)	
R4107	BTS	GT15-I002A	BTS-I002A-03	AMP	125.03	125.06	25.41	45.08	0.56	123.2	3038	20.3			11.3	Broke through intact rock.
R4108	BTS	GT15-I003	BTS-I003-01	AMP	177.71	177.74	25.03	44.86	0.56	121.2	3064	14.2			8.1	Broke through intact rock.
R4109	BTS	GT15-I008	BTS-I008-01	AMP	97.57	97.60	25.23	44.82	0.56	122.2	3070	26.2			14.8	Broke through intact rock.
R4110	BTS	GT15-I010	BTS-I010-04	AMP	119.38	119.41	25.00	44.72	0.56	121.0	3081	30.1			17.1	Broke through intact rock.
R4111	BTS	GT15-I015	BTS-I015-01	AMP	50.25	50.28	25.83	44.68	0.58	123.7	3054	24.0			13.2	Broke through intact rock.
R4112	BTS	GT15-I001	BTS-I001-01	IF	33.51	33.54	26.35	45.11	0.58	140.5	3336	21.2			11.4	Broke through intact rock.
R4113	BTS	GT15-I002A	BTS-I002A-02	IF	74.31	74.34	26.94	45.10	0.60	120.7	2805	24.7			12.9	Broke through intact rock.
R4114	BTS	GT15-I010	BTS-I010-05	IF	25.90	25.93	25.39	44.64	0.57	128.0	3221	13.2			7.4	Broke through intact rock.
R4115	BTS	GT15-I013	BTS-I013-01	IF	33.22	33.25	25.97	44.86	0.58	129.2	3148	25.3			13.8	Broke through intact rock.
R4116	BTS	GT15-I013	BTS-I013-02	IF	170.03	170.06	24.98	44.93	0.56	124.2	3136	19.3			10.9	Broke through intact rock.
R4117	BTS	GT15-I002A	BTS-I002A-01	QR	8.20	8.23	25.85	44.99	0.57	109.0	2652	28.4			15.5	Broke through intact rock.
R4118	BTS	GT15-I003	BTS-I003-02	QR	115.34	115.37	27.01	44.95	0.60	111.6	2604	21.7			11.4	Broke through intact rock.
R4119	BTS	GT15-I006	BTS-I006-01	QR	60.18	60.21	28.81	45.10	0.64	122.3	2657	18.2			8.9	Broke through intact rock.
R4120	BTS	GT15-I010	BTS-I010-01	QR	147.83	147.86	27.14	45.06	0.60	114.1	2636	22.3			11.6	Broke through intact rock.
R4121	BTS	GT15-I012	BTS-I012-01	QR	130.51	130.54	27.81	44.75	0.62	114.8	2625	18.0			9.2	Broke through intact rock.
R4122	DS	GT15-I002A	DS-I002A-02	AMP	121.08											
R4123	DS	GT15-I003	DS-I003-01	AMP	182.39											
R4124	DS	GT15-I003	DS-I003-02	AMP	160.59											
R4125	DS	GT15-I009	DS-I009-01	AMP	121.40											
R4126	DS	GT15-I014	DS-I014-02	AMP	88.25											
R4127	DS	GT15-I005	DS-I005-01	IF	35.25											
R4128	DS	GT15-I010	DS-I010-03	IF	28.63											
R4129	DS	GT15-I010	DS-I010-04	IF	23.72											
R4130	DS	GT15-I013	DS-I013-02	IF	54.12											
R4131	DS	GT15-I014	DS-I014-01	IF	147.07											
R4132	DS	GT15-I002A	DS-I002A-01	QR	59.68											
R4133	DS	GT15-I007	DS-I007-01	QR	162.87											
R4134	DS	GT15-I010	DS-I010-01	QR	147.46											
R4135	DS	GT15-I008	DS-I008-02	QR	126.02											
R4136	DS	GT15-I012	DS-I012-01	QR	123.34											

Amec Foster Wheeler Environment & Infrastructure
Hamilton Rock Mechanics Lab
Direct Shear Data Summary

TB152053 - Piteau Associates Rock Mechanics						
Hamilton ID	R4122	Area (mm^2)	2173			
Borehole ID	GT15-I002A					
Sample ID	DS-I002A-02	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	121.08	1	150	0.33	178	160
Major Axis (mm)	61.31	2	300	0.65	331	311
Minor Axis (mm)	45.12	3	500	1.09	520	462
		4	850	1.85	811	702
		5	1350	2.93	1216	1137
Hamilton ID	R4123	Area (mm^2)	2551			
Borehole ID	GT15-I003					
Sample ID	DS-I003-01	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	182.39	1	150	0.38	121	68
Major Axis (mm)	72.07	2	300	0.77	244	201
Minor Axis (mm)	45.07	3	500	1.28	344	311
		4	850	2.17	500	470
		5	1350	3.44	768	681
Hamilton ID	R4124	Area (mm^2)	1907			
Borehole ID	GT15-I003					
Sample ID	DS-I003-02	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	160.59	1	150	0.29	271	266
Major Axis (mm)	53.98	2	300	0.57	442	371
Minor Axis (mm)	44.97	3	500	0.95	664	582
		4	850	1.62	976	947
		5	1350	2.57	1483	1421
Hamilton ID	R4125	Area (mm^2)	2102			
Borehole ID	GT15-I009					
Sample ID	DS-I009-01	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	121.40	1	150	0.32	156	150
Major Axis (mm)	58.82	2	300	0.63	247	240
Minor Axis (mm)	45.49	3	500	1.05	410	398
		4	850	1.79	596	561
		5	1350	2.84	725	634

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Hamilton Rock Mechanics Lab
Direct Shear Data Summary

TB152053 - Piteau Associates Rock Mechanics						
Hamilton ID	R4126	Area (mm^2)	2354			
Borehole ID	GT15-I014					
Sample ID	DS-I014-02	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	88.25	1	150	0.35	279	260
Major Axis (mm)	65.60	2	300	0.71	455	412
Minor Axis (mm)	45.68	3	500	1.18	701	622
		4	850	2.00	1086	860
		5	1350	3.18	1615	1396
Hamilton ID	R4127	Area (mm^2)	2261			
Borehole ID	GT15-I005					
Sample ID	DS-I005-01	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	35.25	1	150	0.34	221	187
Major Axis (mm)	63.41	2	300	0.68	386	366
Minor Axis (mm)	45.39	3	500	1.13	565	540
		4	850	1.92	902	861
		5	1350	3.05	1421	1330
Hamilton ID	R4128	Area (mm^2)	1893			
Borehole ID	GT15-I010					
Sample ID	DS-I010-03	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	28.63	1	150	0.28	136	125
Major Axis (mm)	53.97	2	300	0.57	397	365
Minor Axis (mm)	44.66	3	500	0.95	561	542
		4	850	1.61	935	891
		5	1350	2.56	1345	1283
Hamilton ID	R4129	Area (mm^2)	1836			
Borehole ID	GT15-I010					
Sample ID	DS-I010-04	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	23.72	1	150	0.28	235	197
Major Axis (mm)	52.58	2	300	0.55	449	383
Minor Axis (mm)	44.47	3	500	0.92	594	523
		4	850	1.56	1019	921
		5	1350	2.48	1488	1358

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Hamilton Rock Mechanics Lab
Direct Shear Data Summary

TB152053 - Piteau Associates Rock Mechanics						
Hamilton ID	R4130	Area (mm^2)	2703			
Borehole ID	GT15-I013					
Sample ID	DS-I013-02	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	54.12	1	150	0.41	219	198
Major Axis (mm)	76.34	2	300	0.81	368	345
Minor Axis (mm)	45.09	3	500	1.35	549	524
		4	850	2.30	969	931
		5	1350	3.65	1402	1391
Hamilton ID	R4131	Area (mm^2)	3057			
Borehole ID	GT15-I014					
Sample ID	DS-I014-01	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	147.07	1	150	0.46	212	195
Major Axis (mm)	86.84	2	300	0.92	458	350
Minor Axis (mm)	44.82	3	500	1.53	655	598
		4	850	2.60	1061	988
		5	1350	4.13	1598	1418
Hamilton ID	R4132	Area (mm^2)	2987			
Borehole ID	GT15-I002A					
Sample ID	DS-I002A-01	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	59.68	1	150	0.45	297	167
Major Axis (mm)	84.08	2	300	0.90	326	295
Minor Axis (mm)	45.23	3	500	1.49	517	456
		4	850	2.54	826	780
		5	1350	4.03	1309	1168
Hamilton ID	R4133	Area (mm^2)	2339			
Borehole ID	GT15-I007					
Sample ID	DS-I007-01	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	162.87	1	150	0.35	135	122
Major Axis (mm)	66.44	2	300	0.70	402	297
Minor Axis (mm)	44.82	3	500	1.17	550	498
		4	850	1.99	901	772
		5	1350	3.16	1343	1148

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Hamilton Rock Mechanics Lab
Direct Shear Data Summary

TB152053 - Piteau Associates Rock Mechanics						
Hamilton ID	R4134	Area (mm^2)	1659			
Borehole ID	GT15-I010					
Sample ID	DS-I010-01	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	147.46	1	150	0.25	210	188
Major Axis (mm)	46.90	2	300	0.50	374	334
Minor Axis (mm)	45.04	3	500	0.83	571	484
		4	850	1.41	916	769
		5	1350	2.24	1257	1121
Hamilton ID	R4135	Area (mm^2)	2797			
Borehole ID	GT15-I008					
Sample ID	DS-I008-02	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	126.02	1	150	0.42	221	194
Major Axis (mm)	79.24	2	300	0.84	487	320
Minor Axis (mm)	44.95	3	500	1.40	650	501
		4	850	2.38	1034	790
		5	1350	3.78	1497	1210
Hamilton ID	R4136	Area (mm^2)	1854			
Borehole ID	GT15-I012					
Sample ID	DS-I012-01	Test	Normal stress (kPa)	Normal Load (kN)	Peak Shear Stress (kPa)	Residual Shear Stress (kPa)
Joint Depth (m)	123.34	1	150	0.28	133	130
Major Axis (mm)	53.11	2	300	0.56	300	285
Minor Axis (mm)	44.45	3	500	0.93	544	531
		4	850	1.58	861	845
		5	1350	2.50	1292	1251

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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I002A-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 114.63m – 114.73m	**Lab #:** R4065





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I010-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 99.55m – 99.65m	**Lab #:** R4066





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I011-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 102.71m – 102.81m	**Lab #:** R4067





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I013-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 117.30m – 117.40m	**Lab #:** R4068





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I015-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 114.61m – 114.71m	**Lab #:** R4069





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I001-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 31.13m – 31.23m	**Lab #:** R4070





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I005-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 75.70m – 75.80m	**Lab #:** R4071





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I009-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 13.81m – 13.91m	**Lab #:** R4072





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I011-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 55.09m – 55.19m	**Lab #:** R4073





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I012-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 110.39m – 110.49m	**Lab #:** R4074





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I003-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 98.25m – 98.35m	**Lab #:** R4075





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I006-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 113.60m – 113.70m	**Lab #:** R4076





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I007-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 177.72m – 177.82m	**Lab #:** R4077





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I008-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 109.18m – 109.28m	**Lab #:** R4078





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: UCS-I011-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 131.97m – 132.07m	**Lab #:** R4079





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I001-04	**Project Name:** Piteau Associates Rock Mechanics
Depth: 102.45m- 102.55m	**Lab #:** R4080





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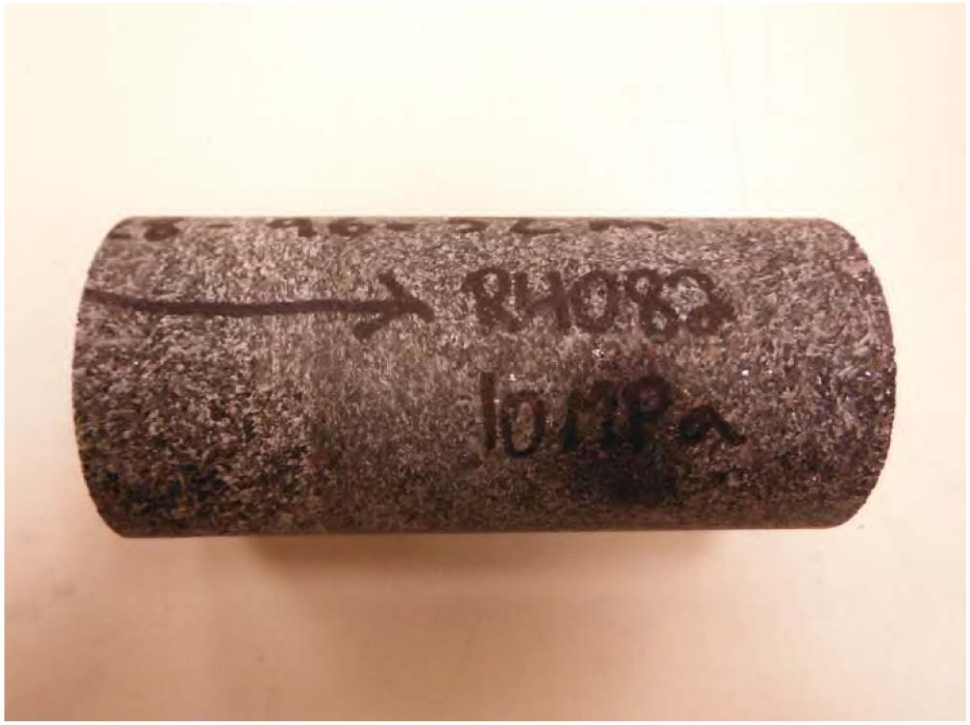
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Sample ID: TCS-I002A-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 128.70m – 128.80m	**Lab #:** R4081





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I008-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 96.39m – 96.49m	**Lab #:** R4082

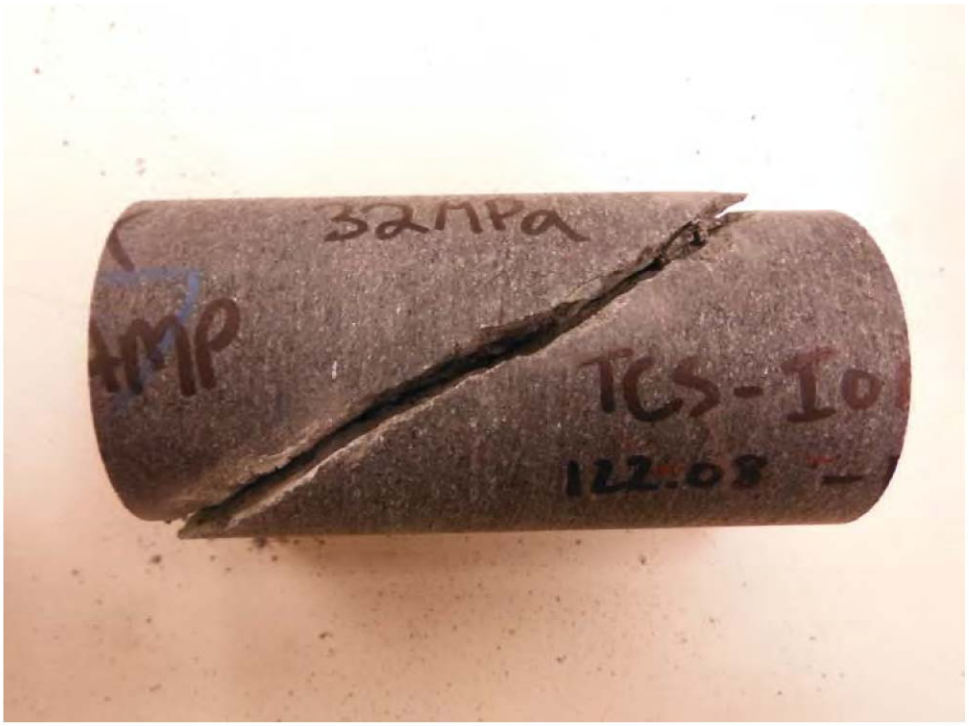




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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I010-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 122.09m – 122.19m	**Lab #:** R4083





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I011-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 101.94m – 102.04m	**Lab #:** R4084





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I012-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 142.96m – 143.06m	**Lab #:** R4085





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I013-04	**Project Name:** Piteau Associates Rock Mechanics
Depth: 194.33m – 194.43m	**Lab #:** R4086





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I014-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 53.33m – 53.43m	**Lab #:** R4087





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I015-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 50.72m – 50.82m	**Lab #:** R4088





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I001-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 35.31m – 35.41m	**Lab #:** R4089





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I001-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 91.18m – 91.28m	**Lab #:** R4090





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I002A-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 75.89m – 75.99m	**Lab #:** R4091





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I003-06	**Project Name:** Piteau Associates Rock Mechanics
Depth: 6.05m – 6.15m	**Lab #:** R4092





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I004-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 98.38m – 98.48m	**Lab #:** R4093





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I012-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 104.17m – 104.27m	**Lab #:** R4094





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I013-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 26.21m – 26.31m	**Lab #:** R4095





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I013-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 168.16m – 168.26m	**Lab #:** R4096





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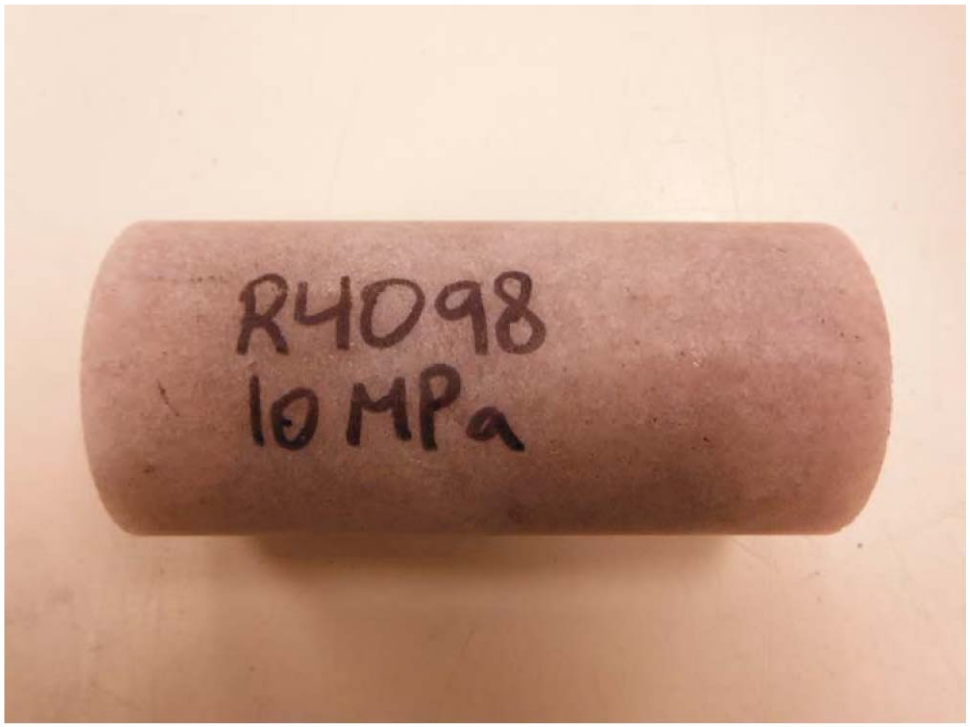
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I014-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 139.01m – 139.11m	**Lab #:** R4097





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I001-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 68.61m – 68.71m	**Lab #:** R4098





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I003-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 117.79m – 117.89m	**Lab #:** R4099





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I003-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 97.49m – 97.59m	**Lab #:** R4100





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I003-04	**Project Name:** Piteau Associates Rock Mechanics
Depth: 92.53m – 92.63m	**Lab #:** R4101





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I003-05	**Project Name:** Piteau Associates Rock Mechanics
Depth: 71.08m – 71.18m	**Lab #:** R4102





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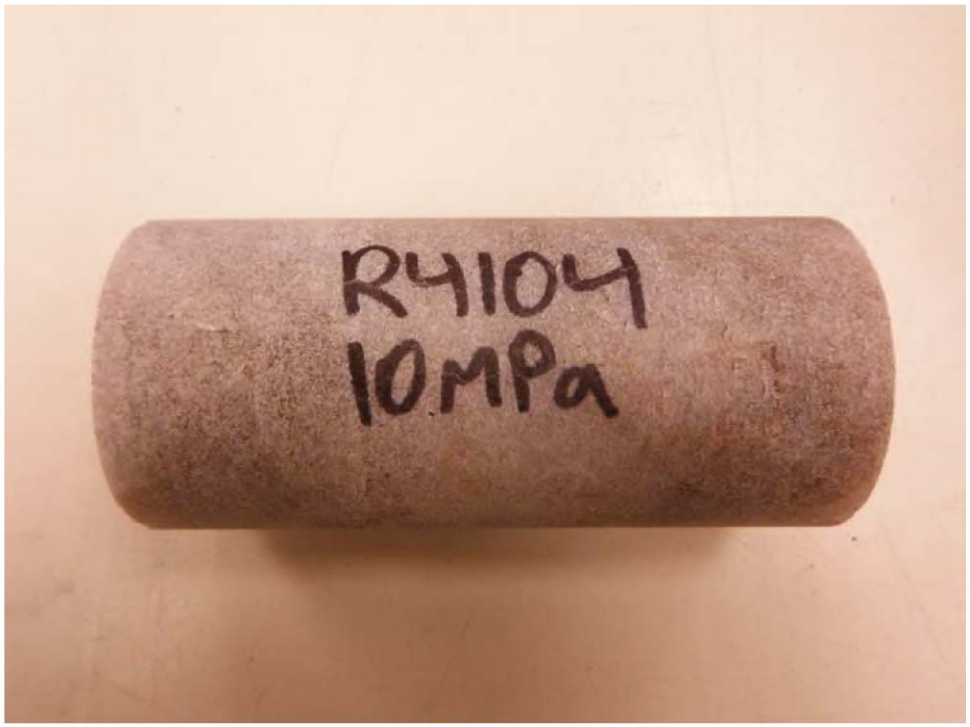
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I006-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 143.57m – 143.67m	**Lab #:** R4103





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I007-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 161.35m – 161.45m	**Lab #:** R4104





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I008-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 56.33m – 56.43m	**Lab #:** R4105





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: TCS-I008-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 155.92m – 156.02m	**Lab #:** R4106





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I002A-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 125.03m – 125.06m	**Lab #:** R4107

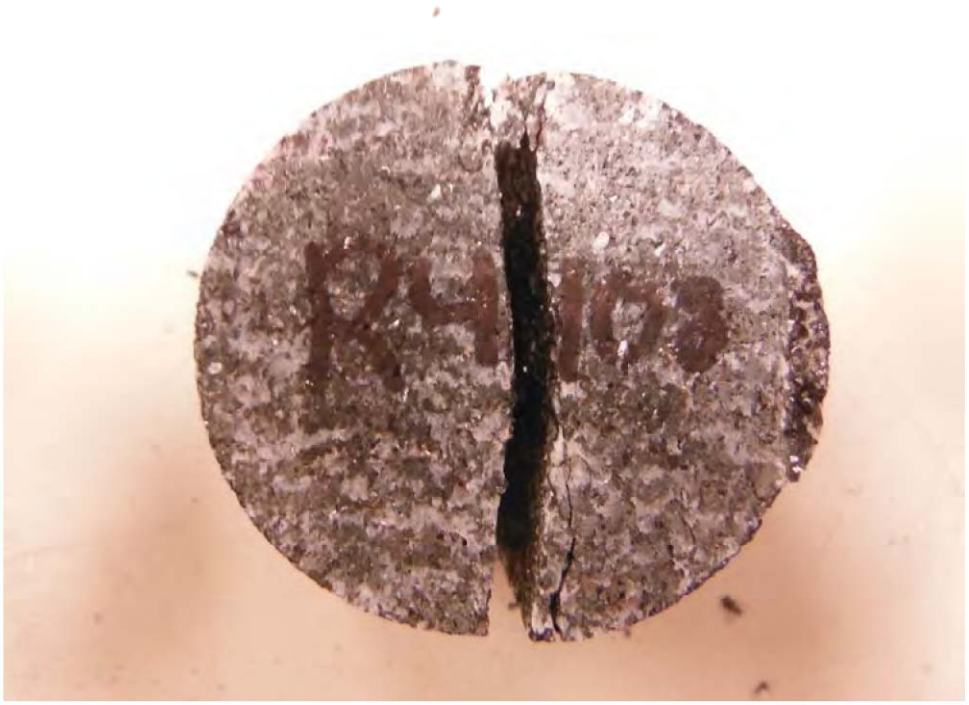




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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I003-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 177.71m – 177.74m	**Lab #:** R4108





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I008-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 97.57m – 97.60m	**Lab #:** R4109





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I010-04	**Project Name:** Piteau Associates Rock Mechanics
Depth: 119.38m – 119.41m	**Lab #:** R4110





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I015-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 50.25m – 50.28m	**Lab #:** R4111





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I001-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 33.51m – 33.54m	**Lab #:** R4112

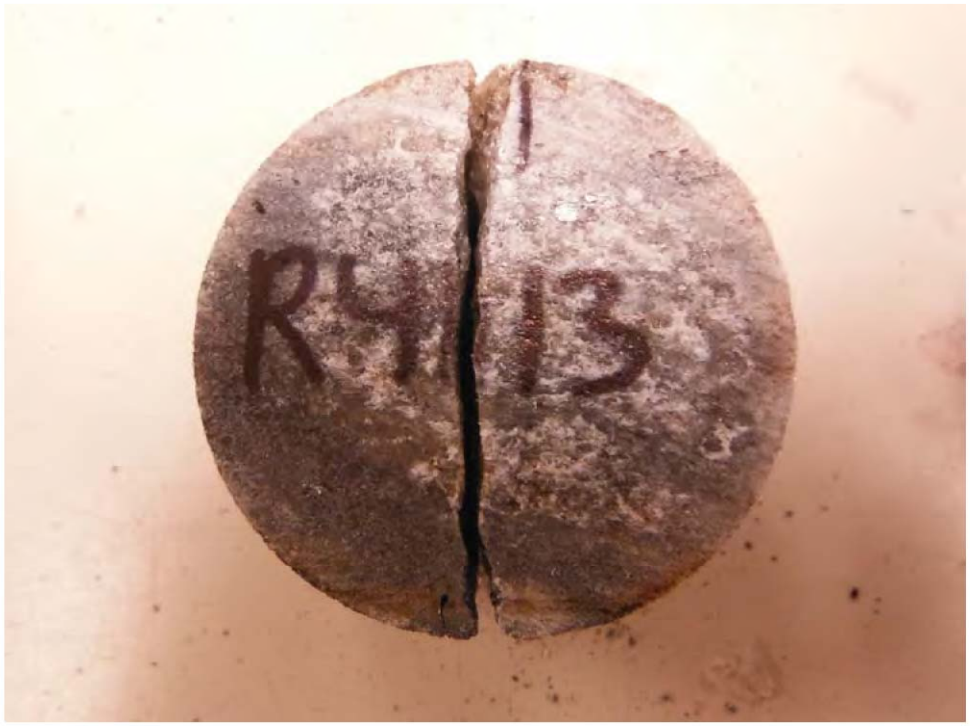




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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I002A-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 74.31m – 74.34m	**Lab #:** R4113





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I010-05	**Project Name:** Piteau Associates Rock Mechanics
Depth: 25.90m – 25.93m	**Lab #:** R4114





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I013-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 33.22m – 33.25m	**Lab #:** R4115





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I013-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 170.03m – 170.06m	**Lab #:** R4116





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Hamilton Rock Mechanics Lab

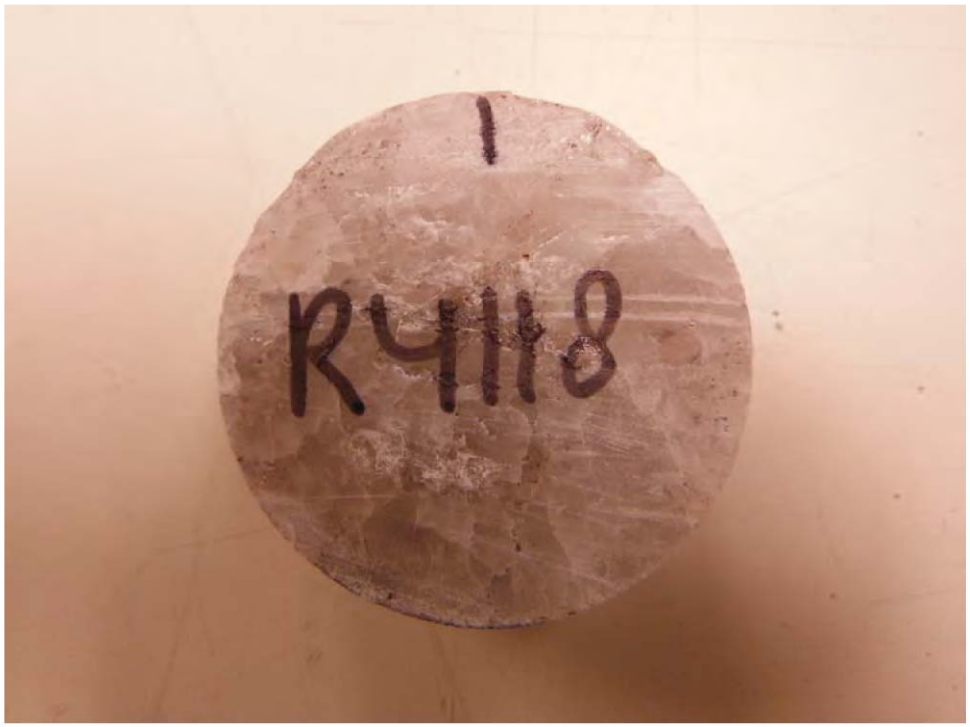
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I002A-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 8.20m – 8.23m	**Lab #:** R4117

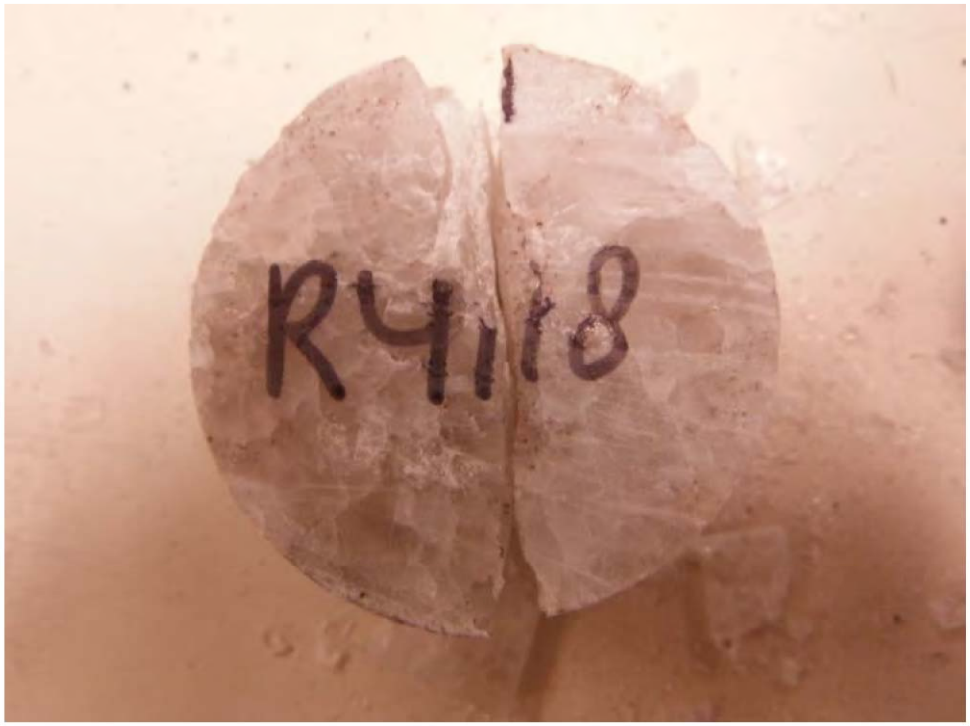




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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I003-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 115.34m – 115.37m	**Lab #:** R4118

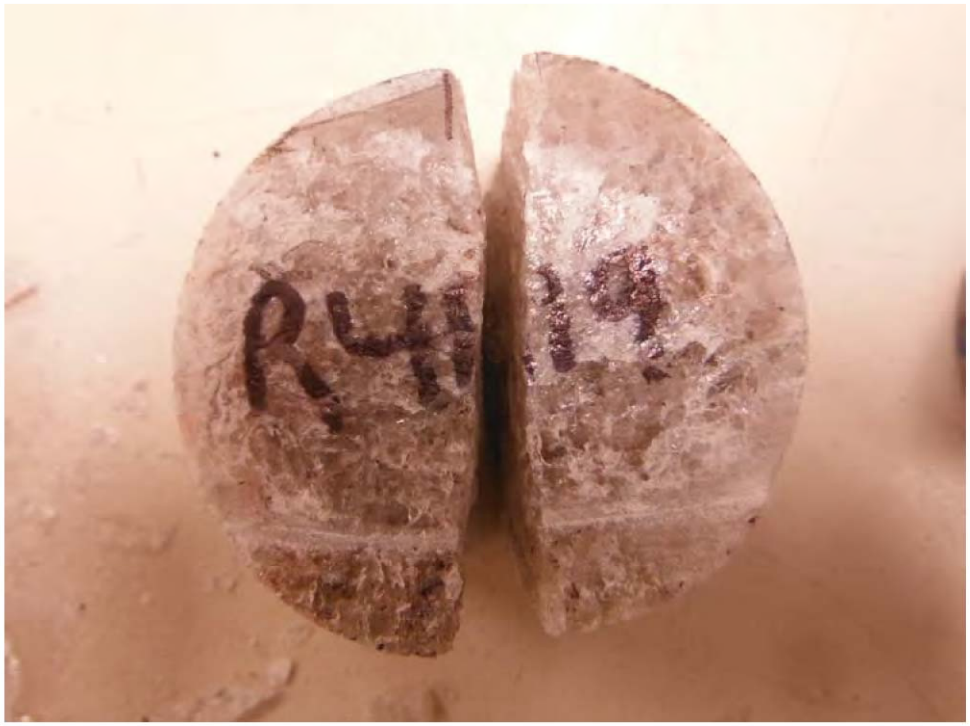




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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I006-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 60.18m – 60.21m	**Lab #:** R4119

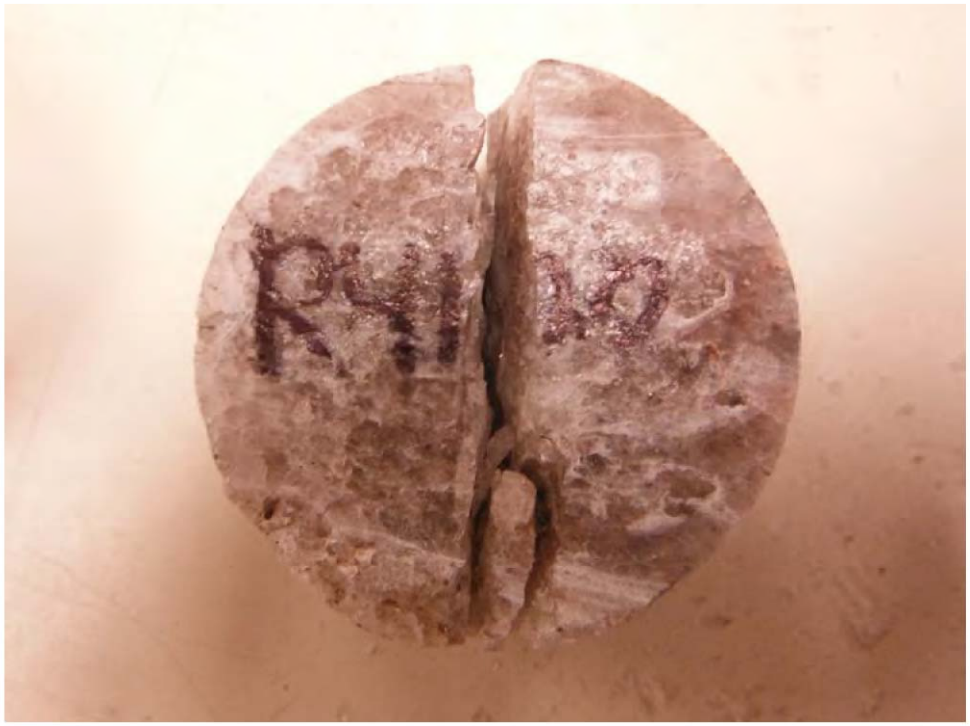




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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I010-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 147.83m – 147.86m	**Lab #:** R4120





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: BTS-I012-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 130.51m – 130.54m	**Lab #:** R4121





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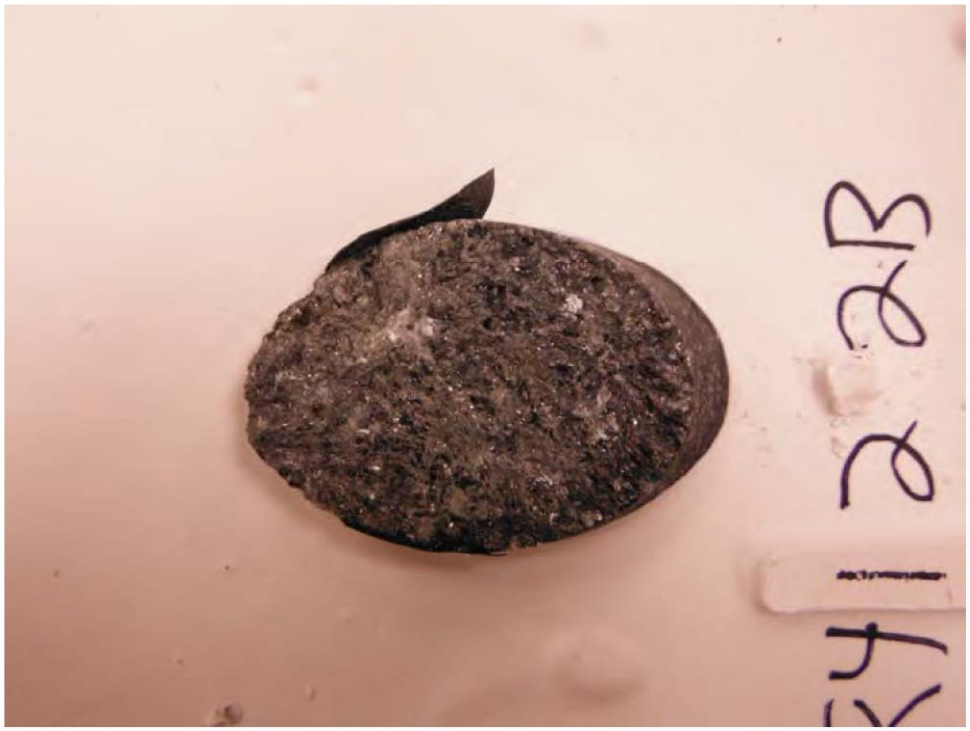
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I002A-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.08m	**Lab #:** R4122





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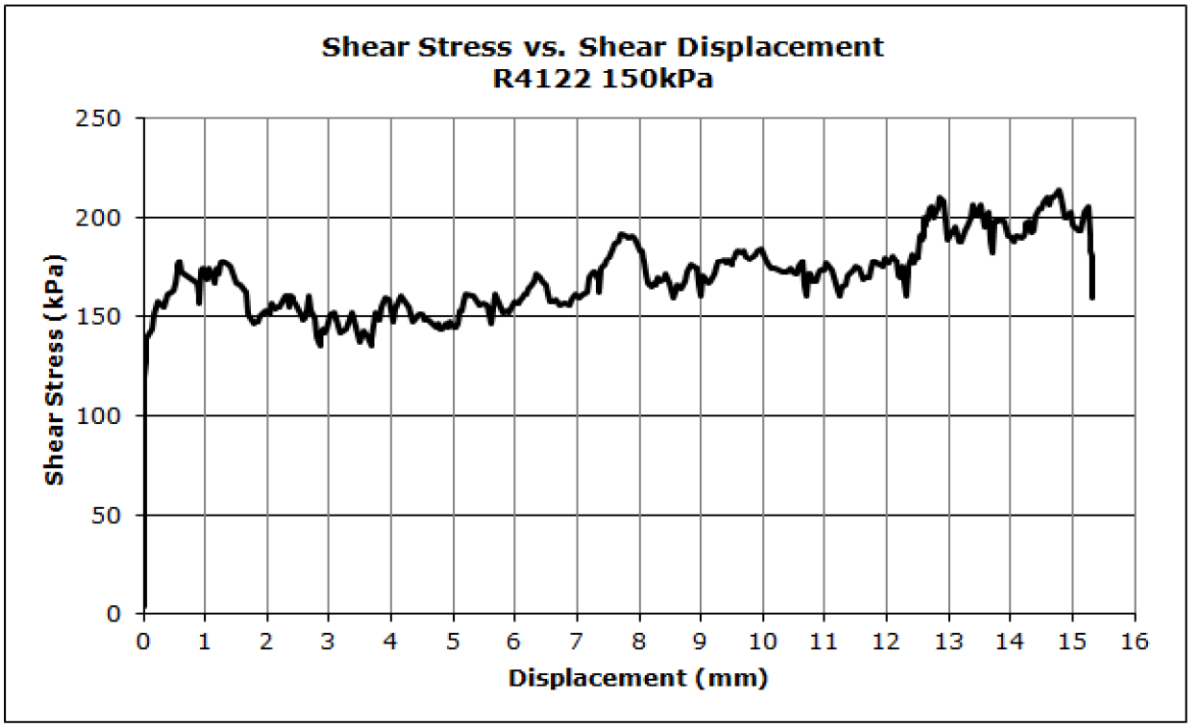
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I002A-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.08m	**Lab #:** R4122

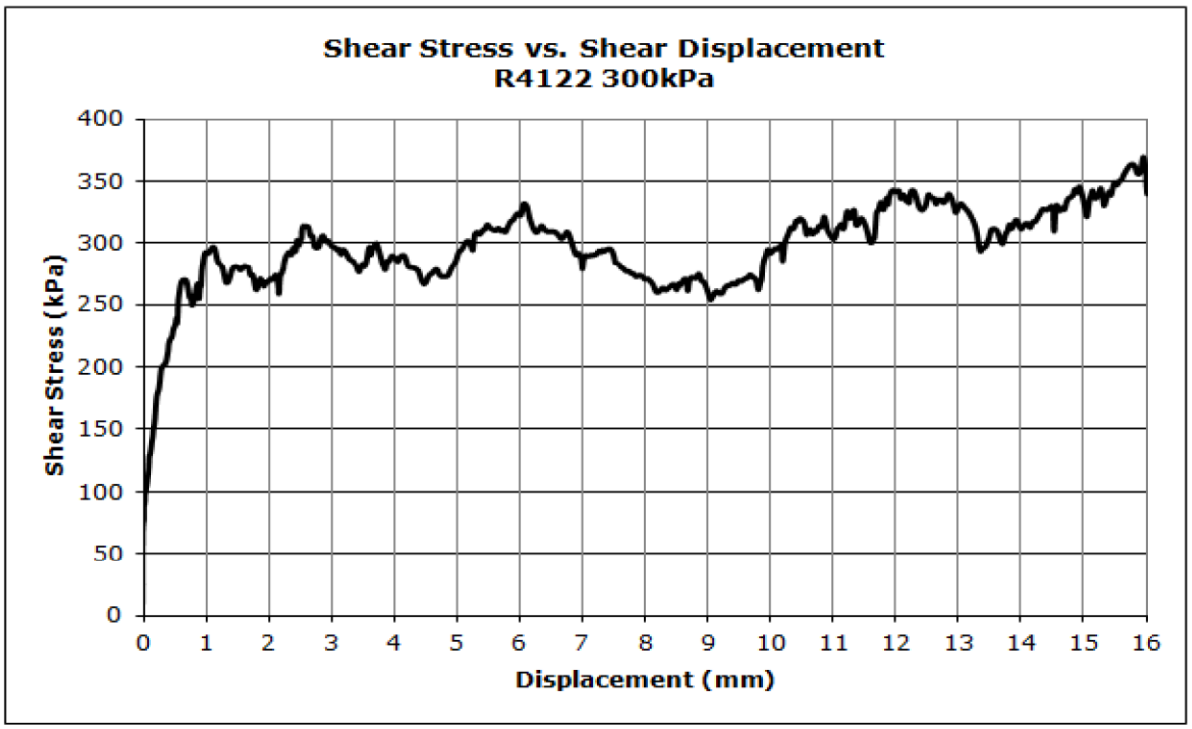




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Hamilton Rock Mechanics Lab

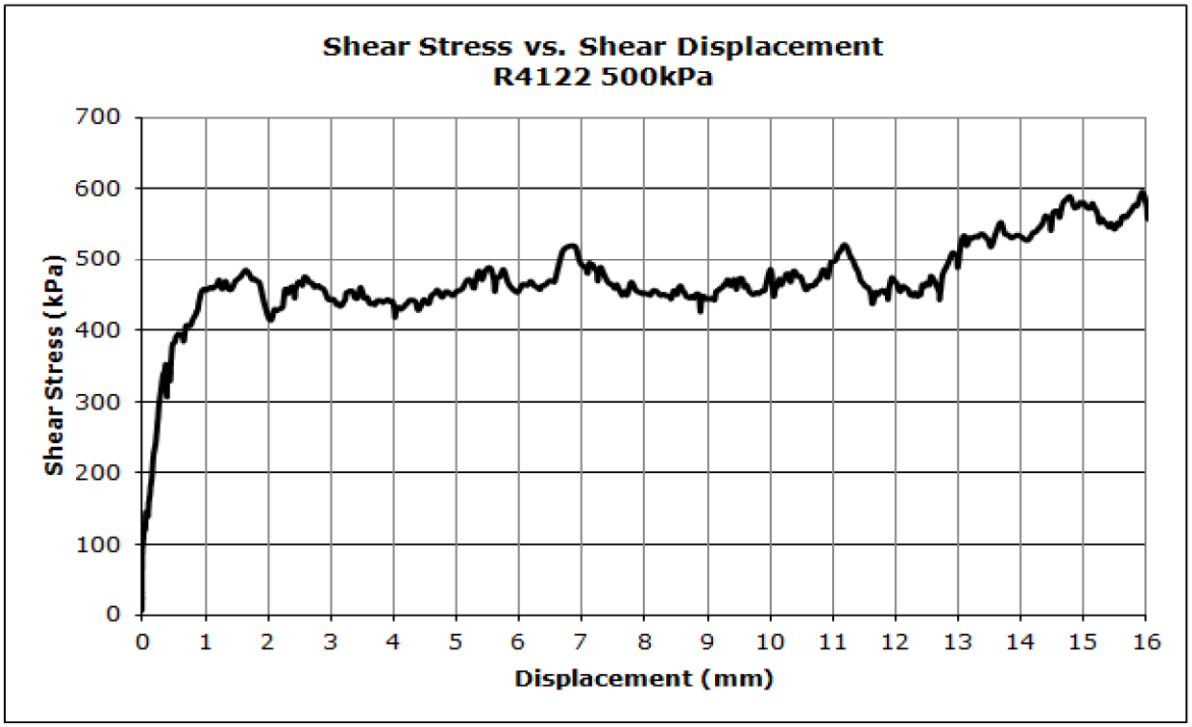
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I002A-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.08m	**Lab #:** R4122

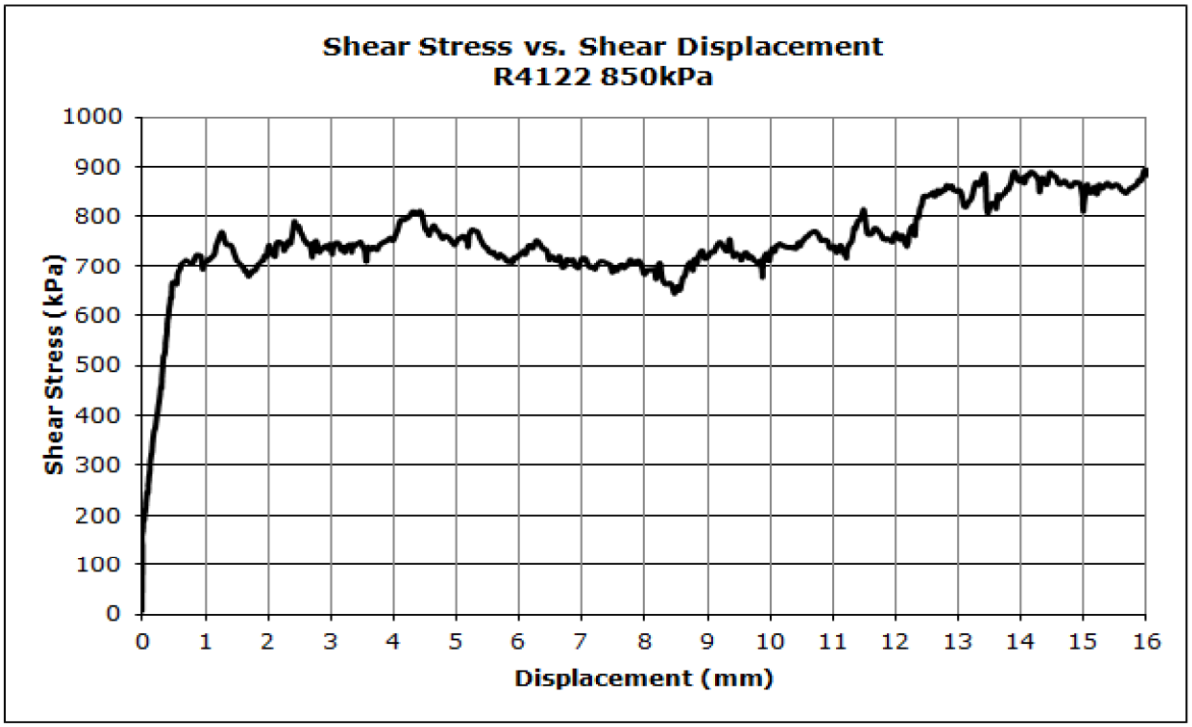




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Hamilton Rock Mechanics Lab

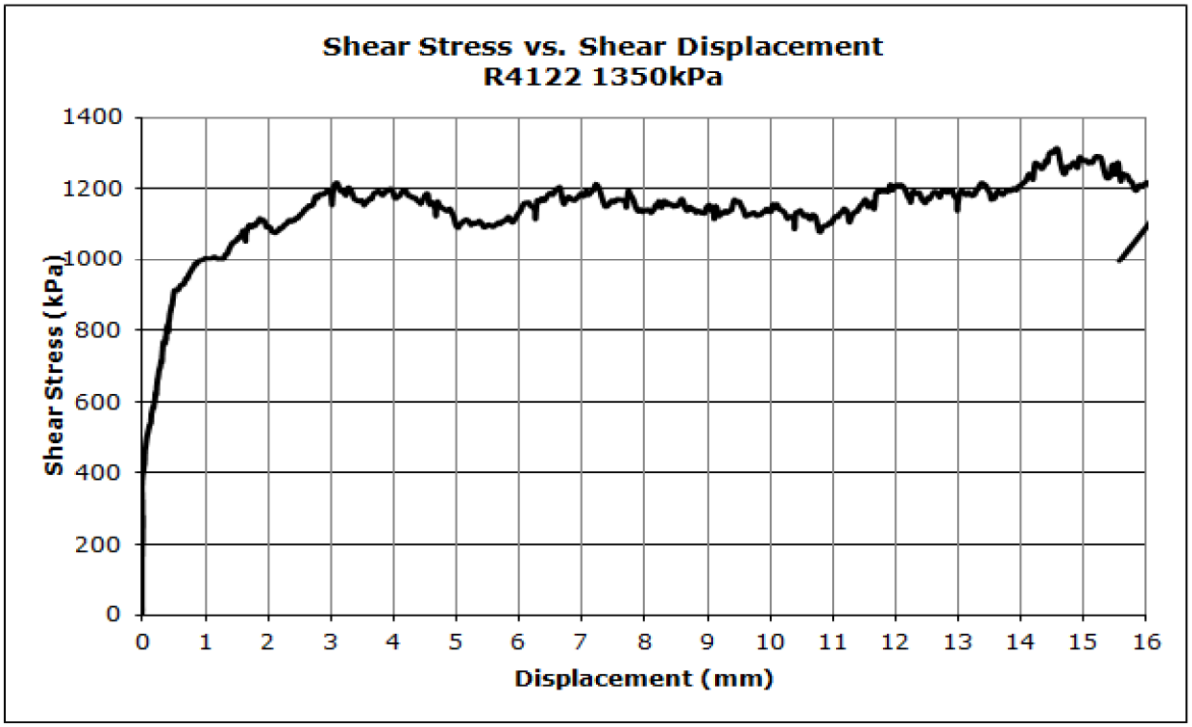
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I002A-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.08m	**Lab #:** R4122





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Hamilton Rock Mechanics Lab

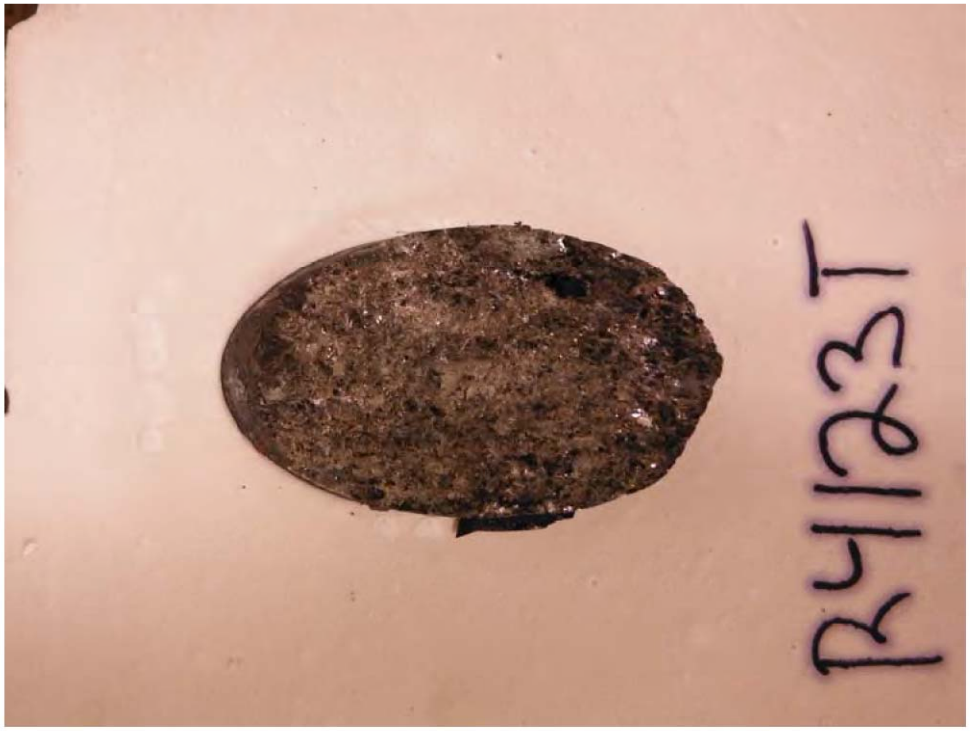
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I002A-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.08m	**Lab #:** R4122



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Hamilton Rock Mechanics Lab

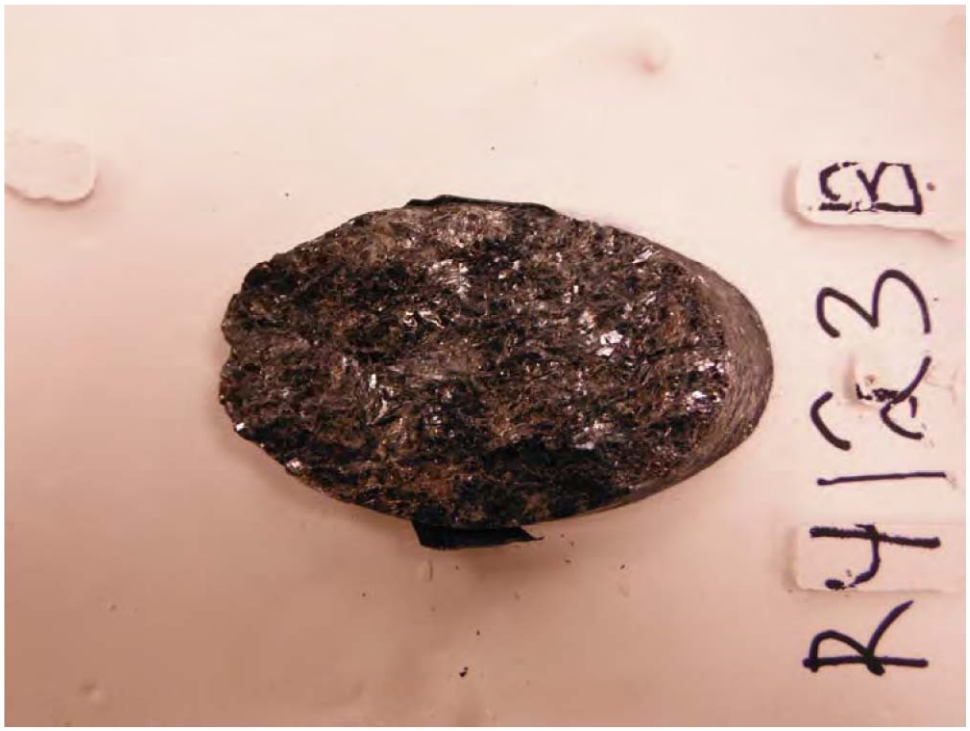
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I003-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 182.39m	**Lab #:** R4123

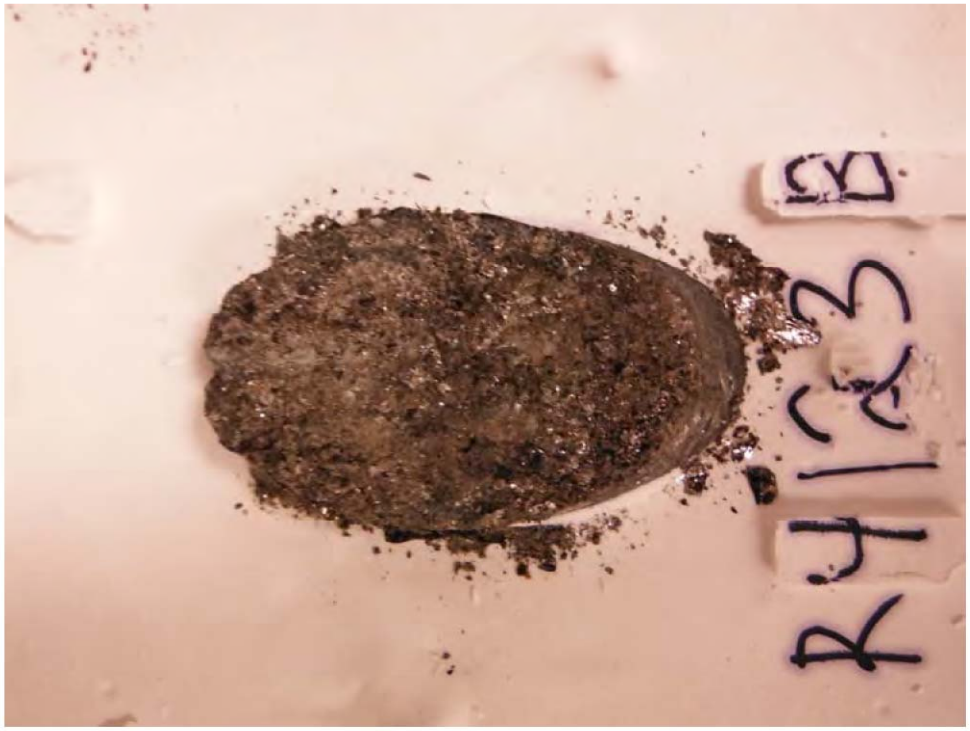




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Hamilton Rock Mechanics Lab

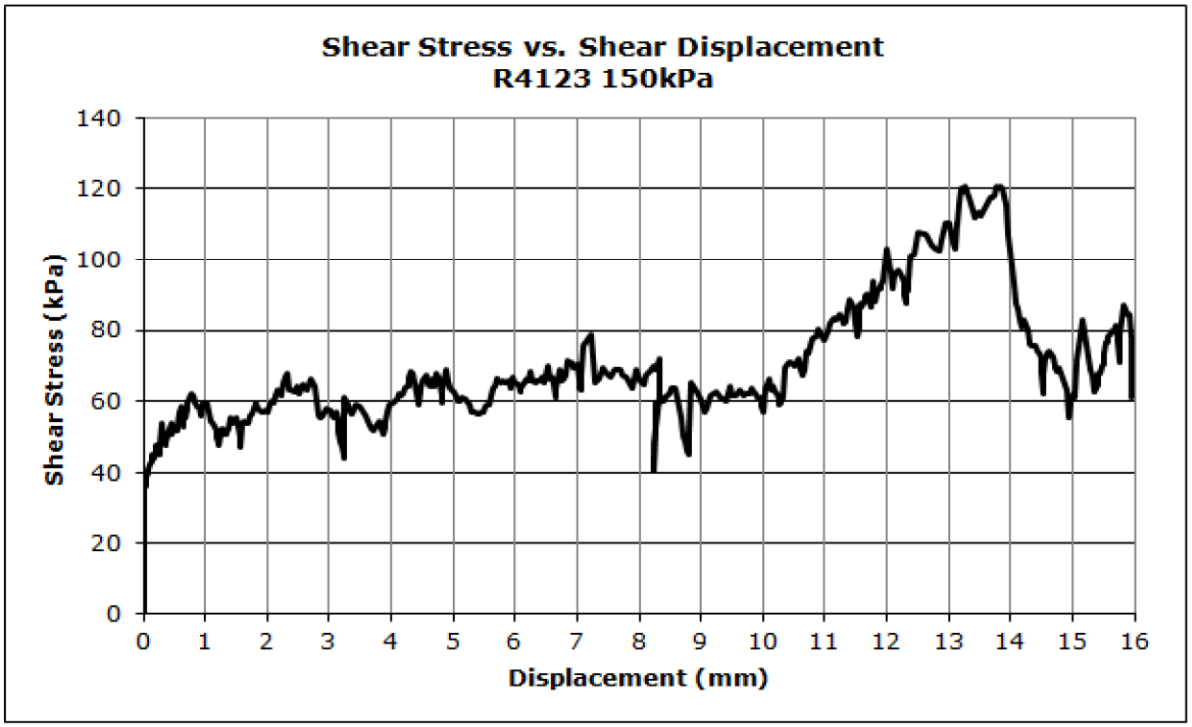
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Sample ID: DS-I003-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 182.39m	**Lab #:** R4123

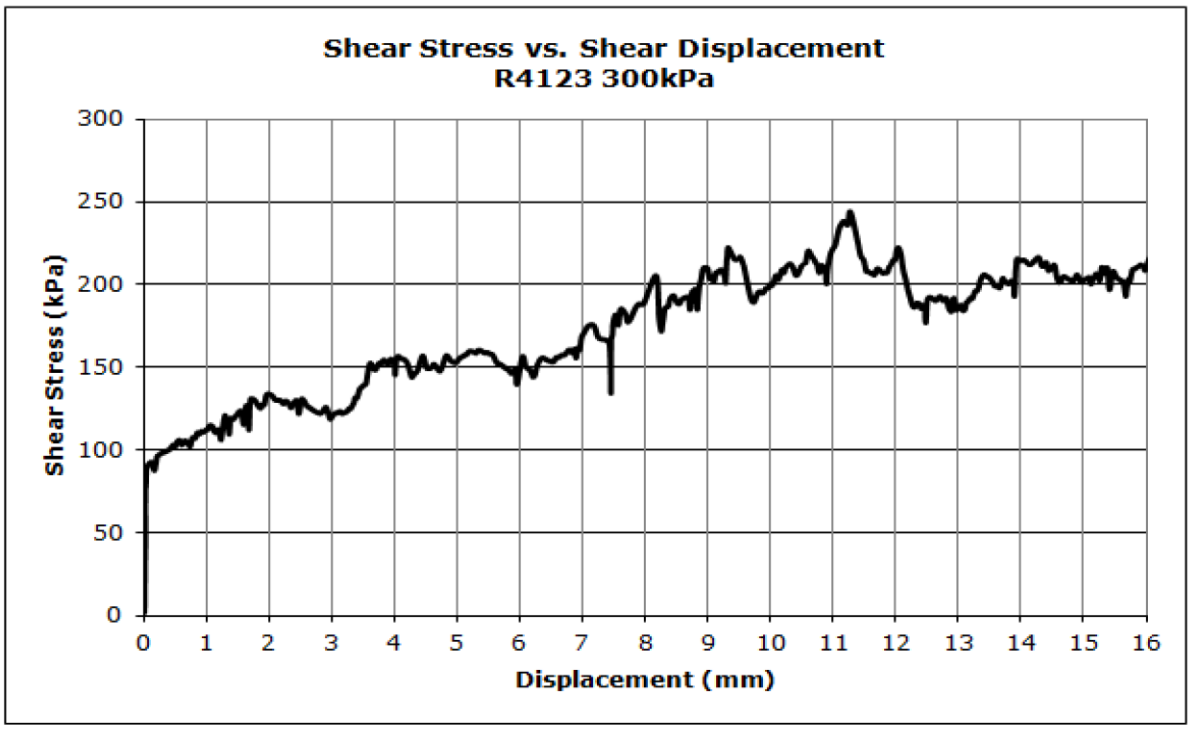




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Hamilton Rock Mechanics Lab

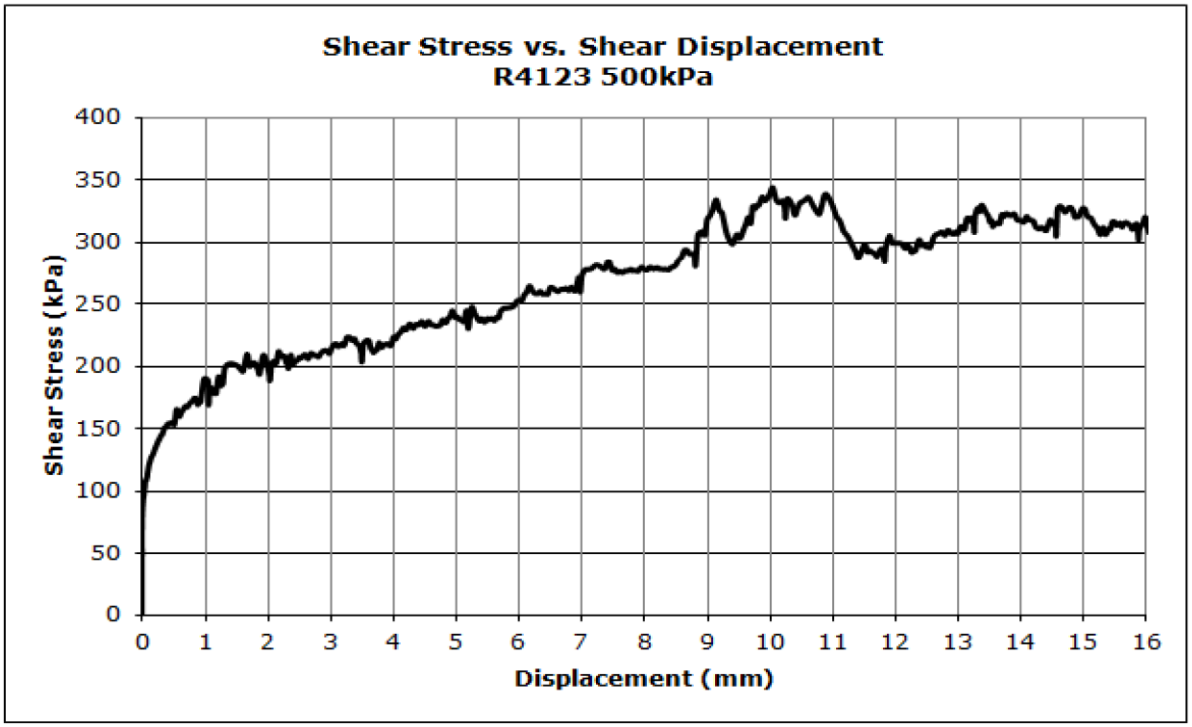
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Sample ID: DS-I003-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 182.39m	**Lab #:** R4123

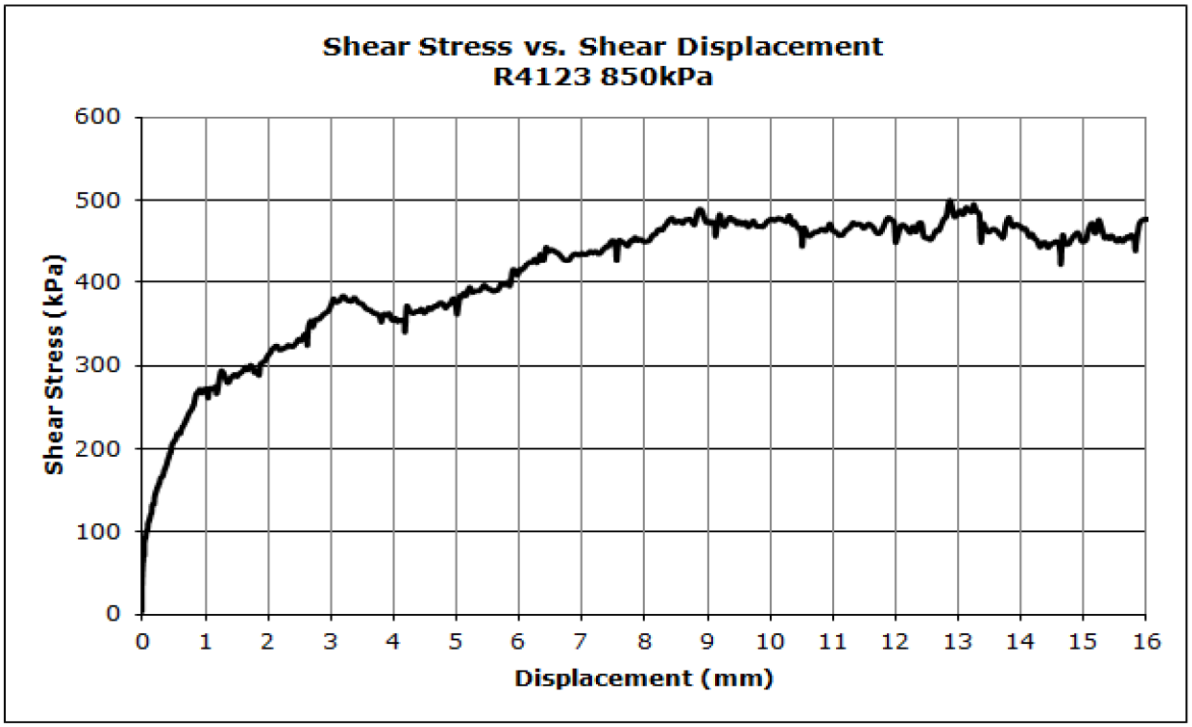




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Hamilton Rock Mechanics Lab

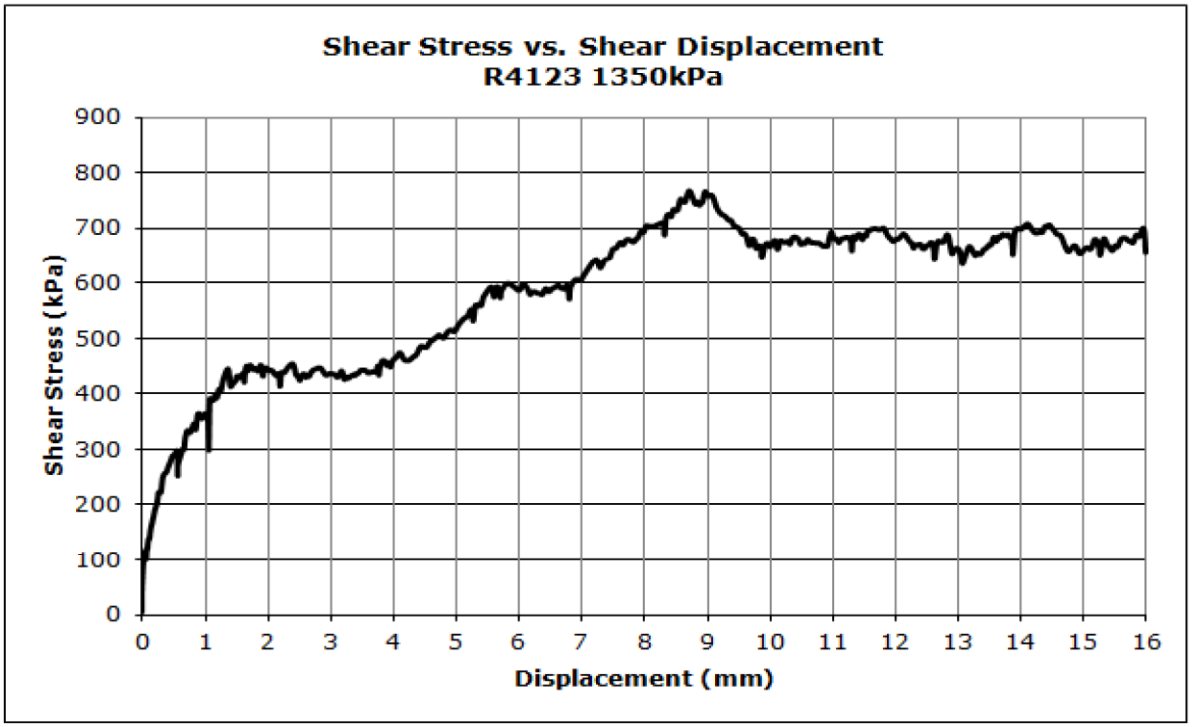
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Sample ID: DS-I003-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 182.39m	**Lab #:** R4123





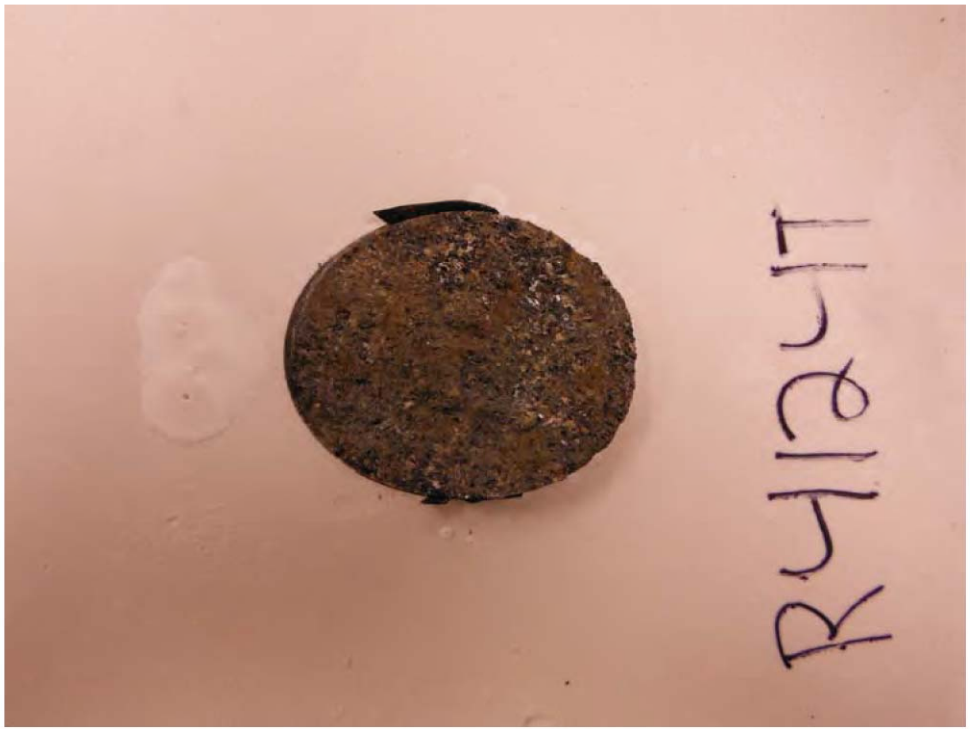
Amec Foster Wheeler Environment & Infrastructure
Hamilton Rock Mechanics Lab

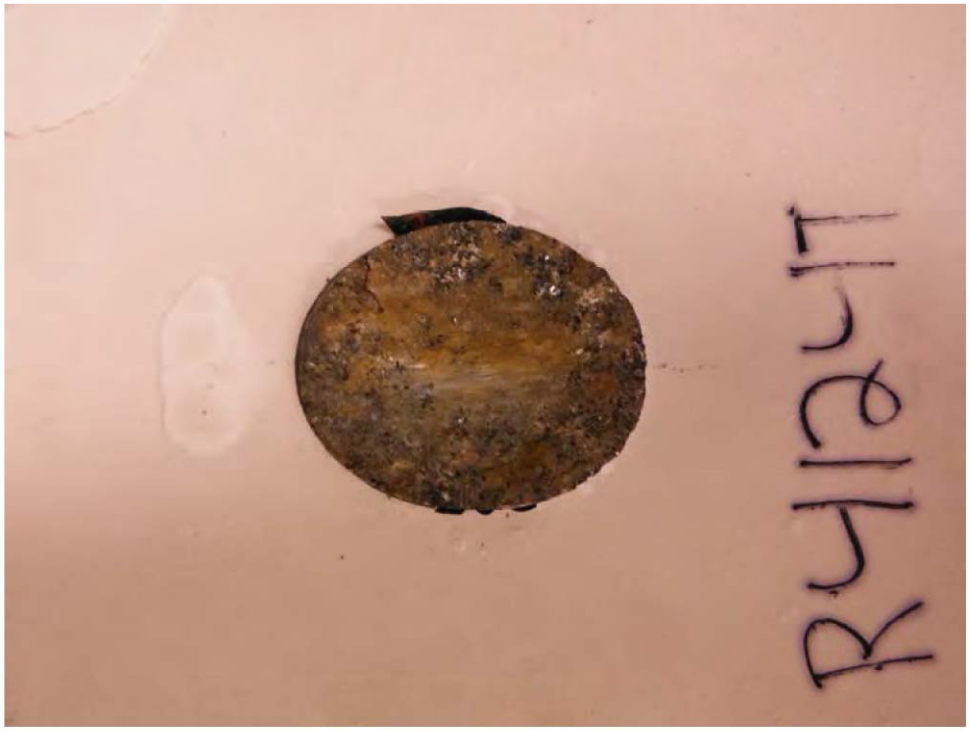
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Sample ID: DS-I003-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 182.39m	**Lab #:** R4123



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Hamilton Rock Mechanics Lab

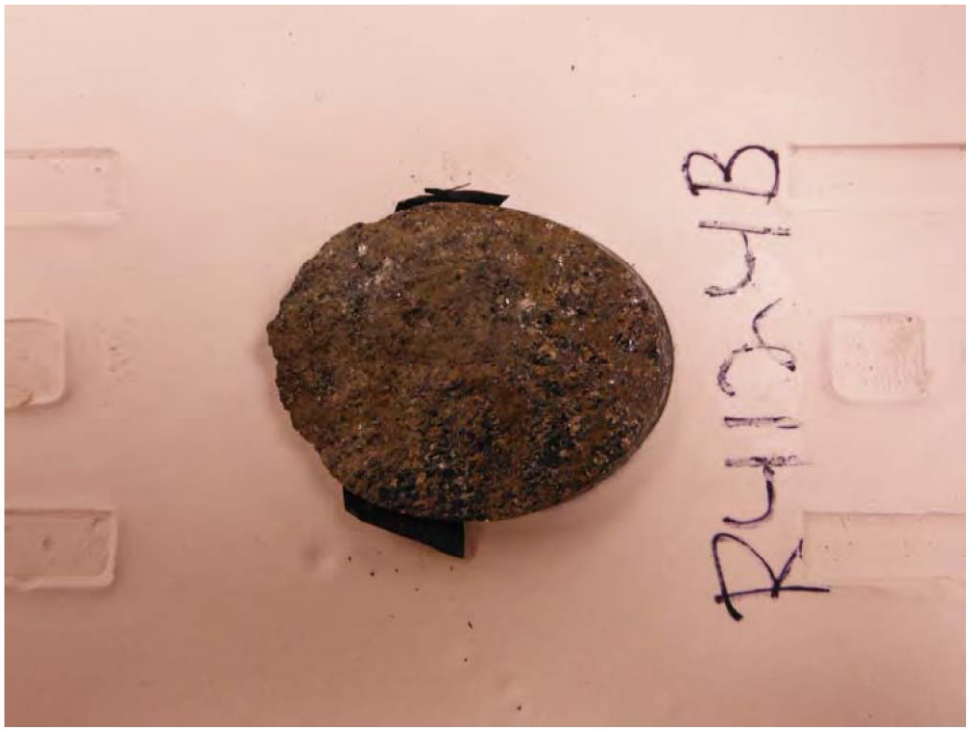
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I003-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 160.59m	**Lab #:** R4124





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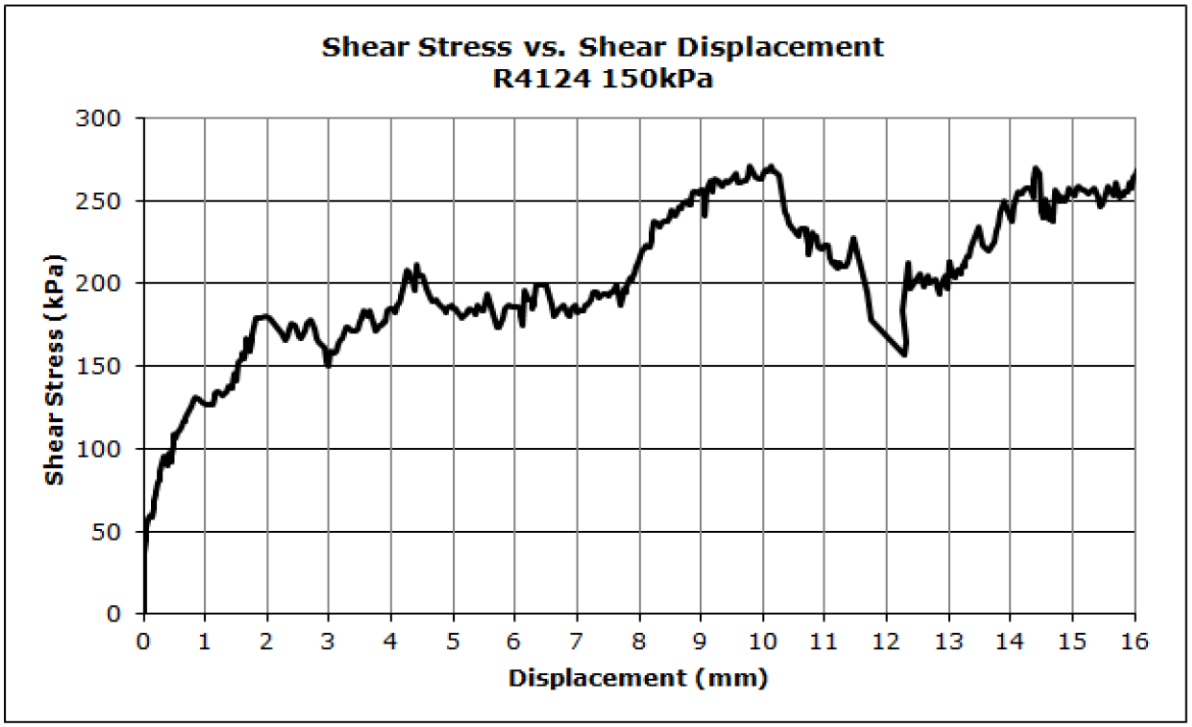
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Sample ID: DS-I003-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 160.59m	**Lab #:** R4124

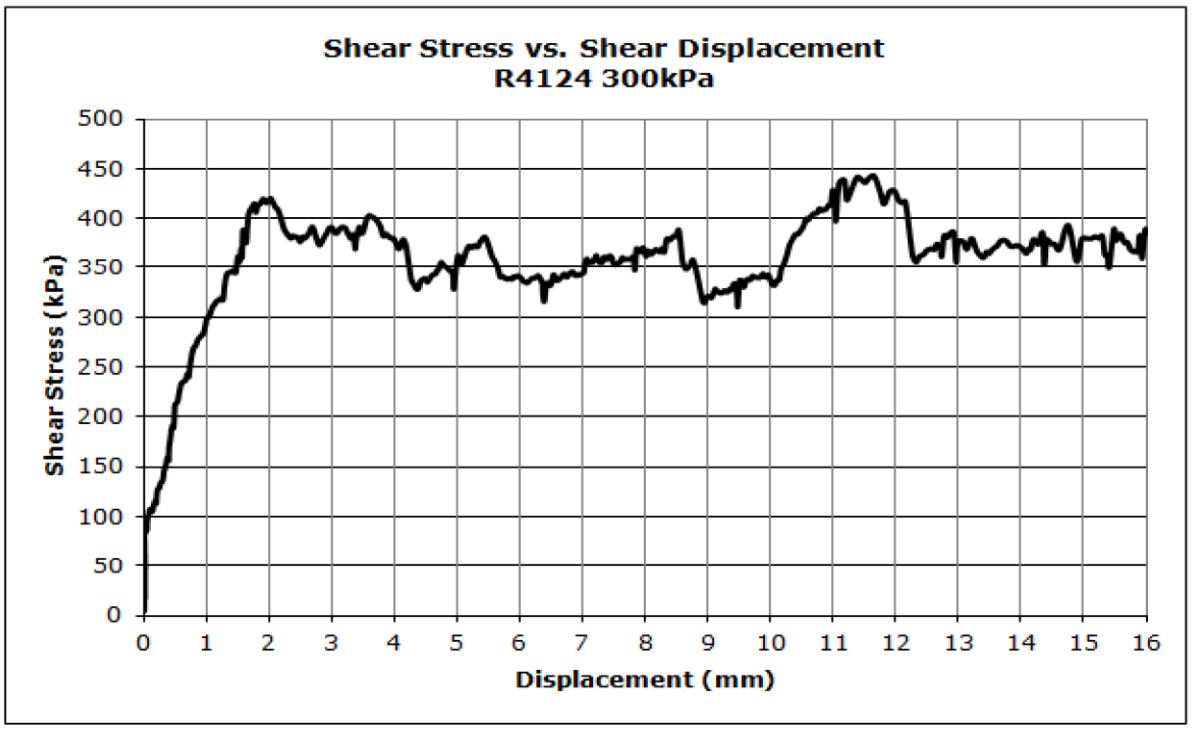




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Hamilton Rock Mechanics Lab

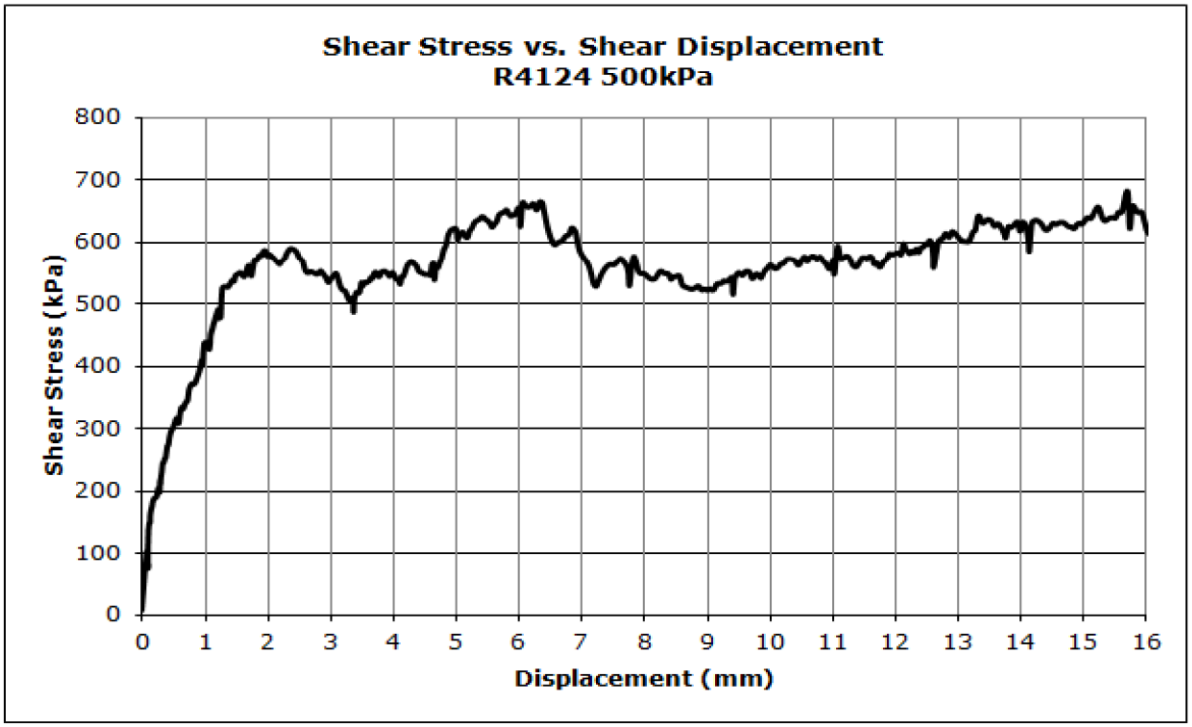
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Sample ID: DS-I003-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 160.59m	**Lab #:** R4124

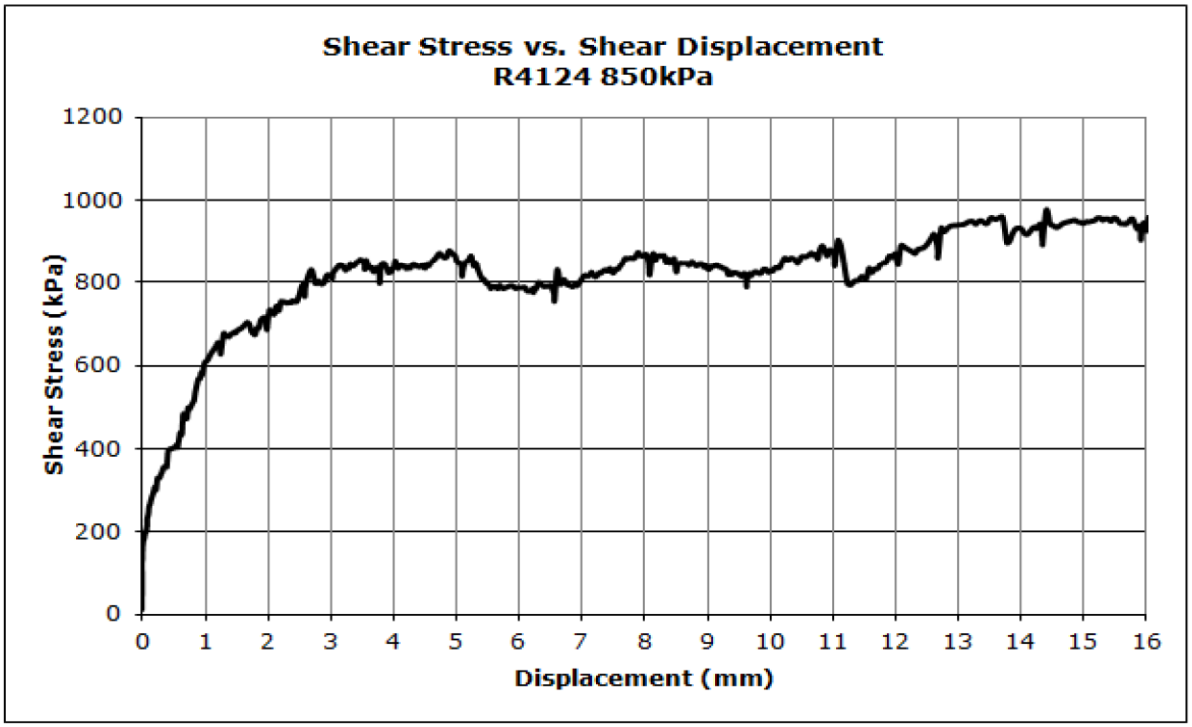




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Hamilton Rock Mechanics Lab

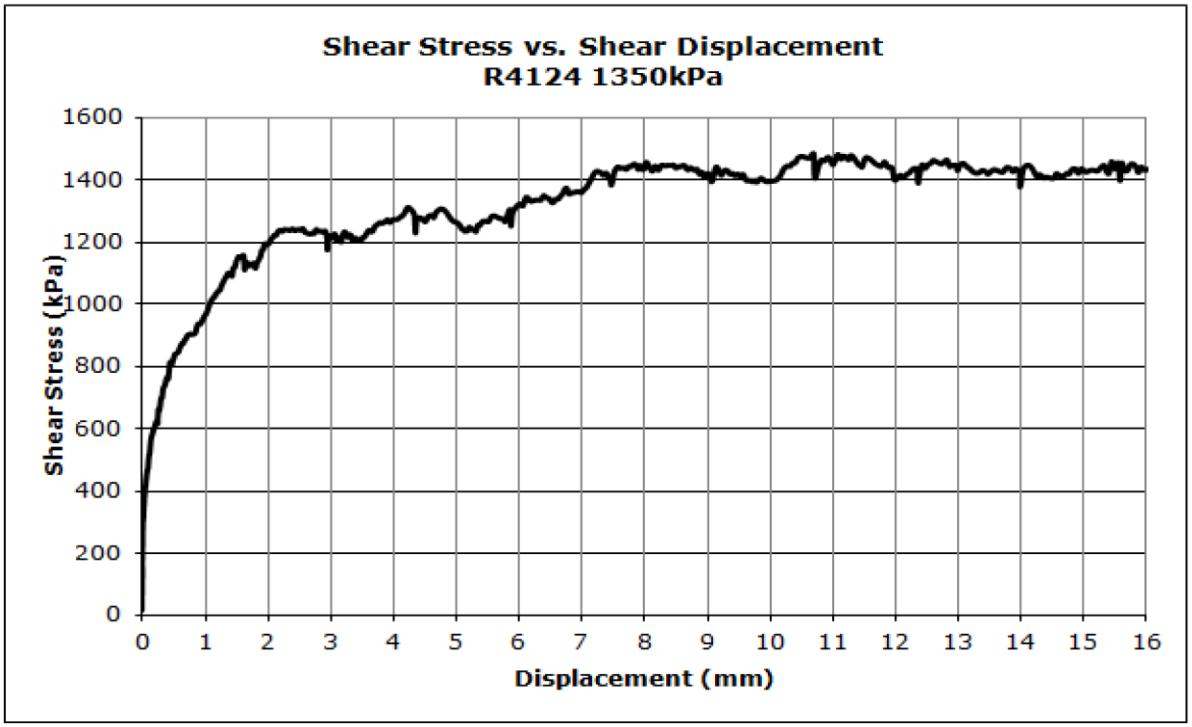
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I003-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 160.59m	**Lab #:** R4124





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Hamilton Rock Mechanics Lab

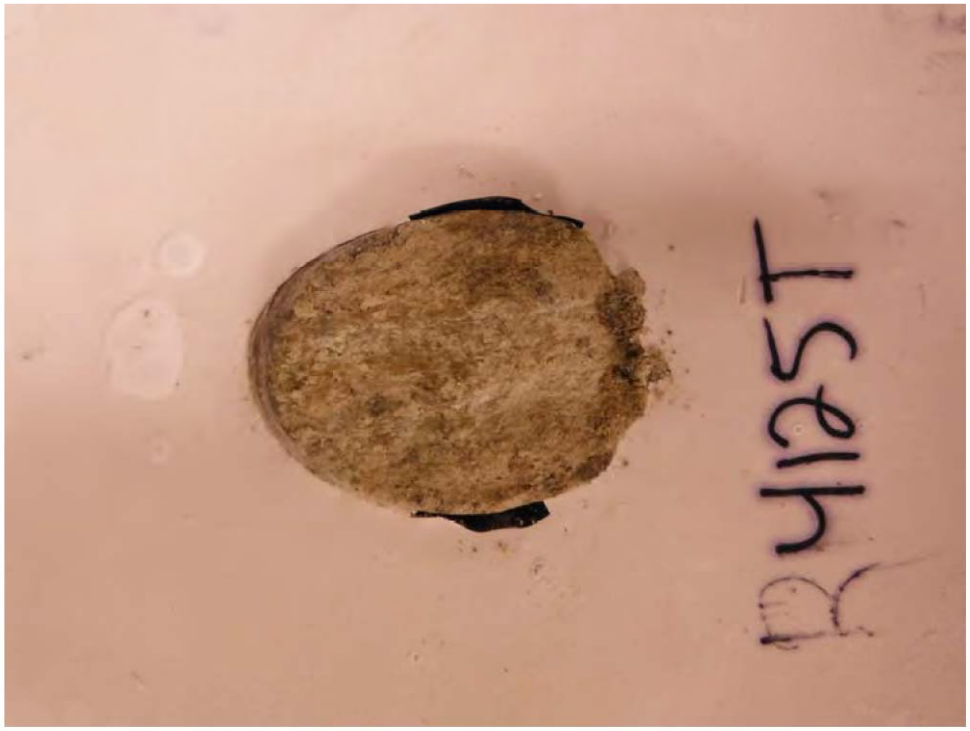
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I003-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 160.59m	**Lab #:** R4124



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Hamilton Rock Mechanics Lab

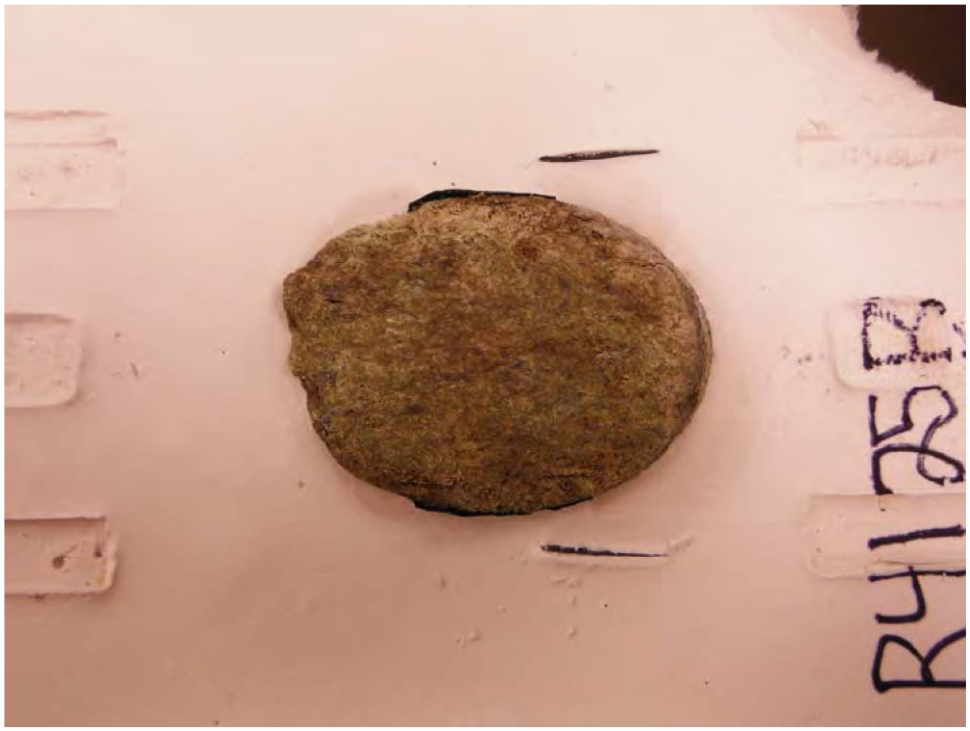
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I009-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.40m	**Lab #:** R4125





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Hamilton Rock Mechanics Lab

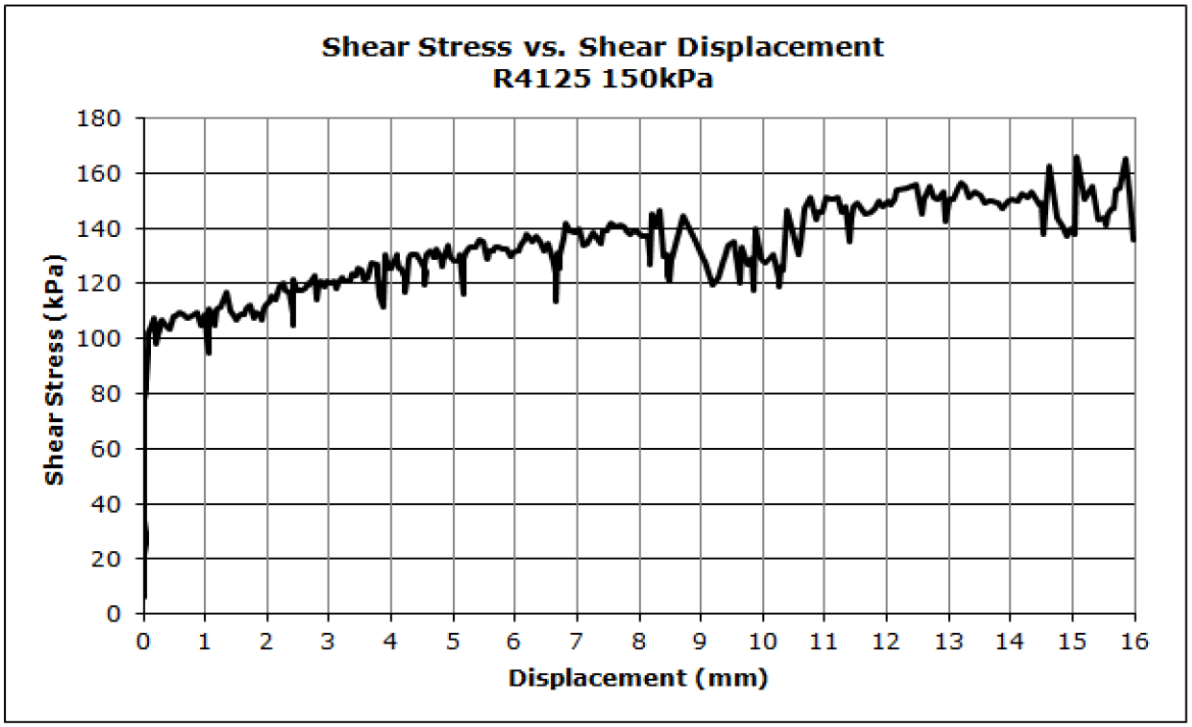
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I009-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.40m	**Lab #:** R4125

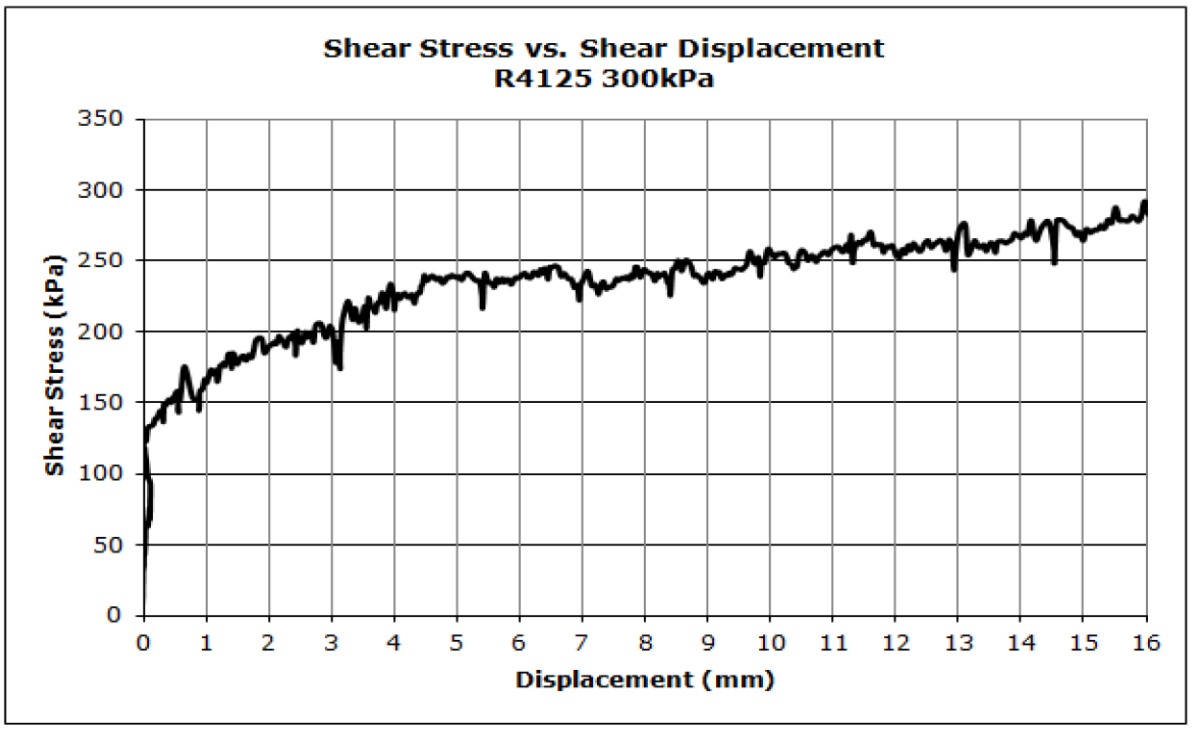




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Hamilton Rock Mechanics Lab

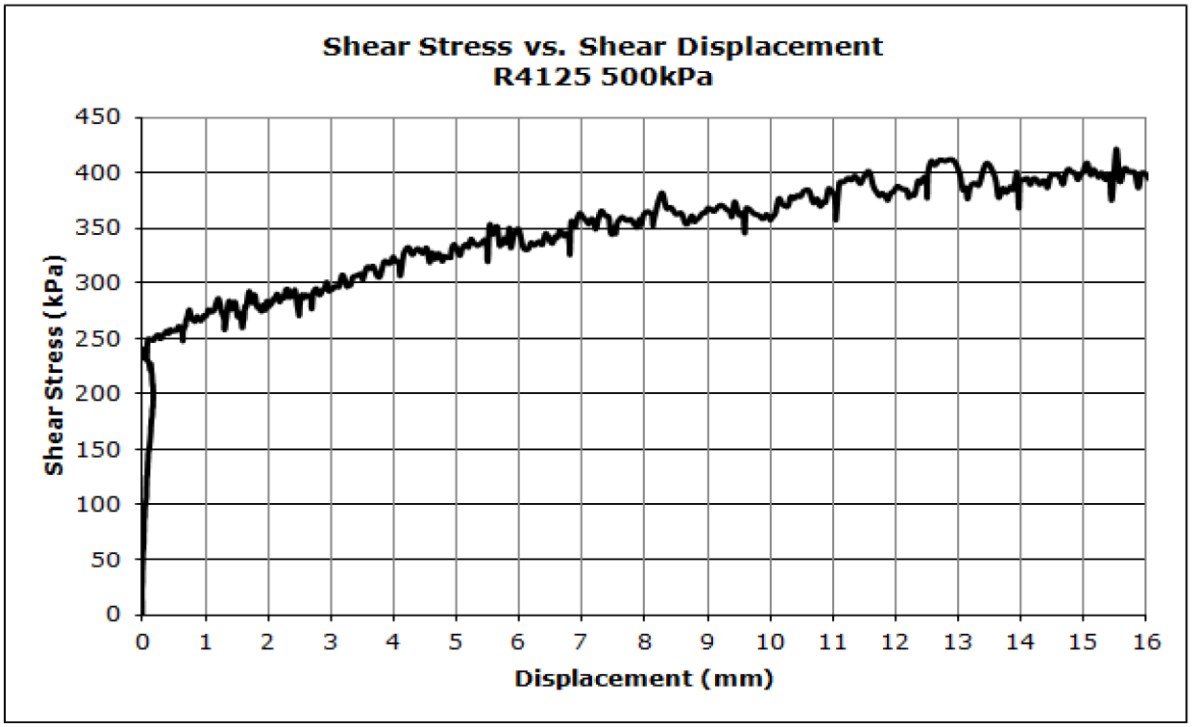
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Sample ID: DS-I009-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.40m	**Lab #:** R4125

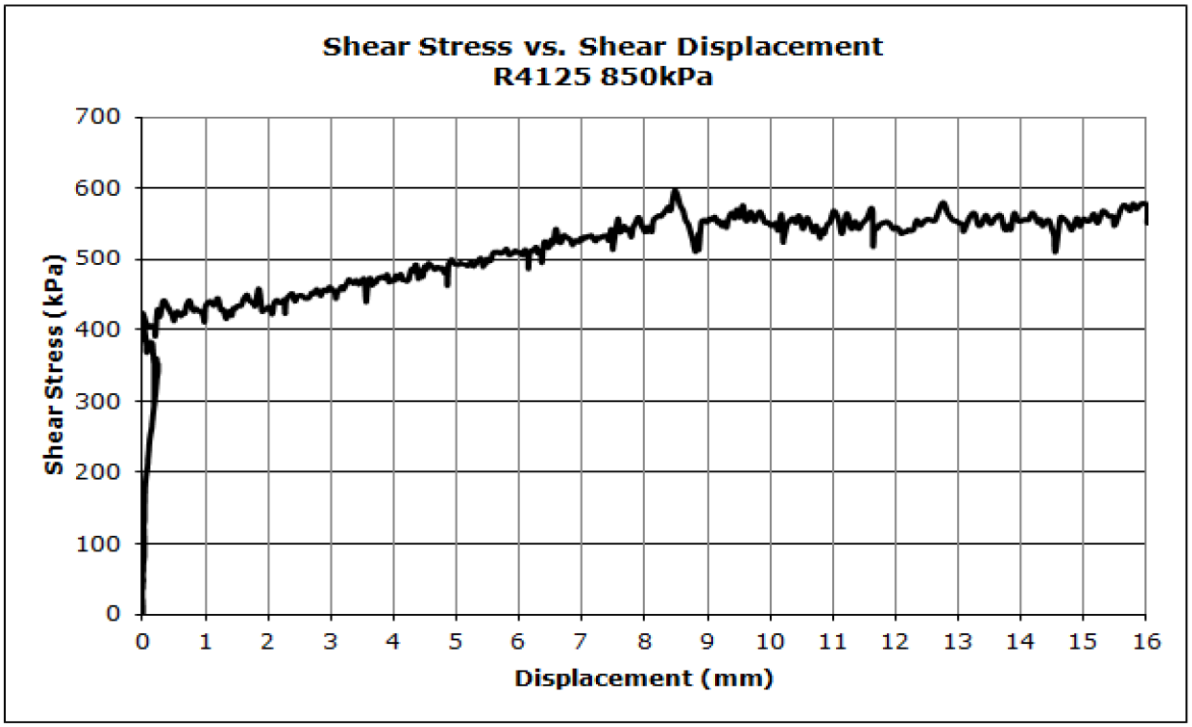




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Hamilton Rock Mechanics Lab

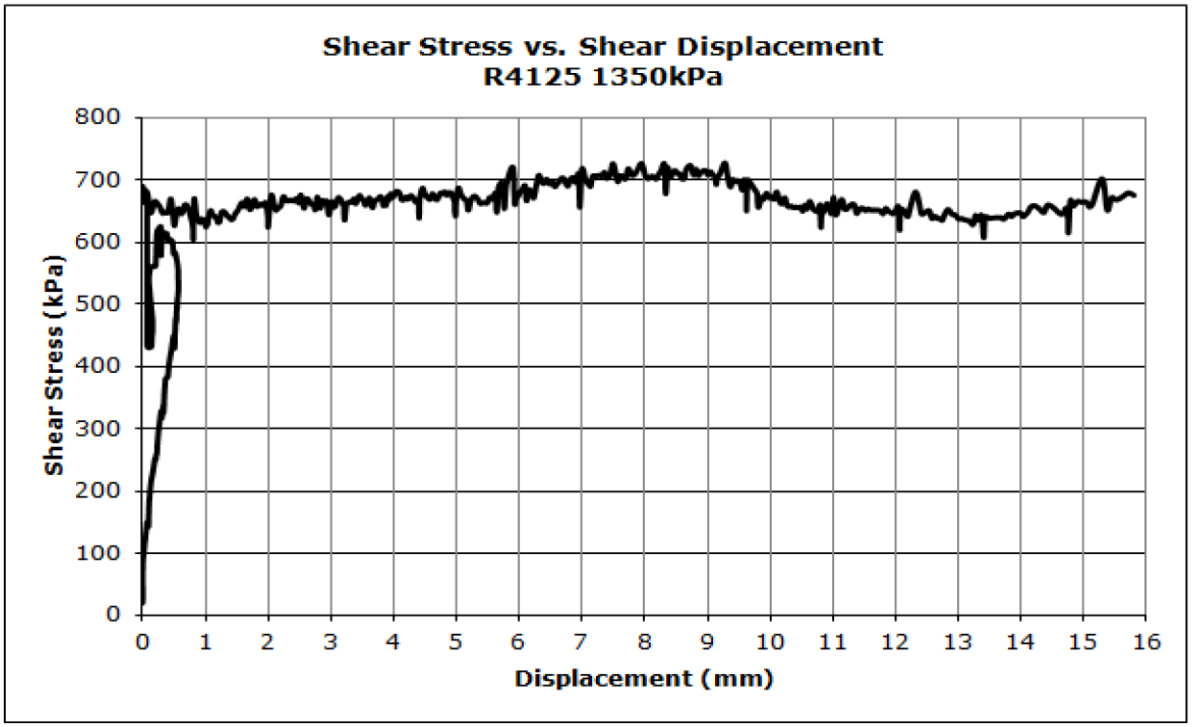
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Sample ID: DS-I009-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.40m	**Lab #:** R4125





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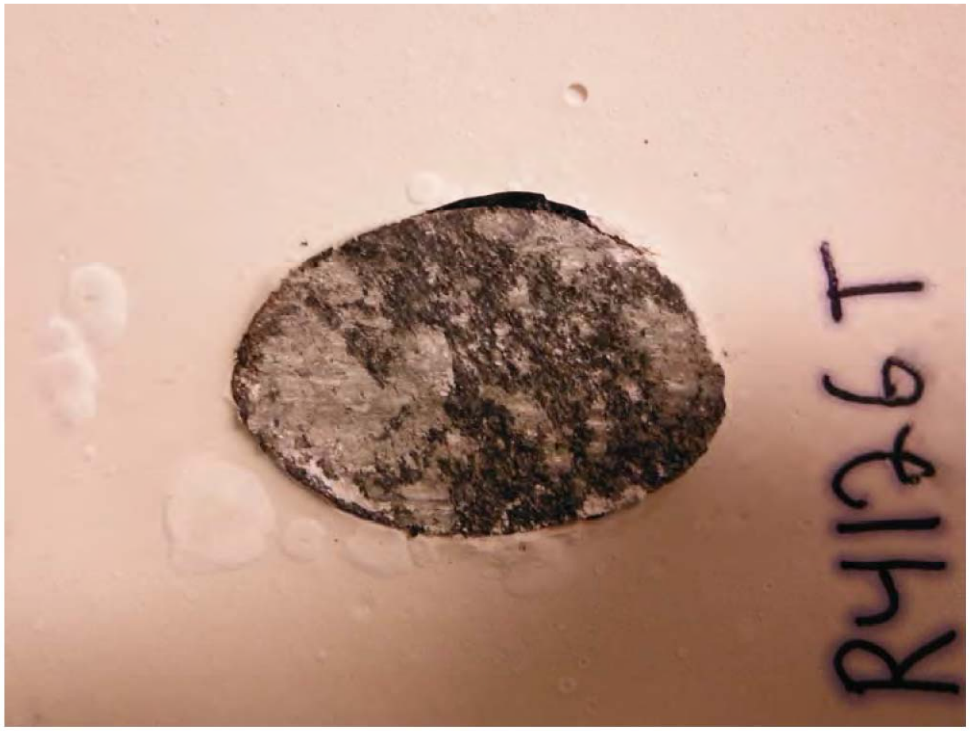
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I009-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 121.40m	**Lab #:** R4125



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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I014-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 88.25m	**Lab #:** R4126

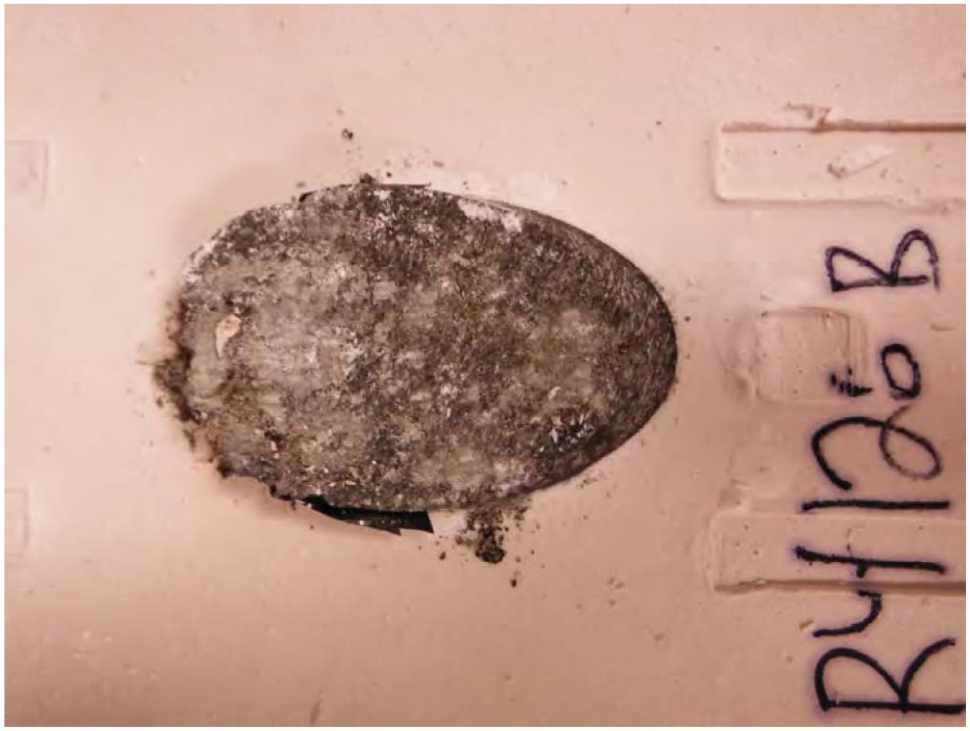




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Hamilton Rock Mechanics Lab

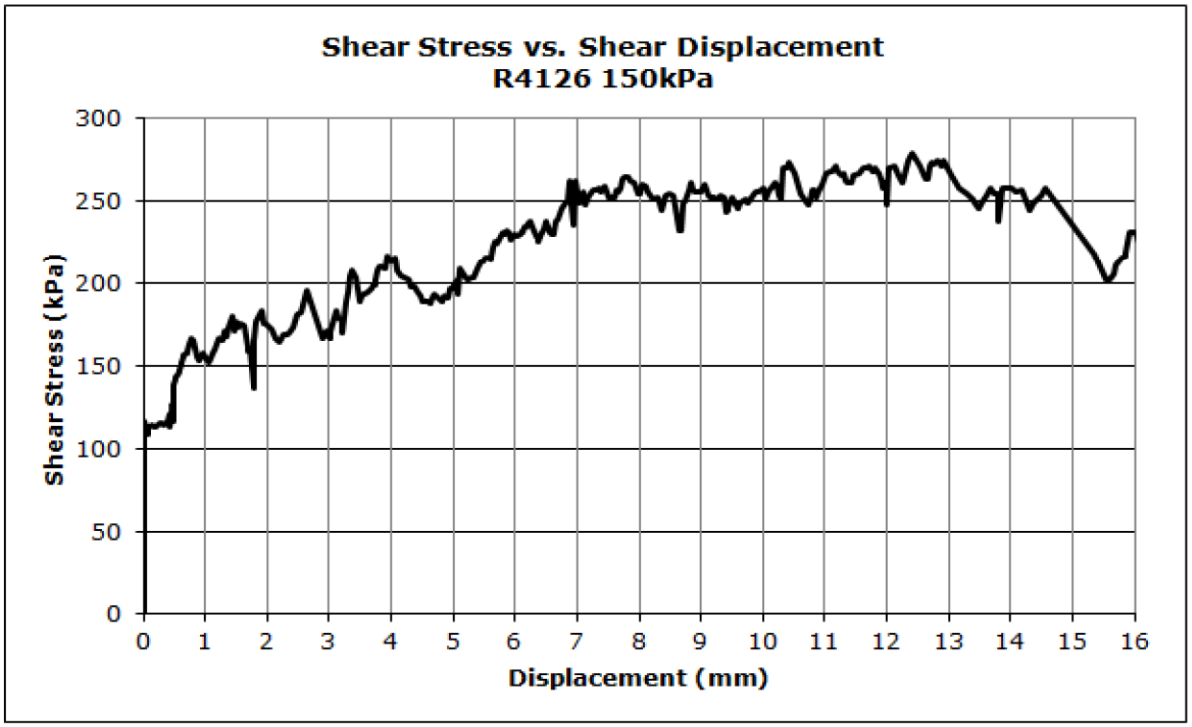
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I014-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 88.25m	**Lab #:** R4126

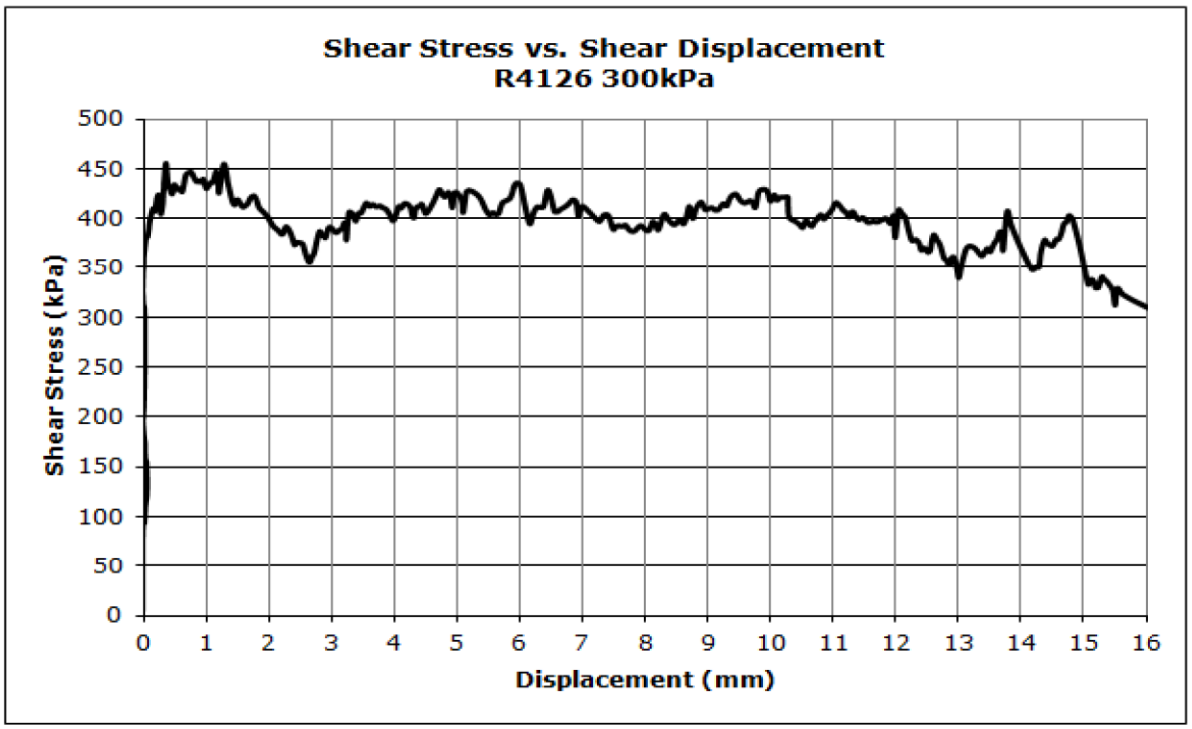




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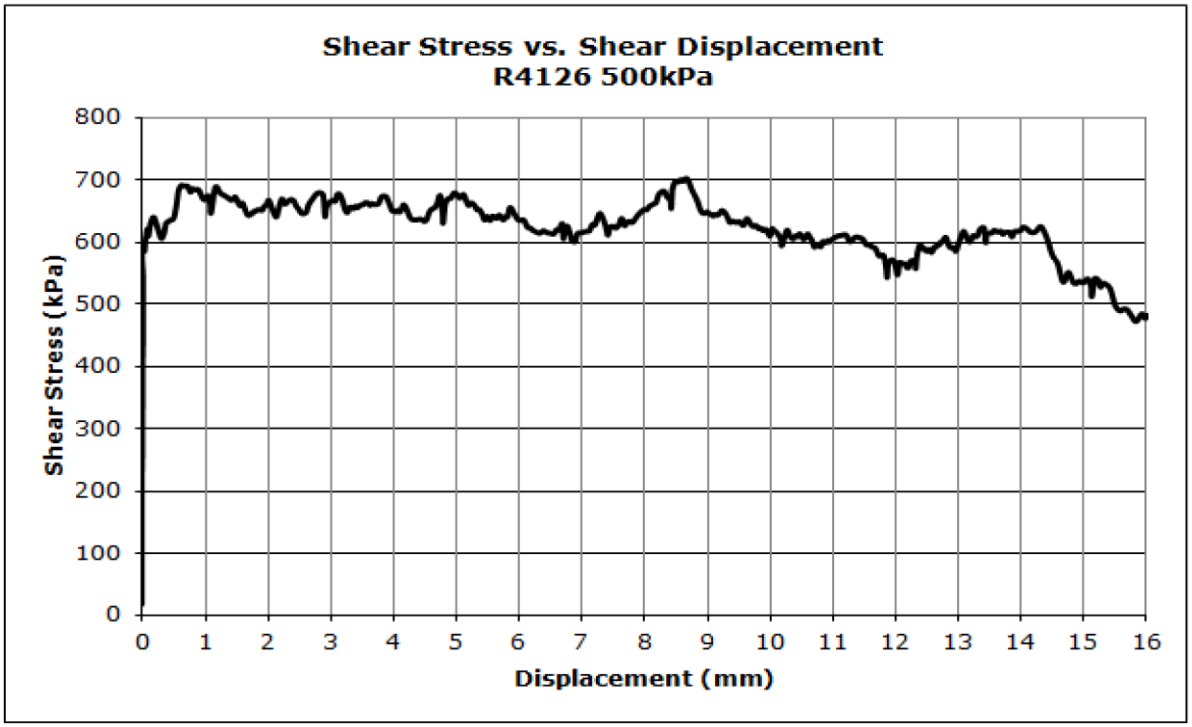
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Sample ID: DS-I014-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 88.25m	**Lab #:** R4126

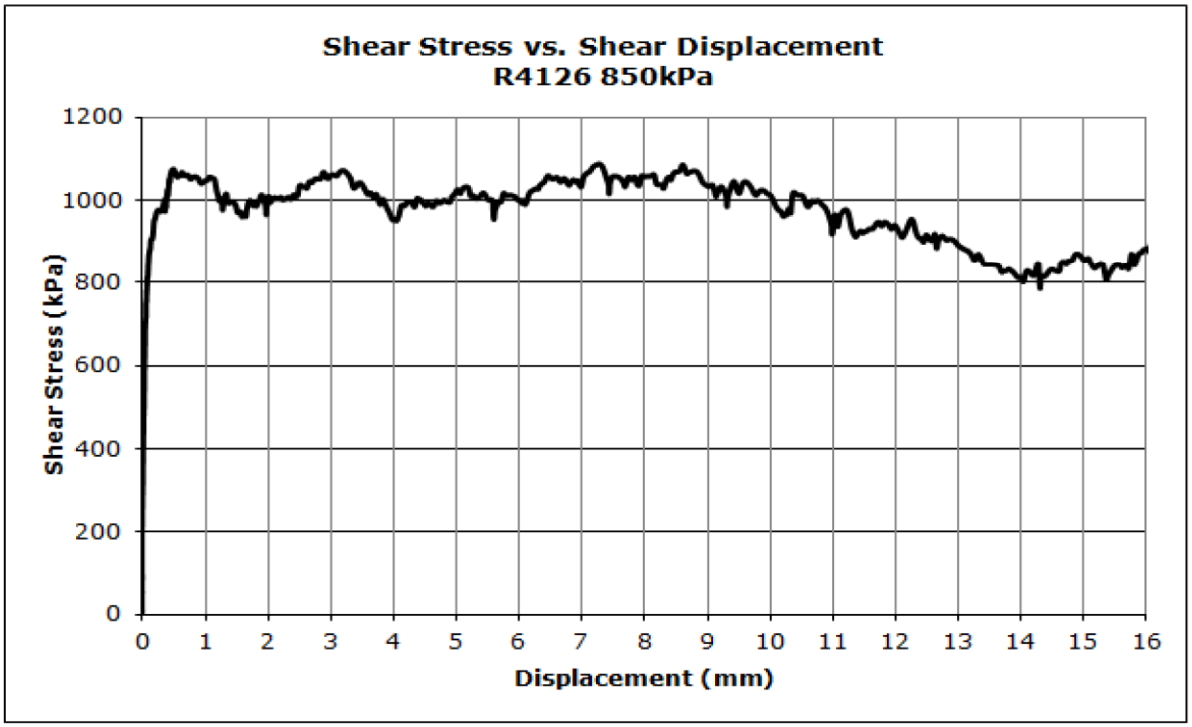




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Hamilton Rock Mechanics Lab

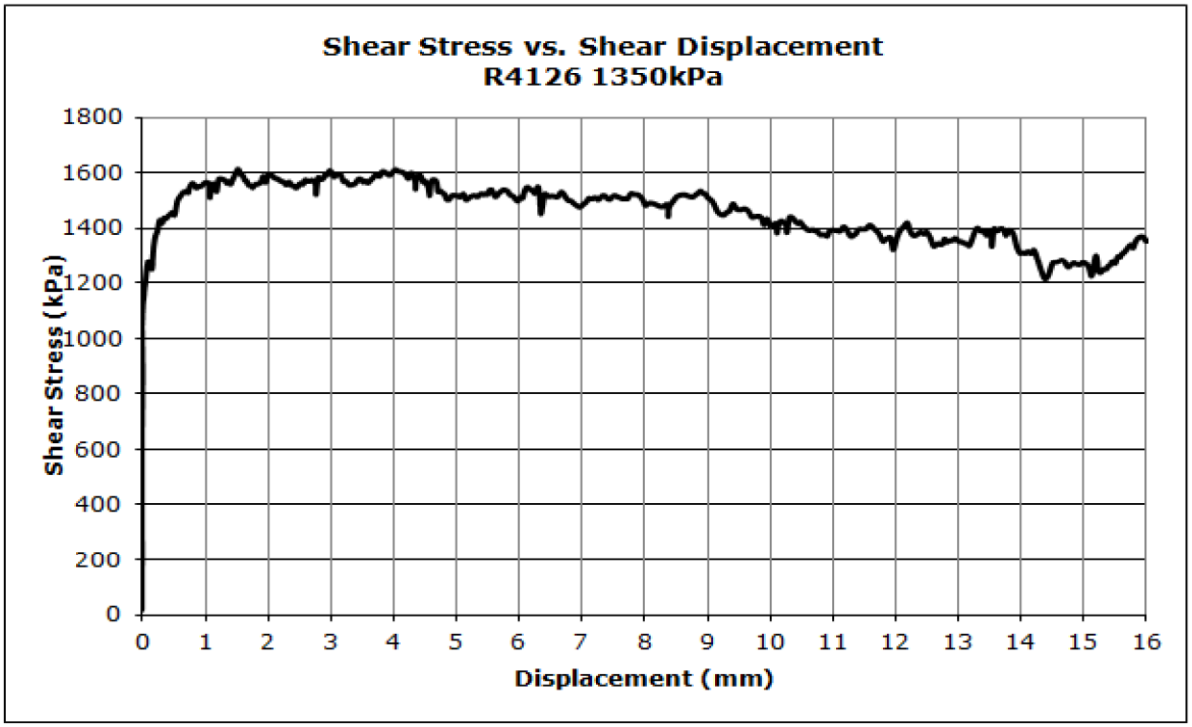
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Sample ID: DS-I014-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 88.25m	**Lab #:** R4126





Amec Foster Wheeler Environment & Infrastructure
Hamilton Rock Mechanics Lab

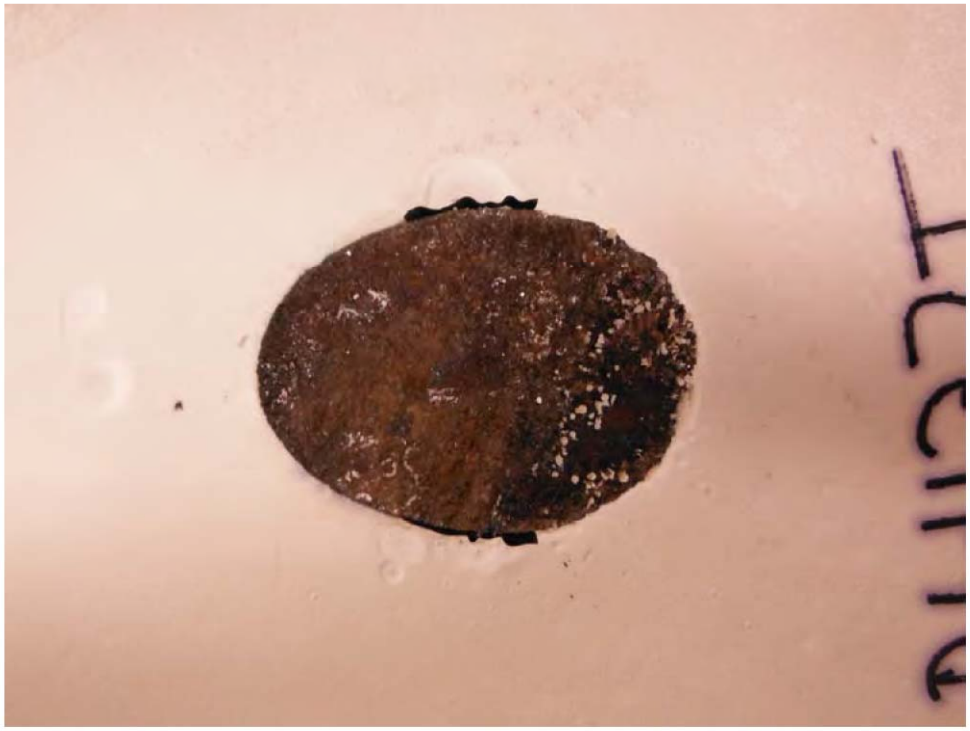
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Sample ID: DS-I014-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 88.25m	**Lab #:** R4126



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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I005-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 35.25m	**Lab #:** R4127





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Hamilton Rock Mechanics Lab

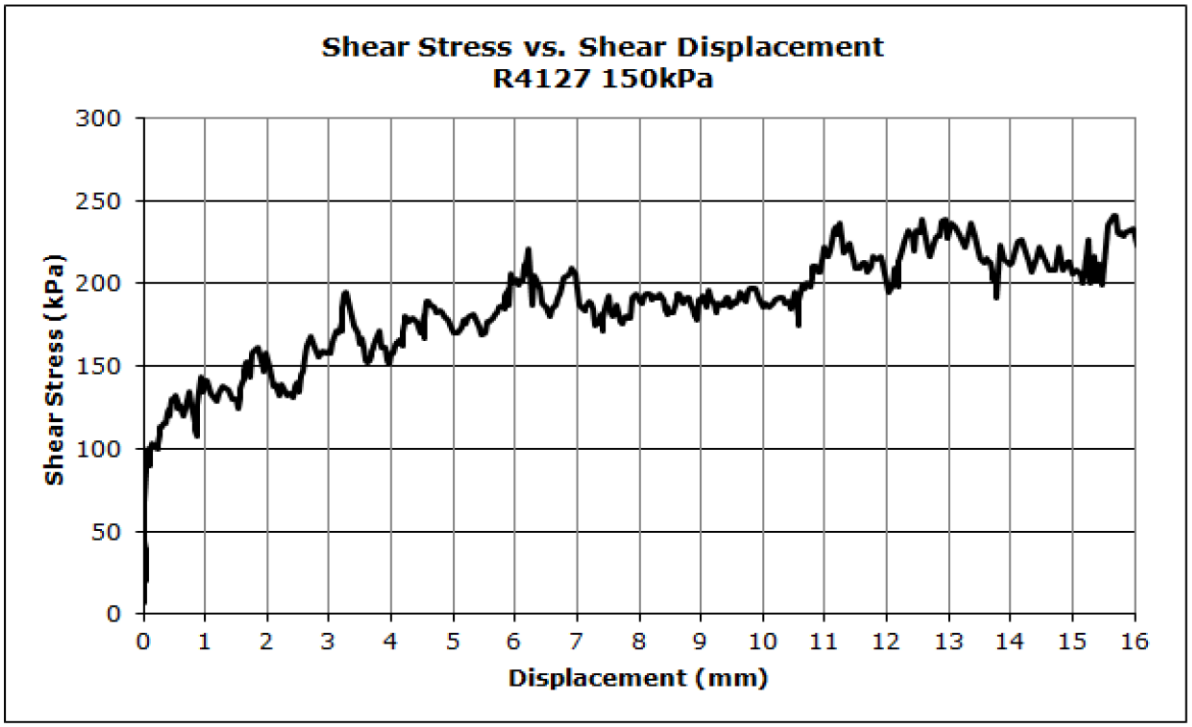
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Sample ID: DS-I005-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 35.25m	**Lab #:** R4127

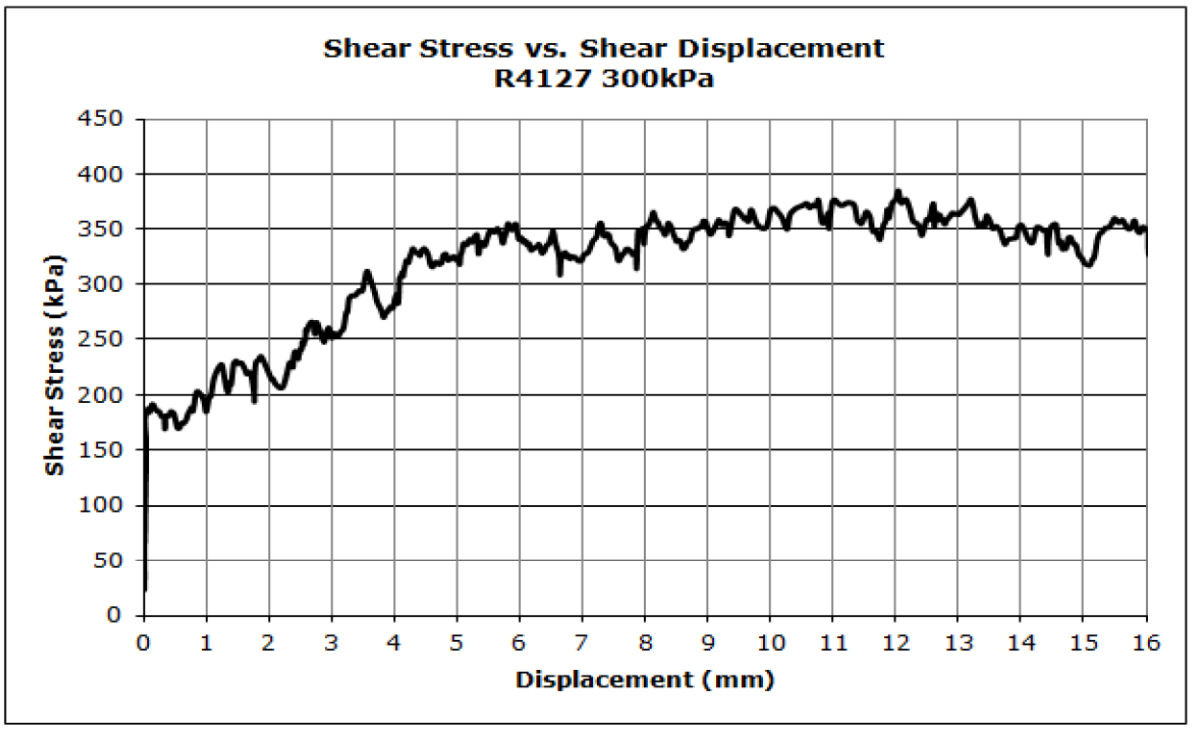




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Hamilton Rock Mechanics Lab

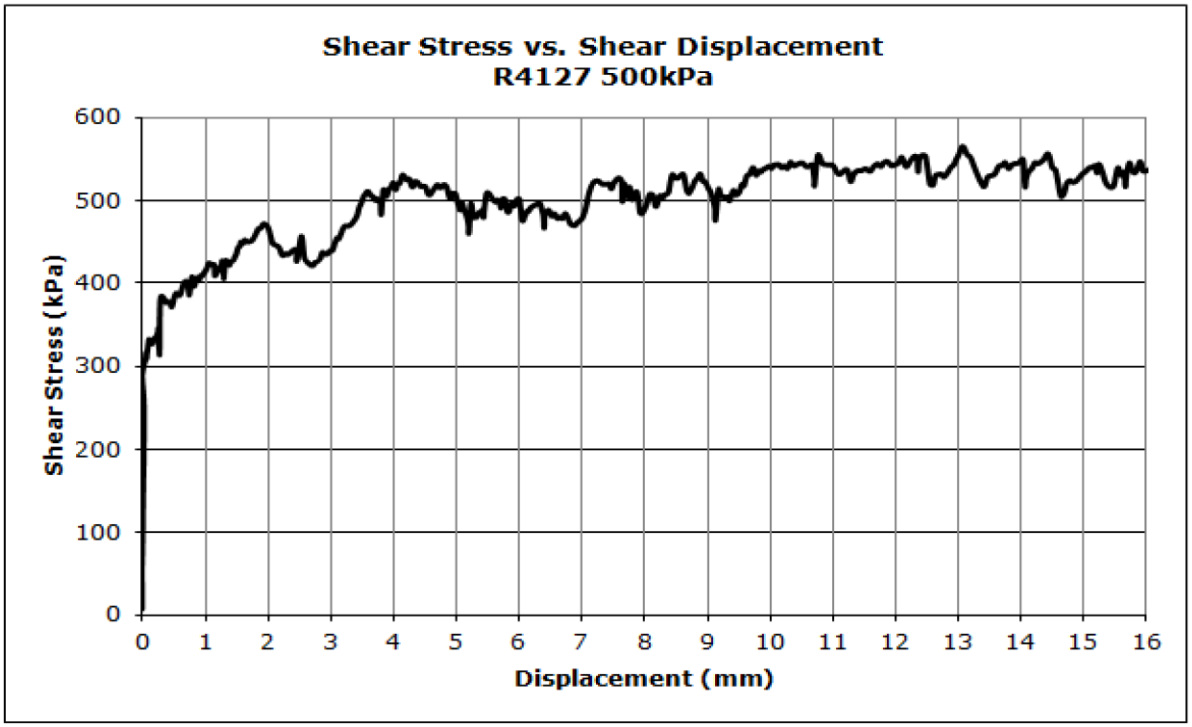
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Sample ID: DS-I005-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 35.25m	**Lab #:** R4127

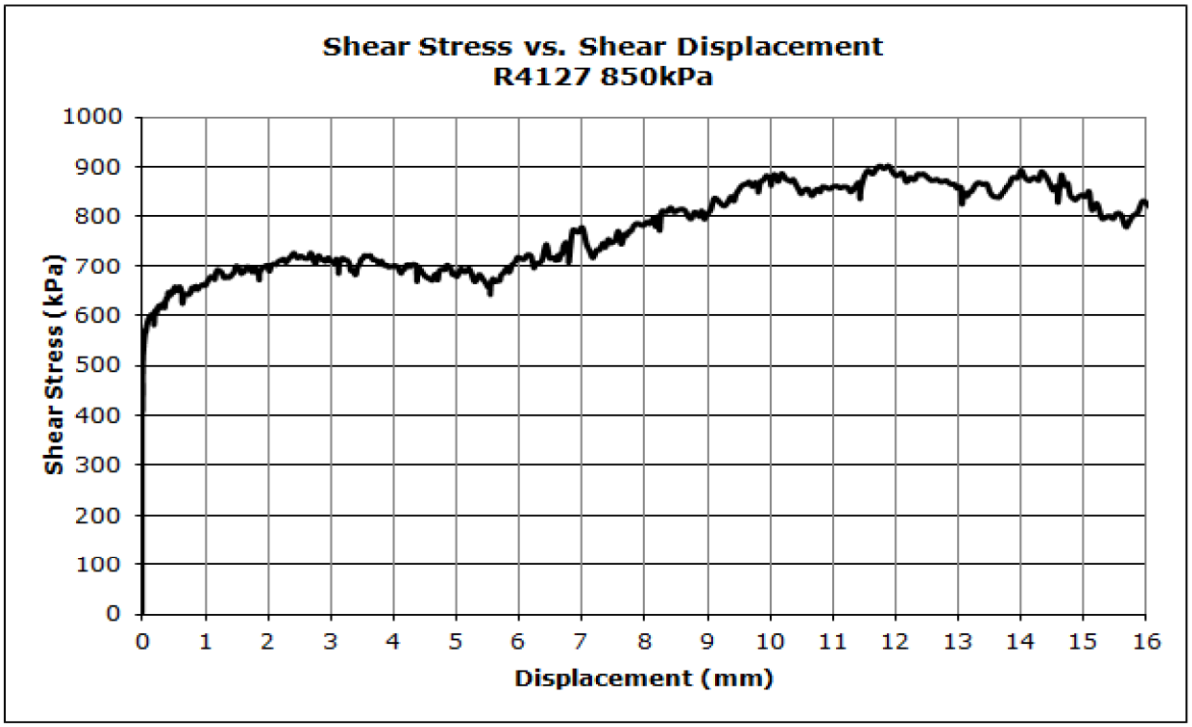




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Hamilton Rock Mechanics Lab

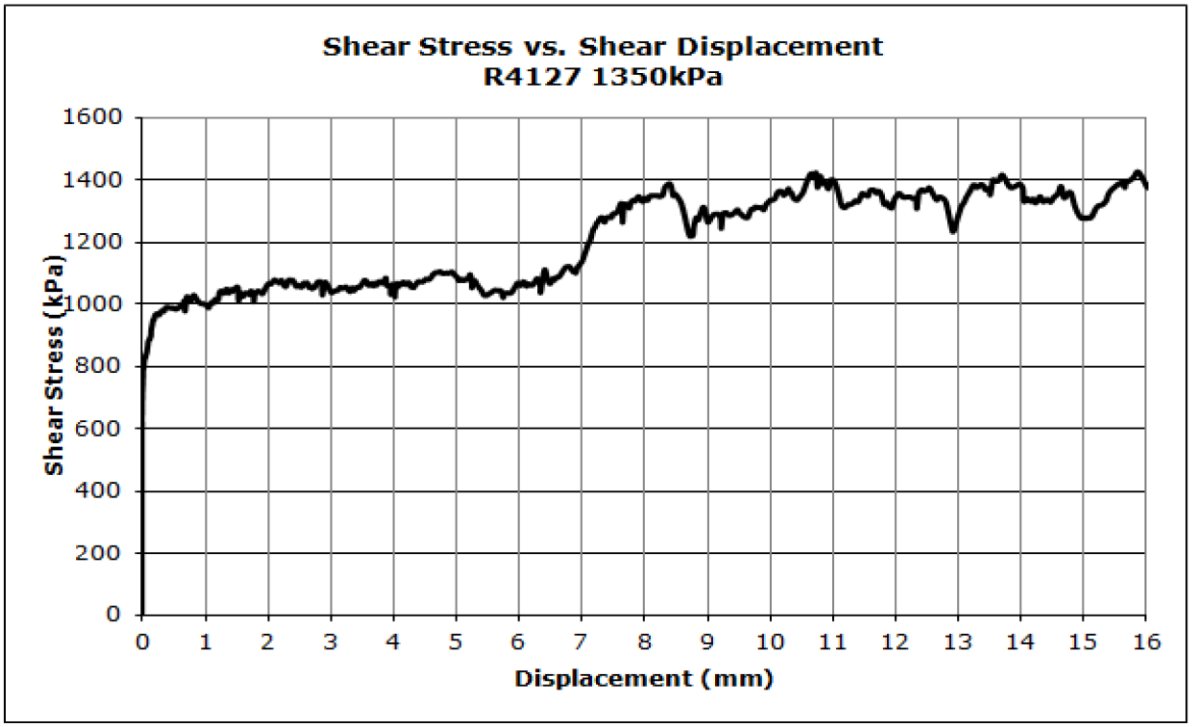
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Sample ID: DS-I005-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 35.25m	**Lab #:** R4127





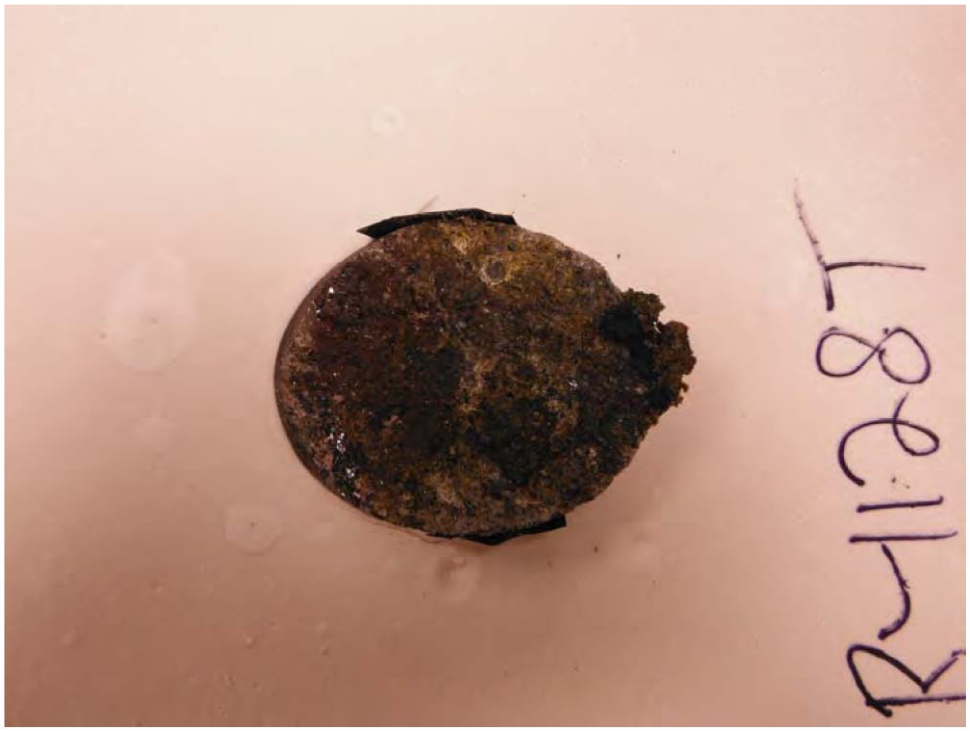
Amec Foster Wheeler Environment & Infrastructure
Hamilton Rock Mechanics Lab

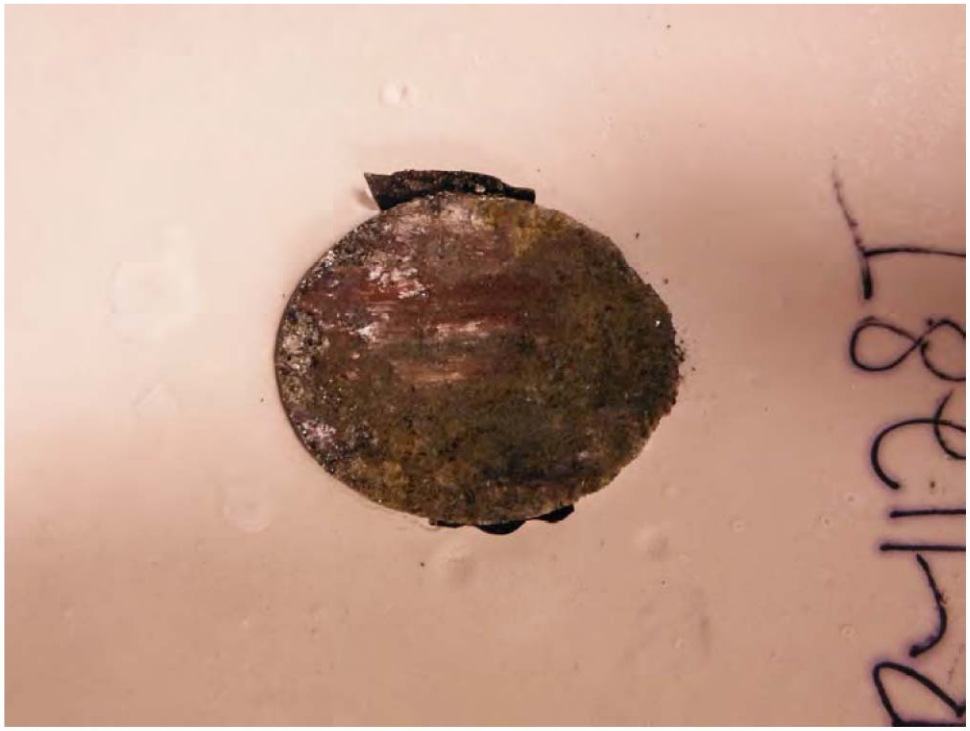
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Sample ID: DS-I005-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 35.25m	**Lab #:** R4127



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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I010-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 28.63m	**Lab #:** R4128





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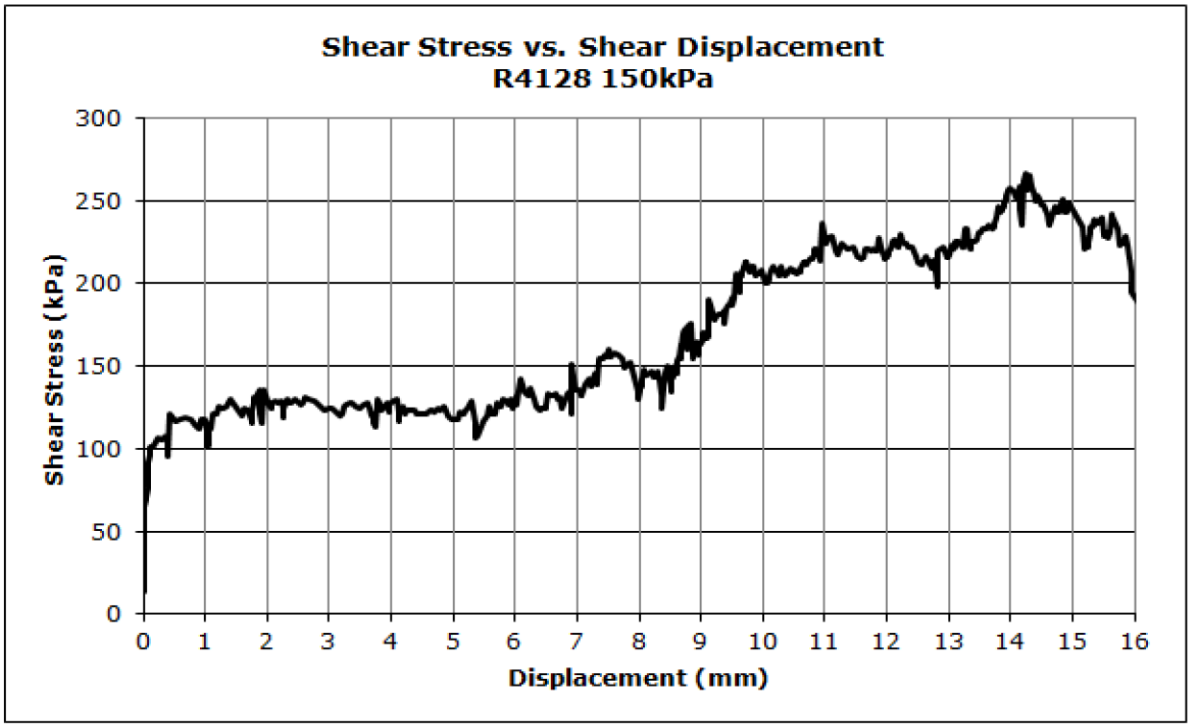
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Sample ID: DS-I010-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 28.63m	**Lab #:** R4128

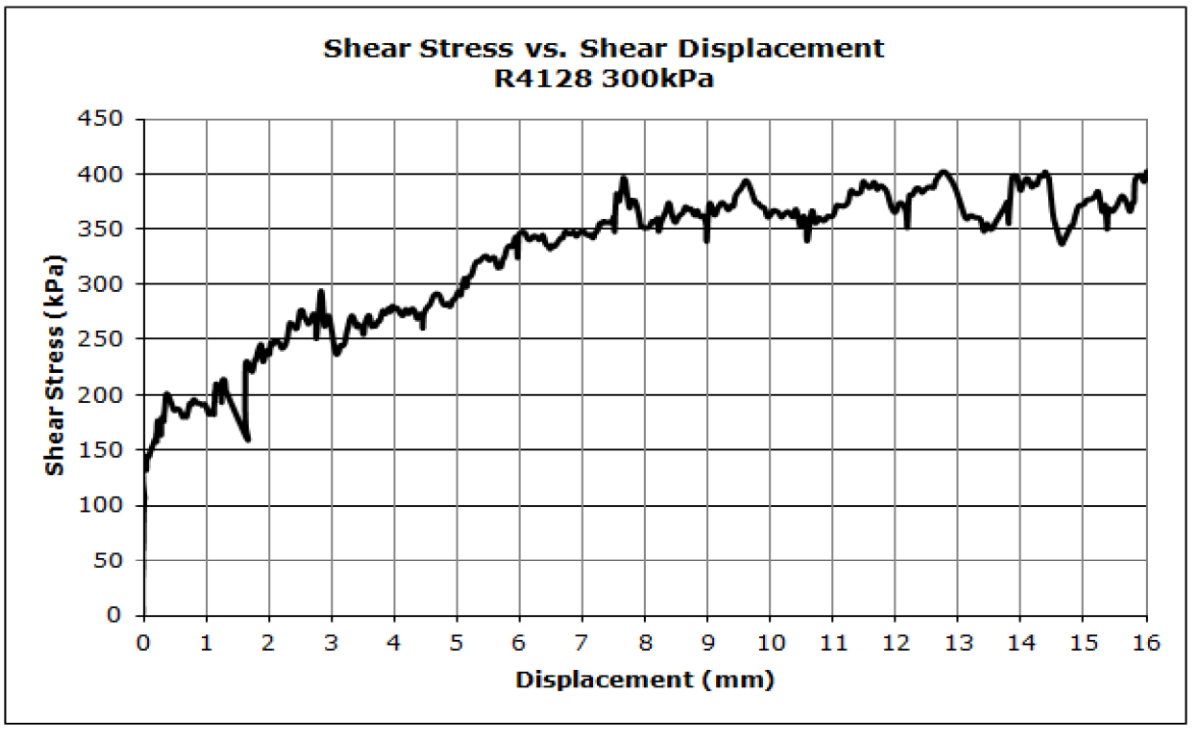




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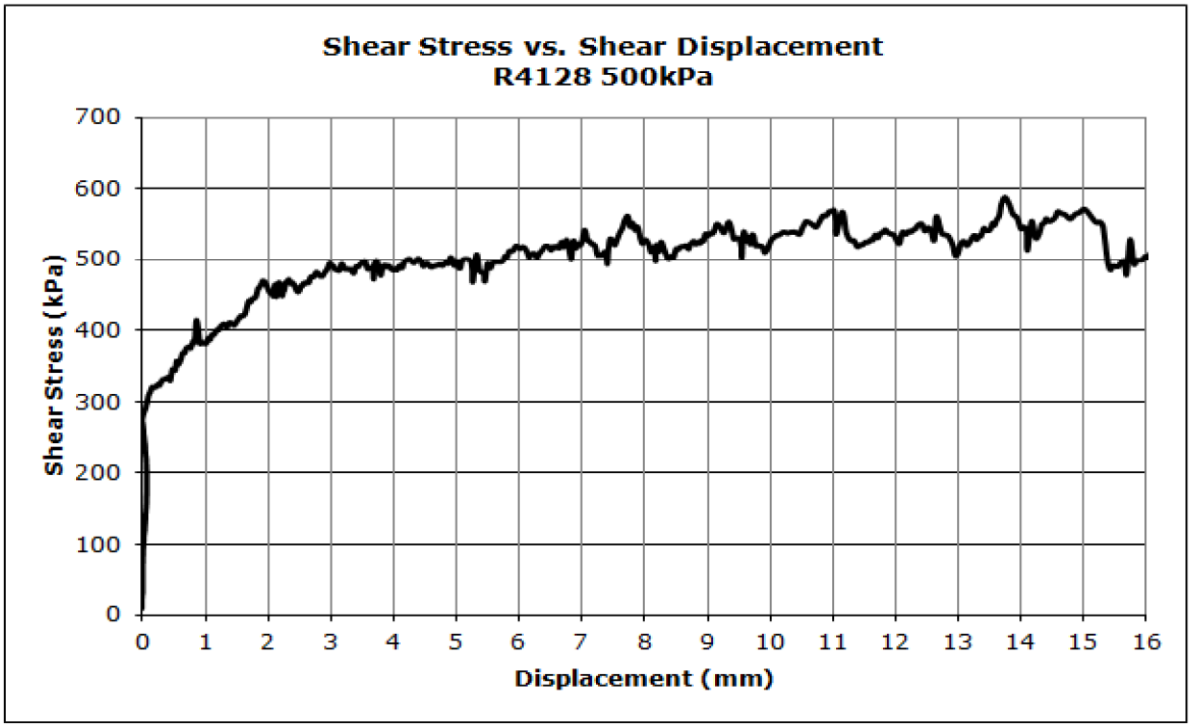
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Sample ID: DS-I010-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 28.63m	**Lab #:** R4128

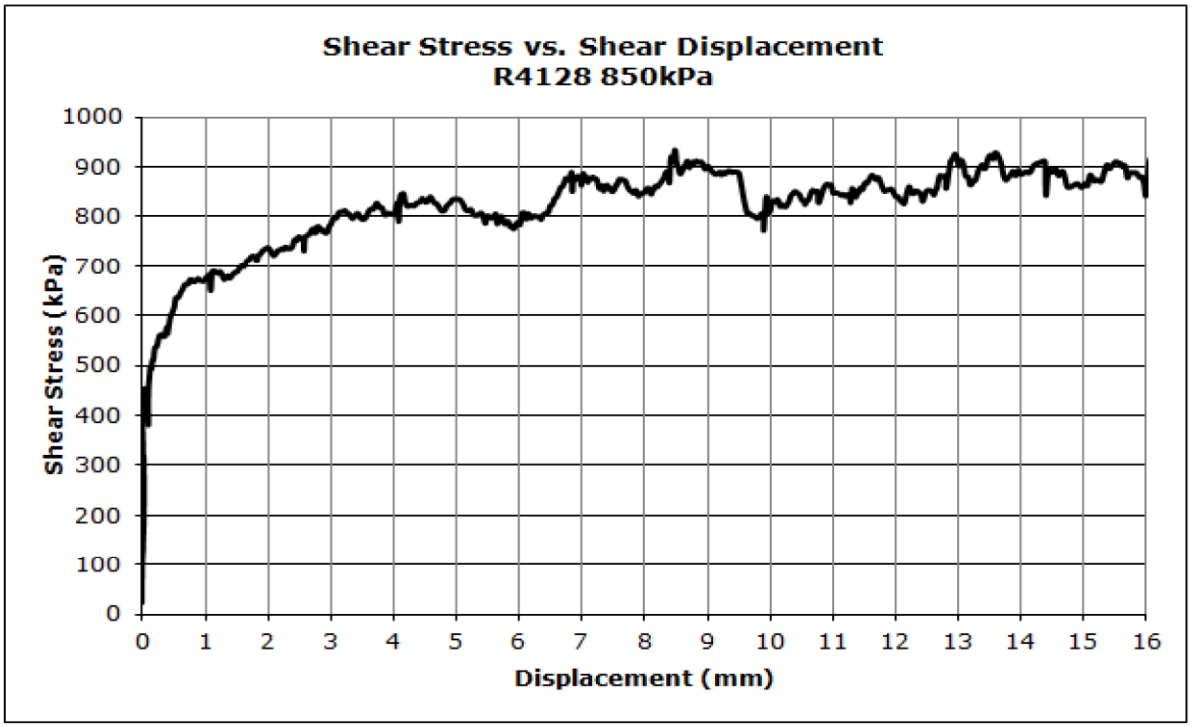




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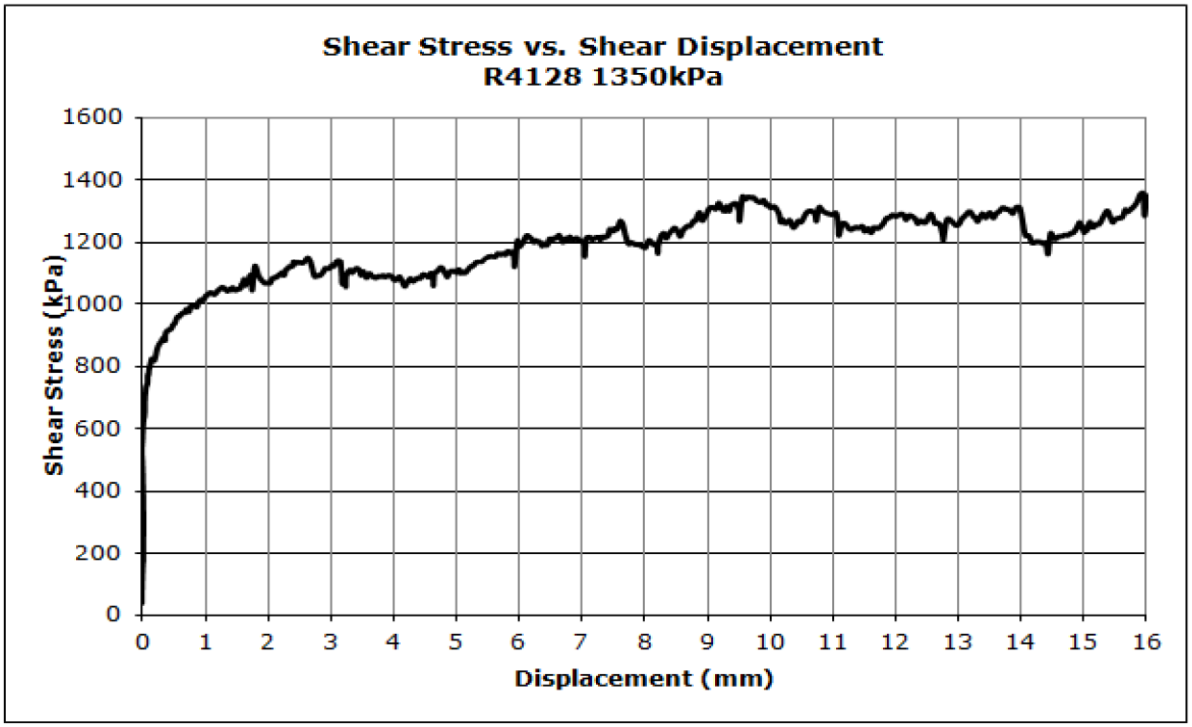
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Sample ID: DS-I010-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 28.63m	**Lab #:** R4128





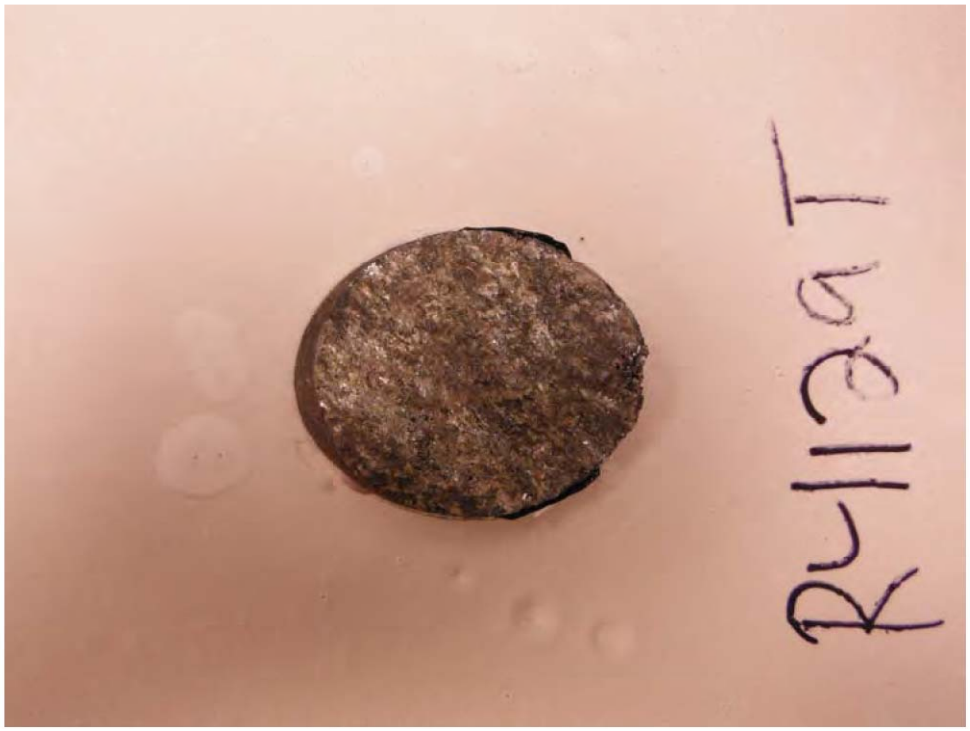
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Hamilton Rock Mechanics Lab

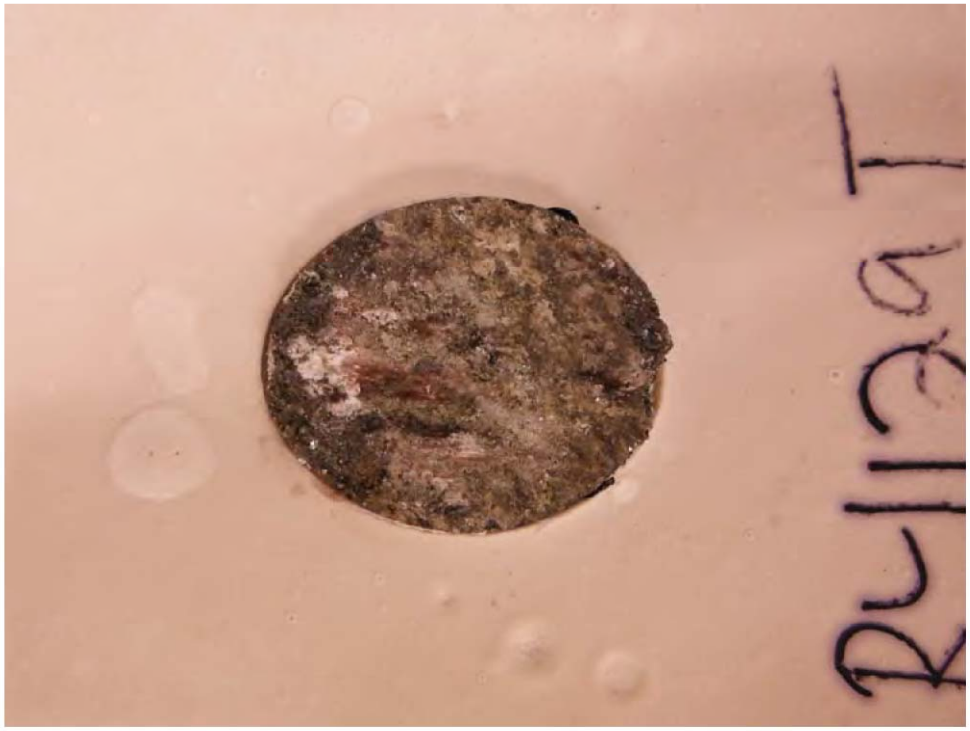
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Sample ID: DS-I010-03	**Project Name:** Piteau Associates Rock Mechanics
Depth: 28.63m	**Lab #:** R4128



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Hamilton Rock Mechanics Lab

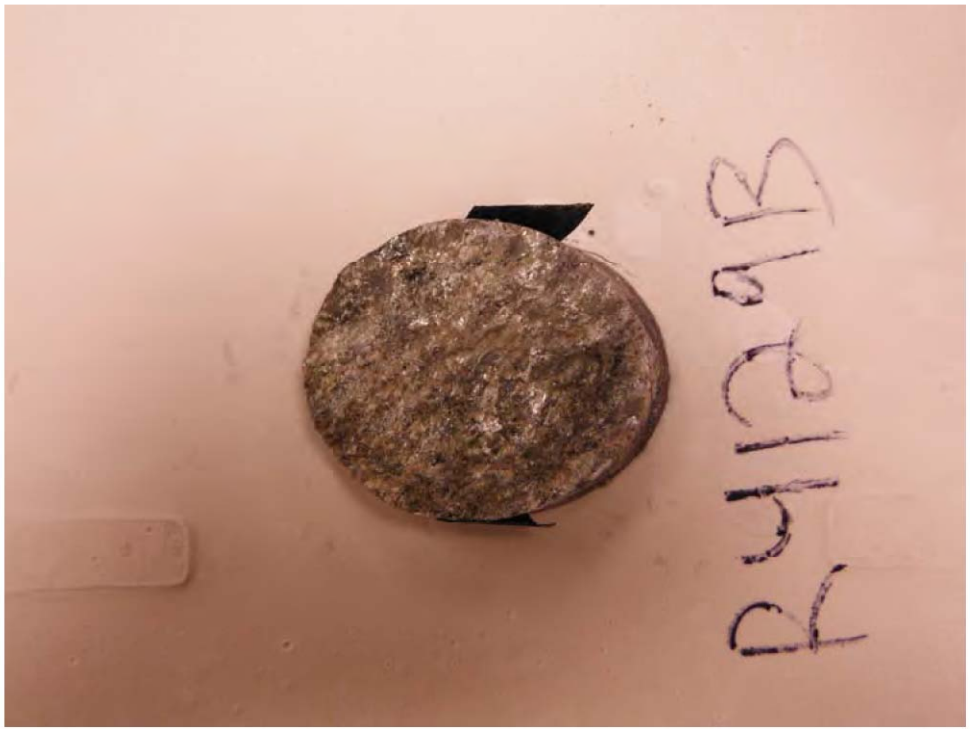
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Depth: 23.72m	**Lab #:** R4129

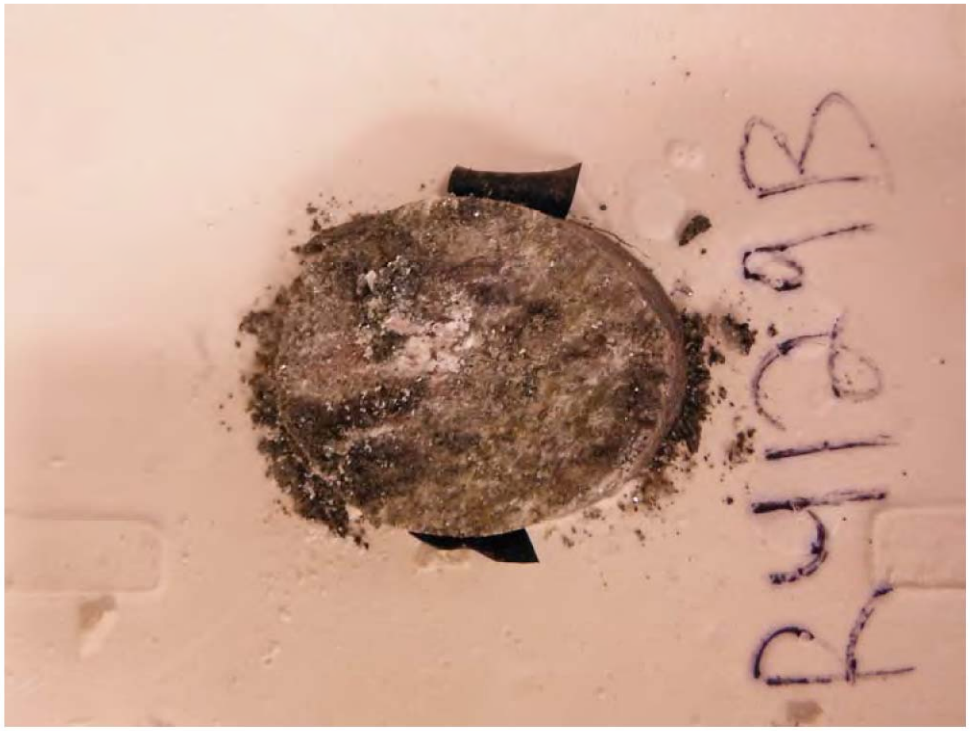




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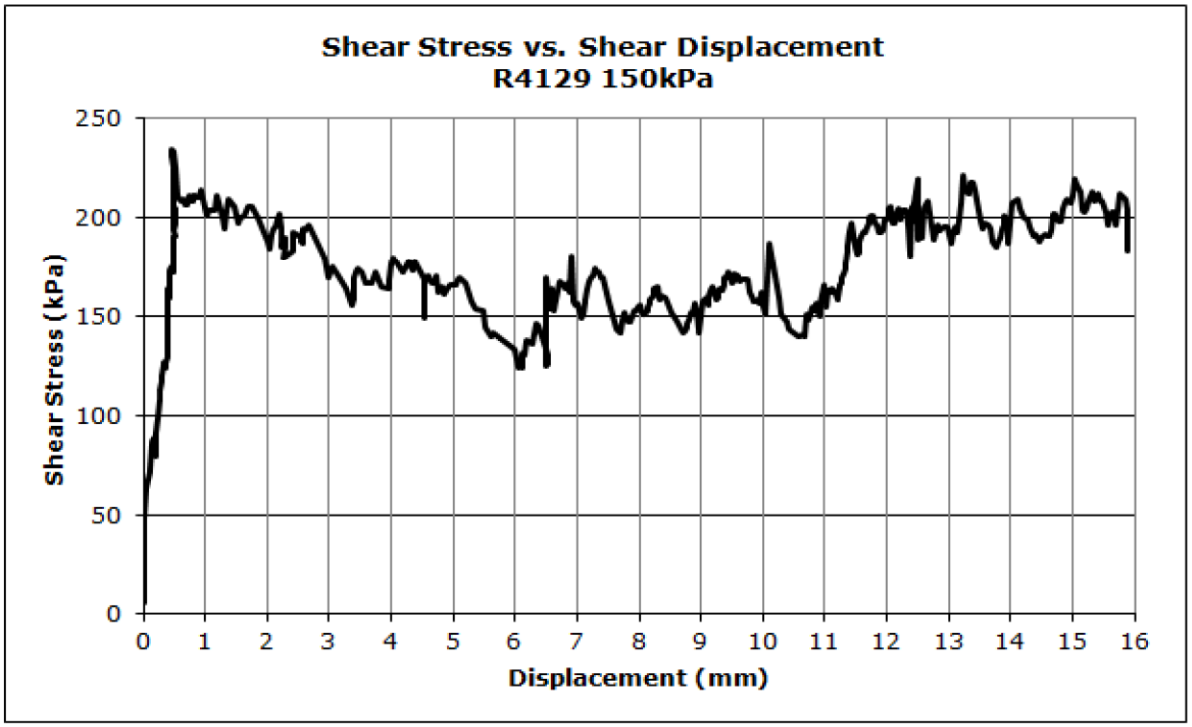
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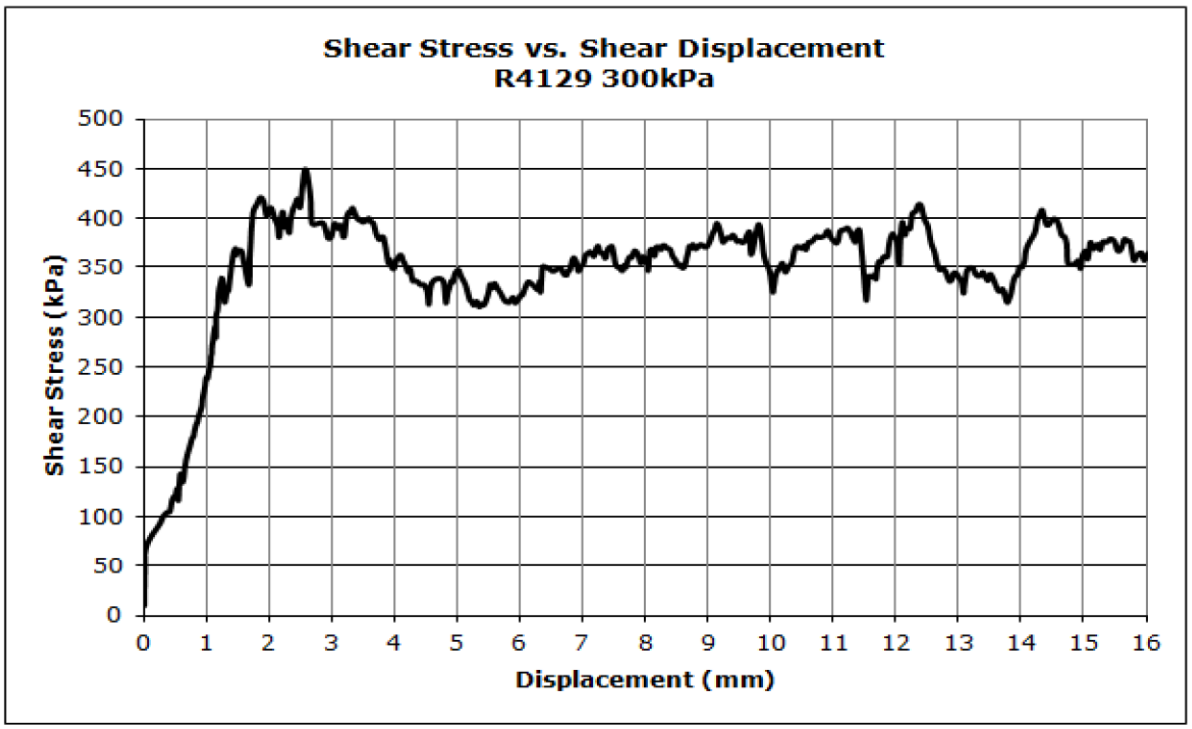




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Hamilton Rock Mechanics Lab

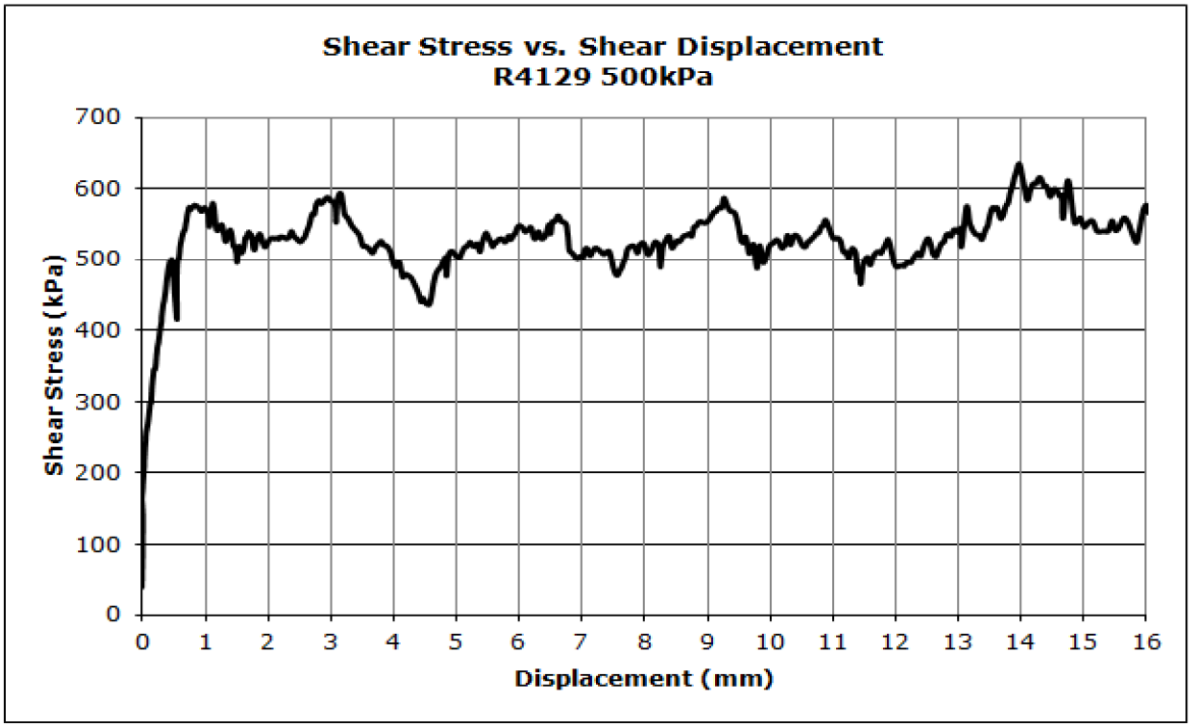
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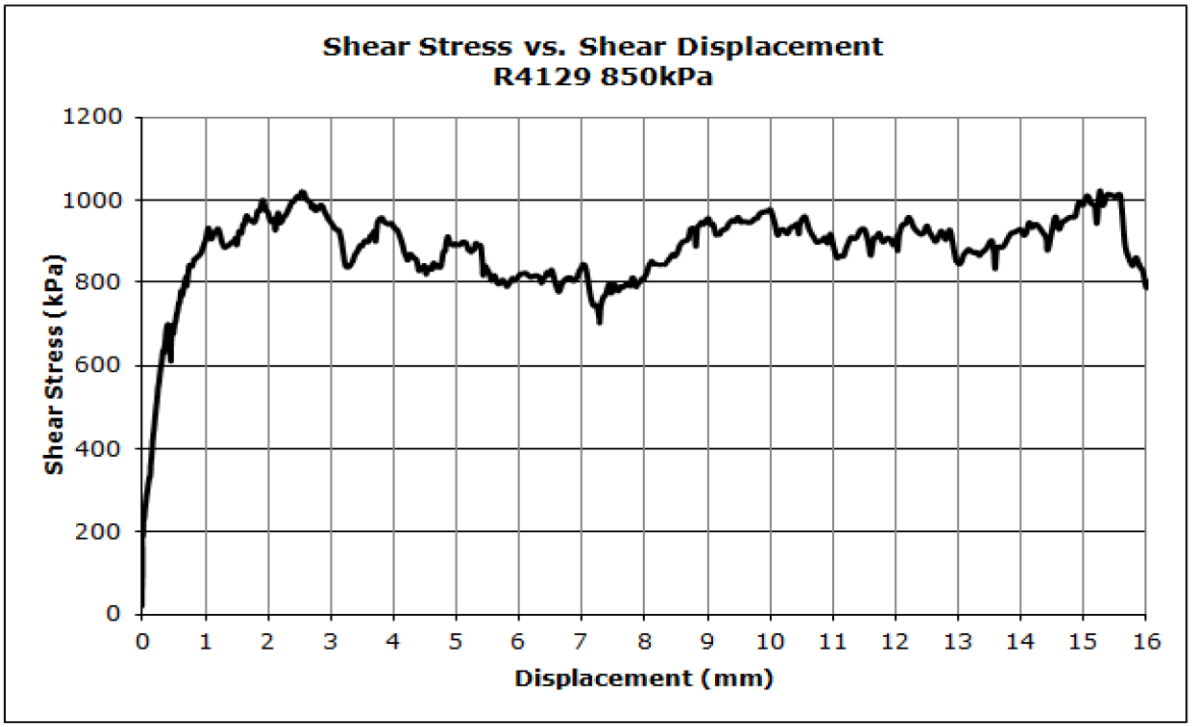




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Hamilton Rock Mechanics Lab

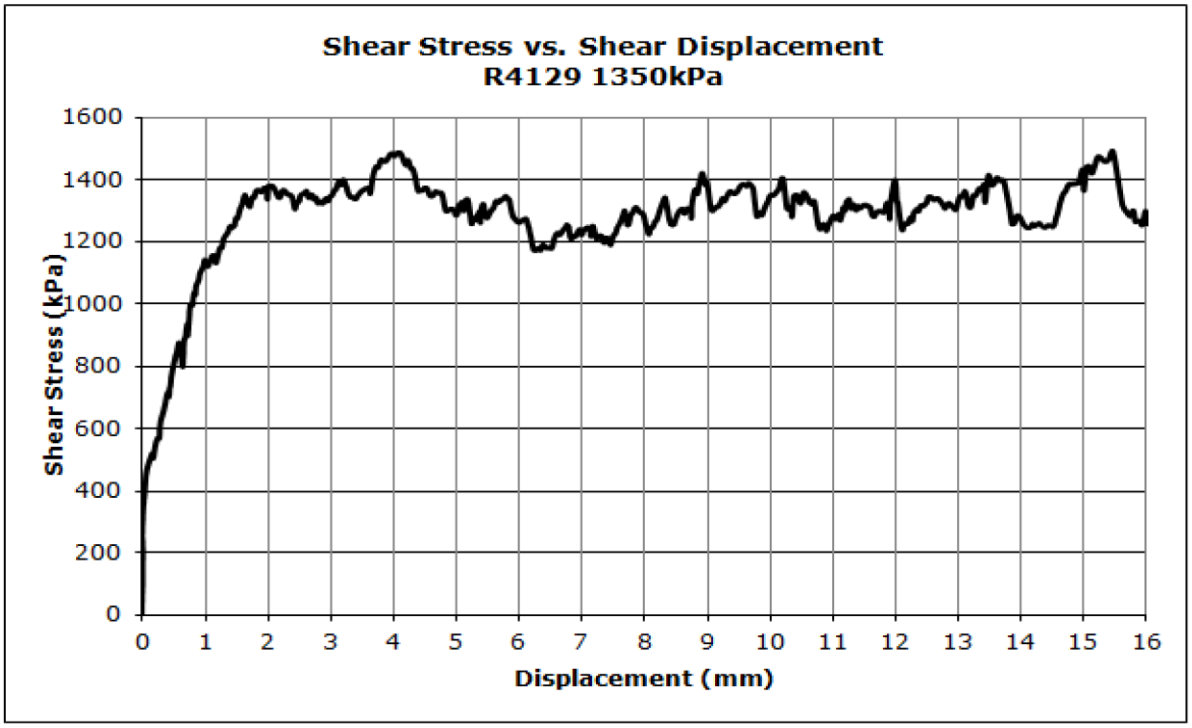
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Depth: 23.72m	**Lab #:** R4129





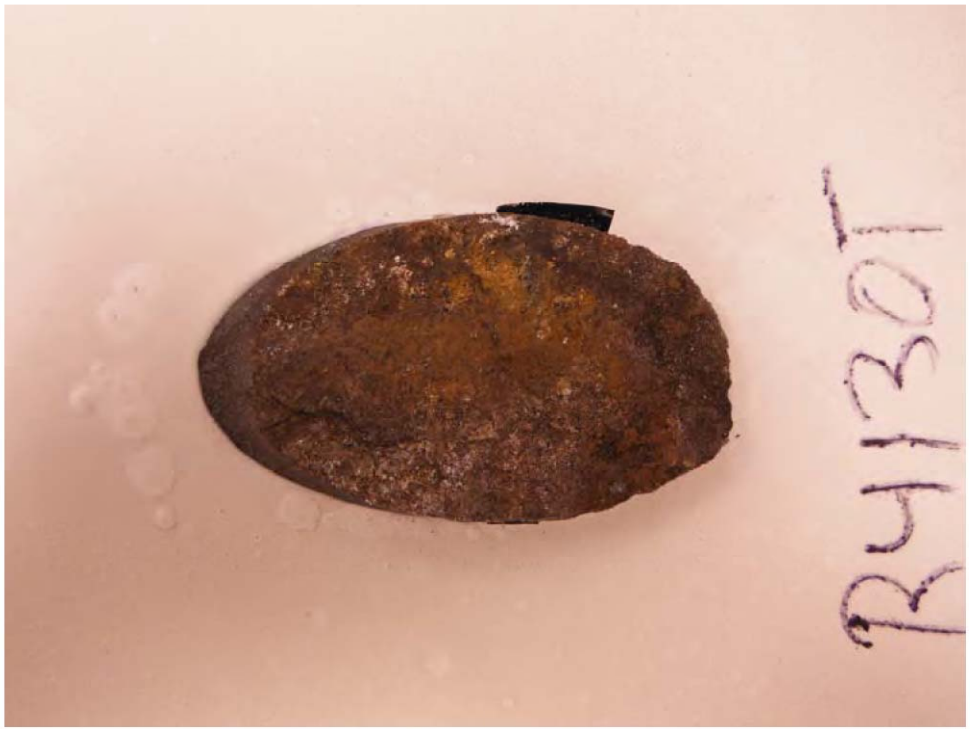
Amec Foster Wheeler Environment & Infrastructure
Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I010-04	**Project Name:** Piteau Associates Rock Mechanics
Depth: 23.72m	**Lab #:** R4129



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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I013-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 54.12m	**Lab #:** R4130





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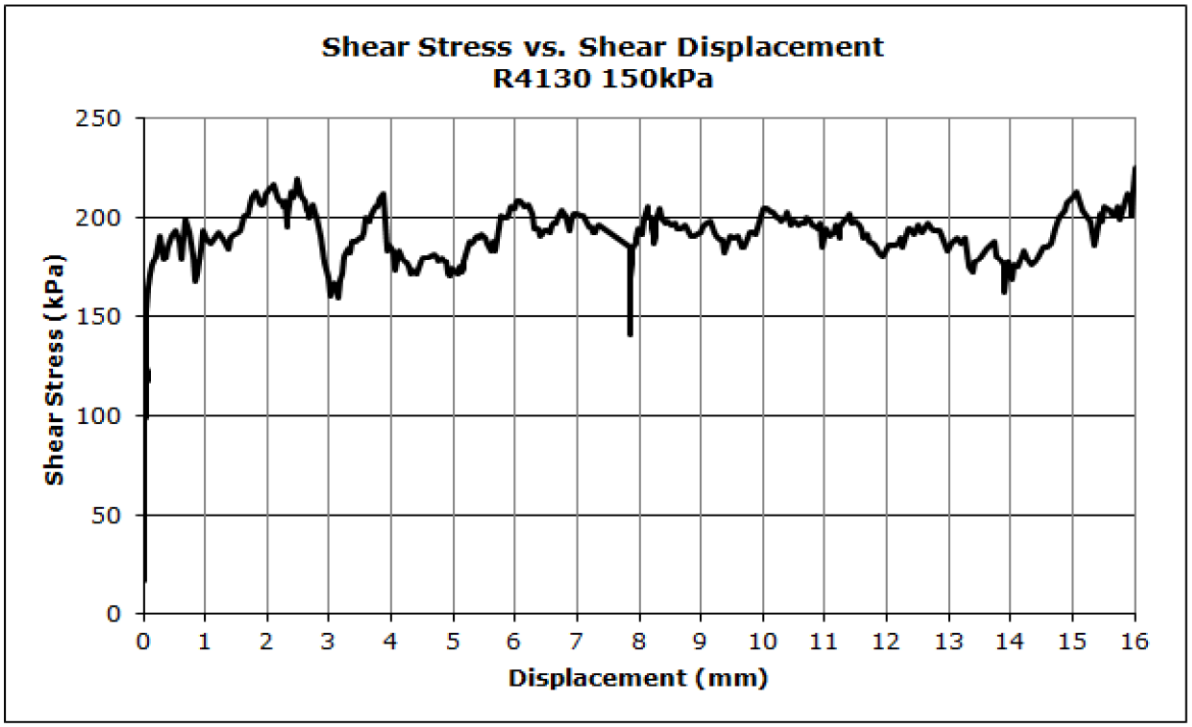
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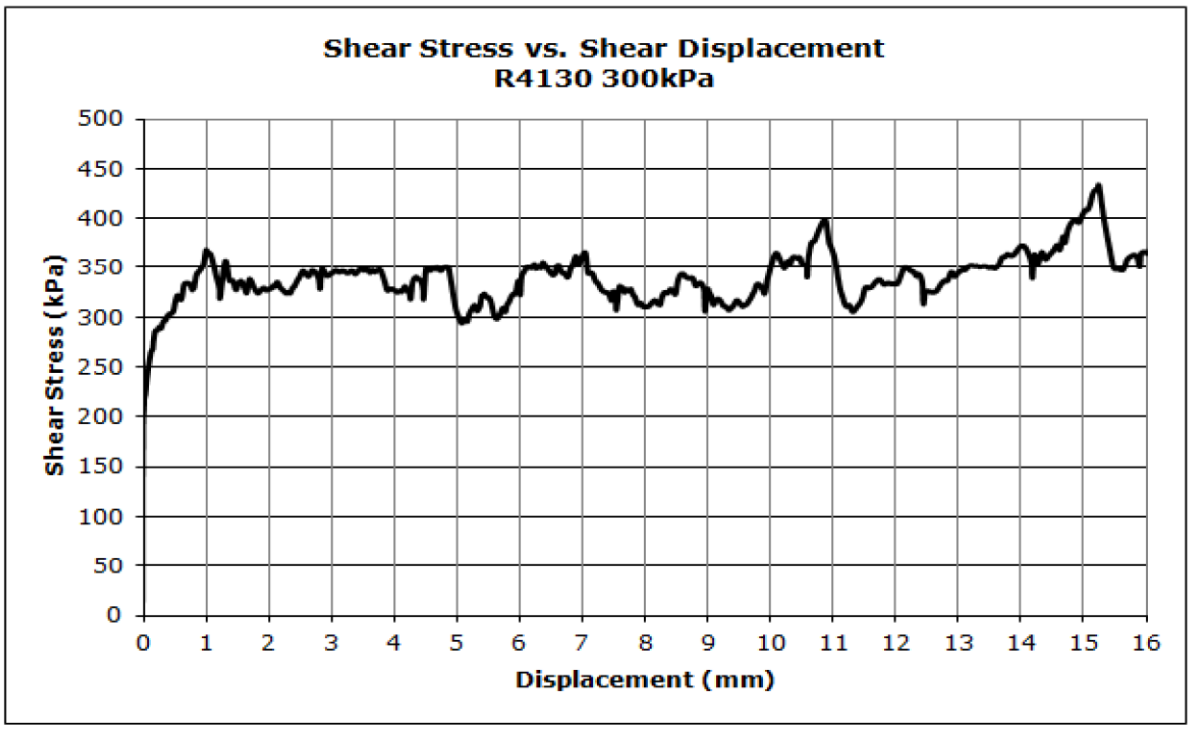




Amec Foster Wheeler Environment & Infrastructure
Hamilton Rock Mechanics Lab

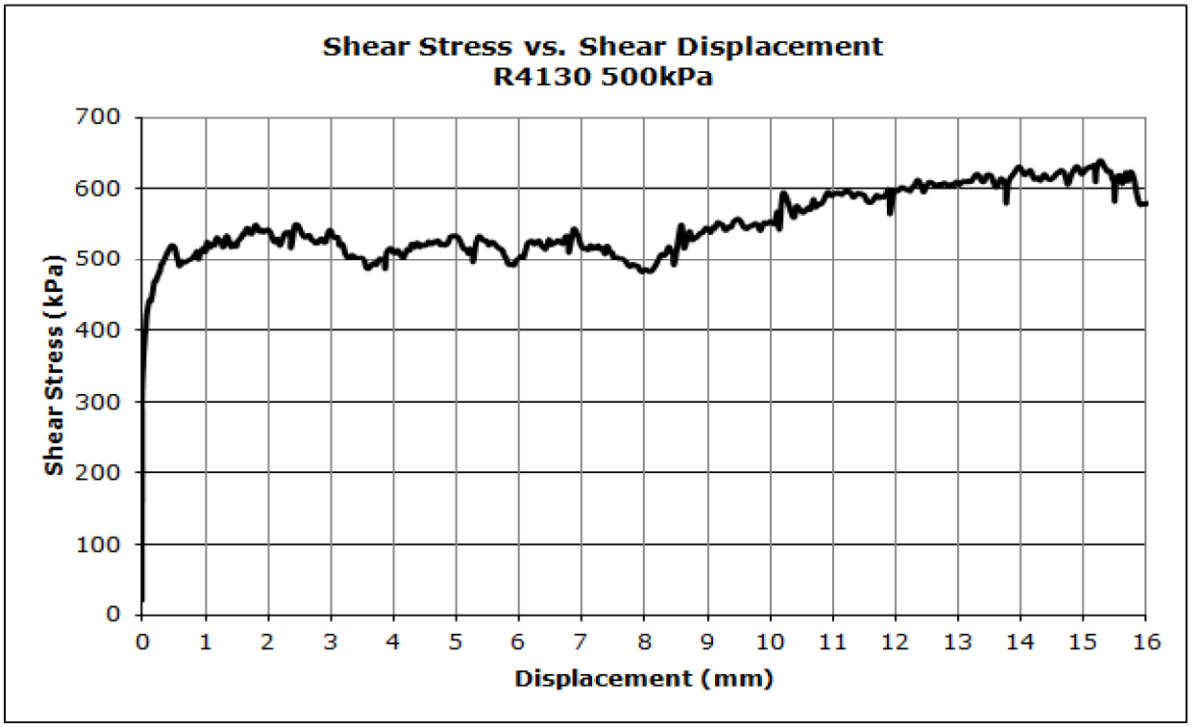
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Depth: 54.12m	**Lab #:** R4130

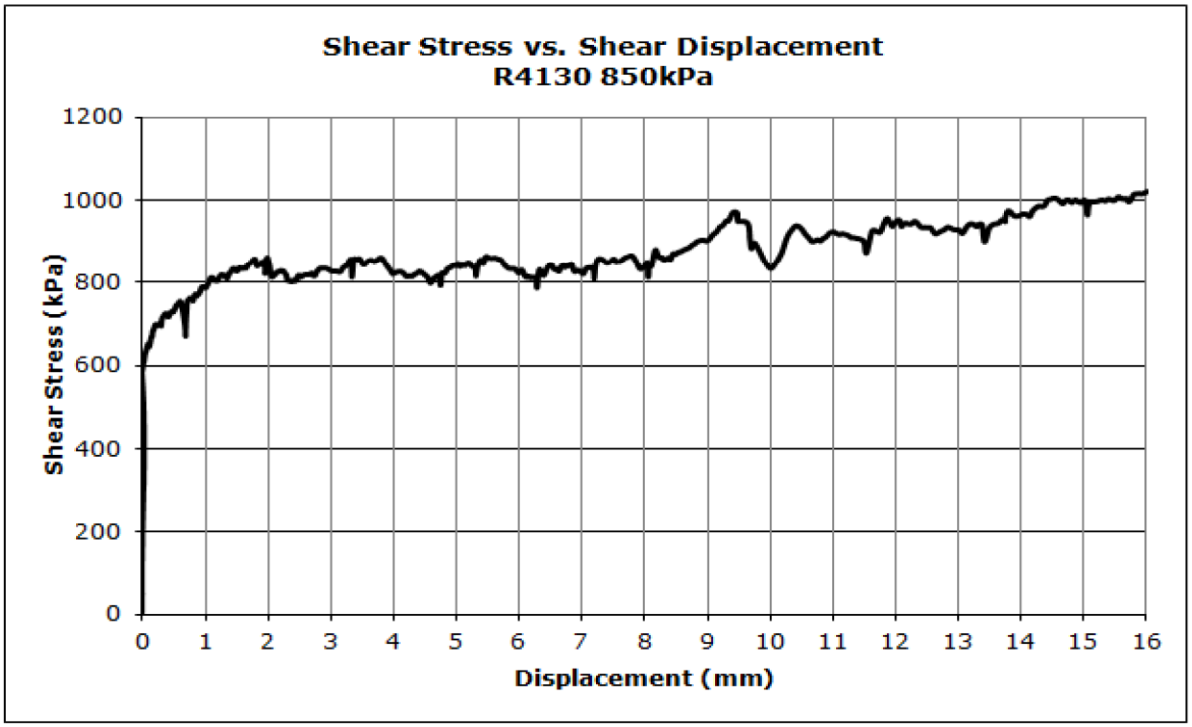




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Hamilton Rock Mechanics Lab

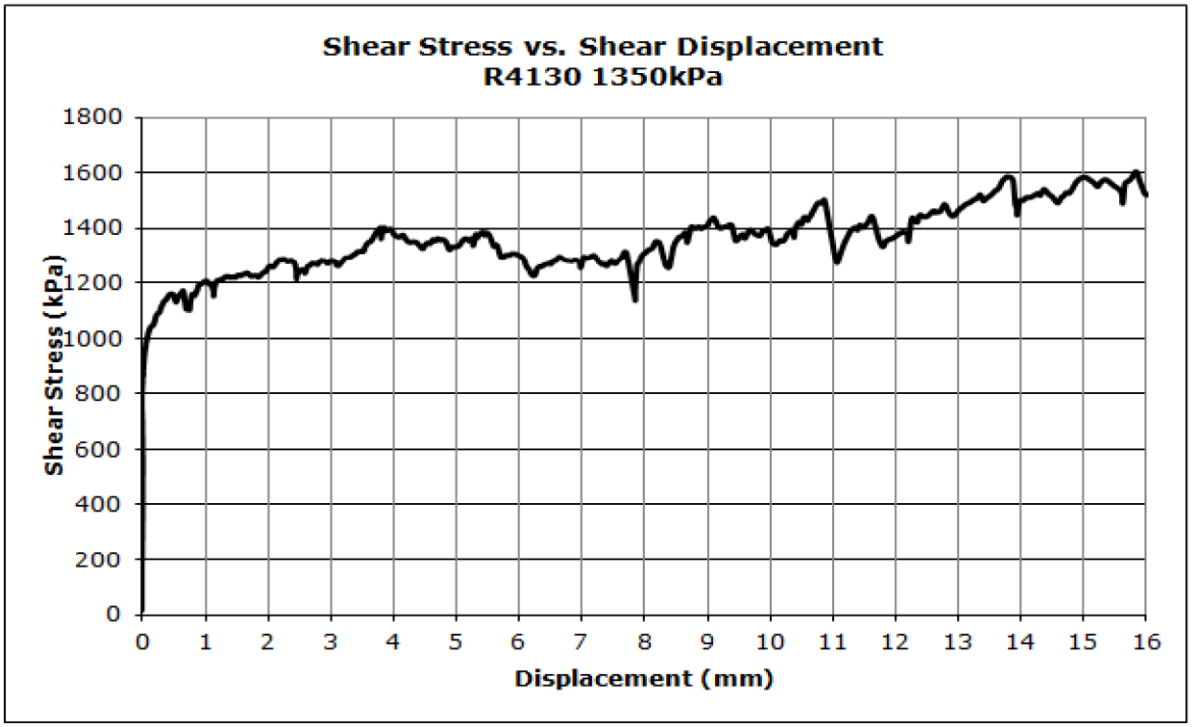
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Sample ID: DS-I013-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 54.12m	**Lab #:** R4130





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I013-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 54.12m	**Lab #:** R4130



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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I014-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 147.07m	**Lab #:** R4131





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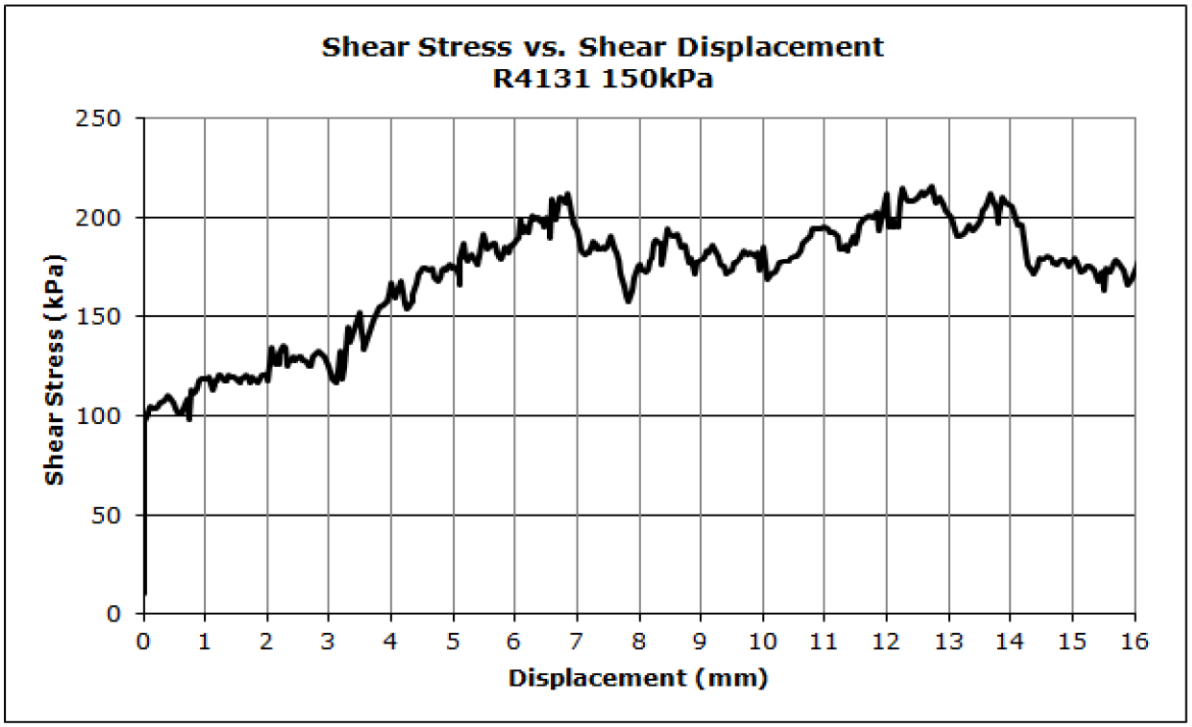
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Sample ID: DS-I014-01	**Project Name:** Piteau Associates Rock Mechanics
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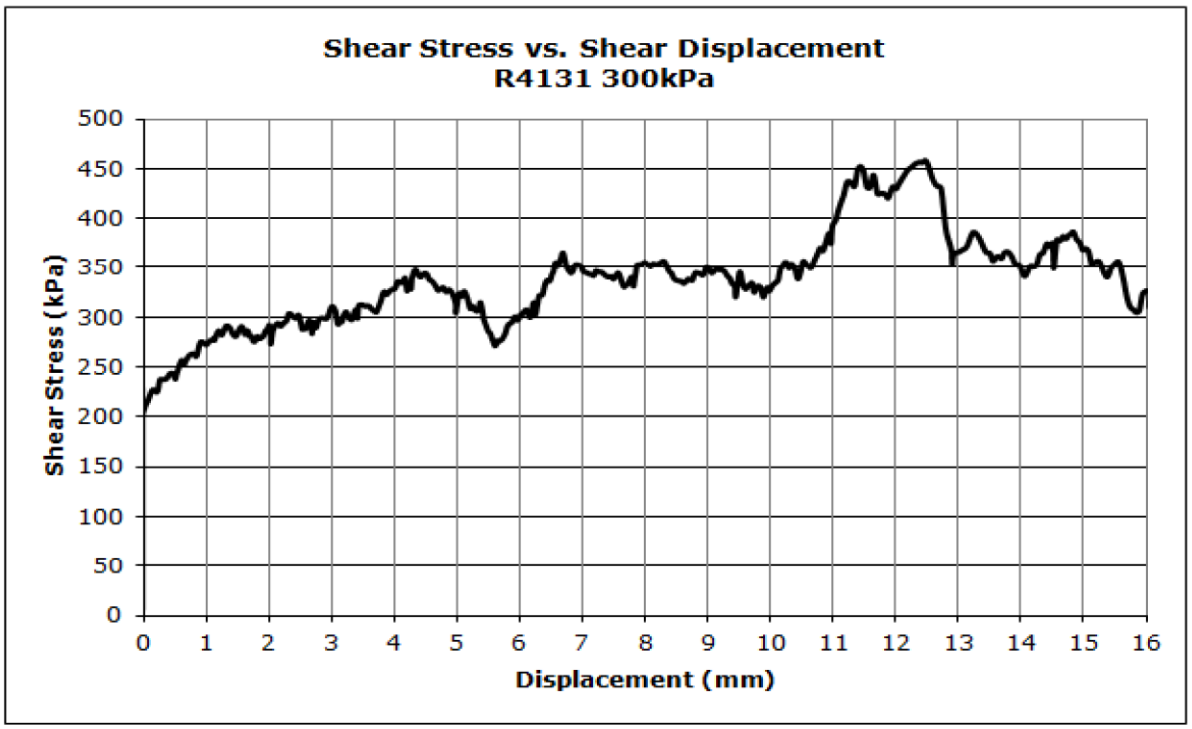




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Hamilton Rock Mechanics Lab

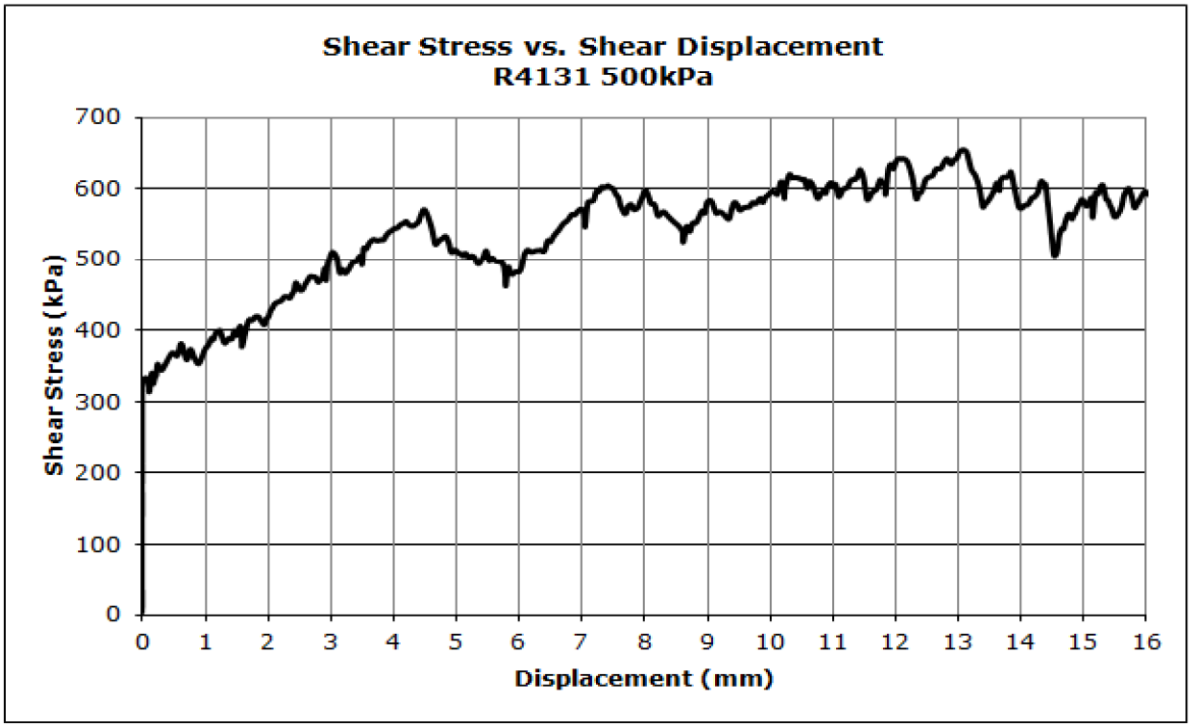
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Depth: 147.07m	**Lab #:** R4131

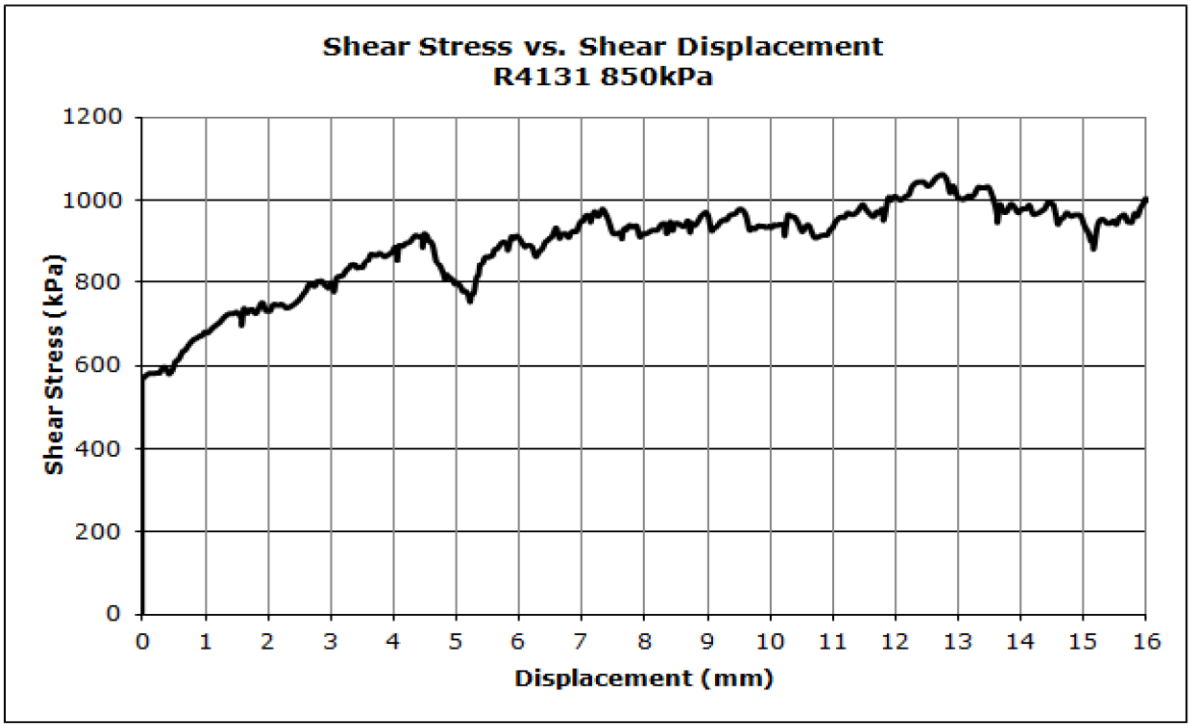




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Hamilton Rock Mechanics Lab

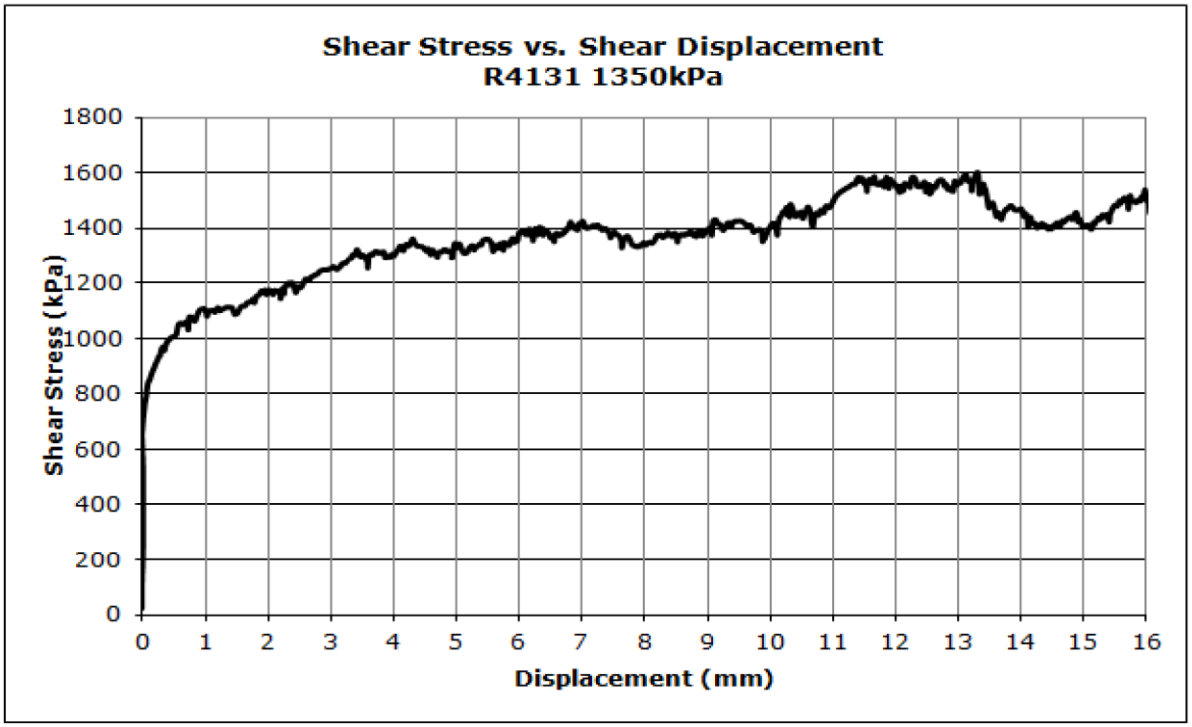
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Sample ID: DS-I014-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 147.07m	**Lab #:** R4131





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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I014-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 147.07m	**Lab #:** R4131



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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I002A-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 59.68m	**Lab #:** R4132





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Hamilton Rock Mechanics Lab

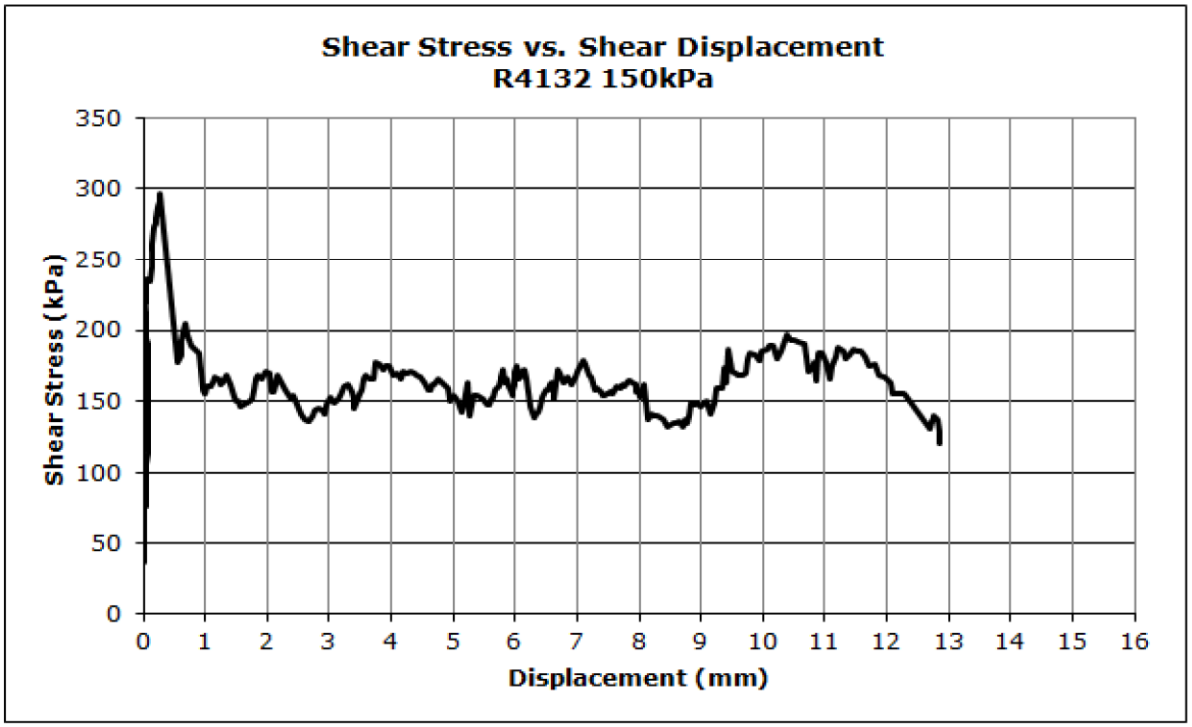
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Sample ID: DS-I002A-01	**Project Name:** Piteau Associates Rock Mechanics
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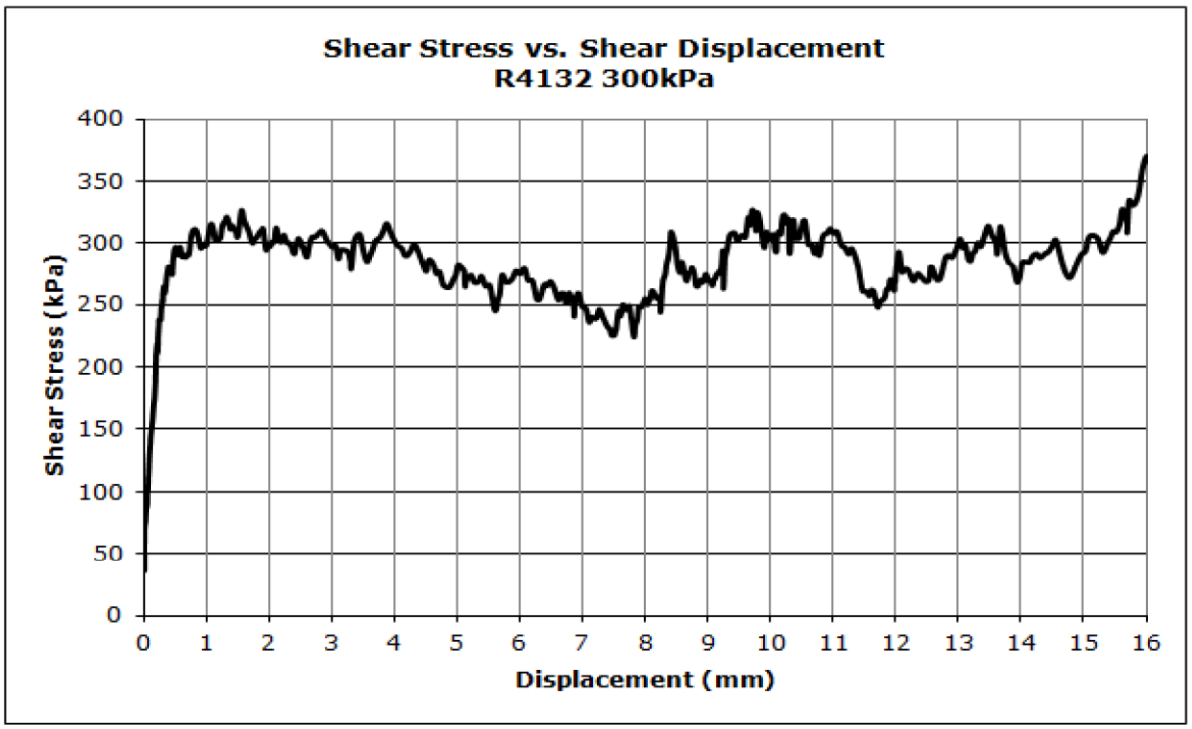




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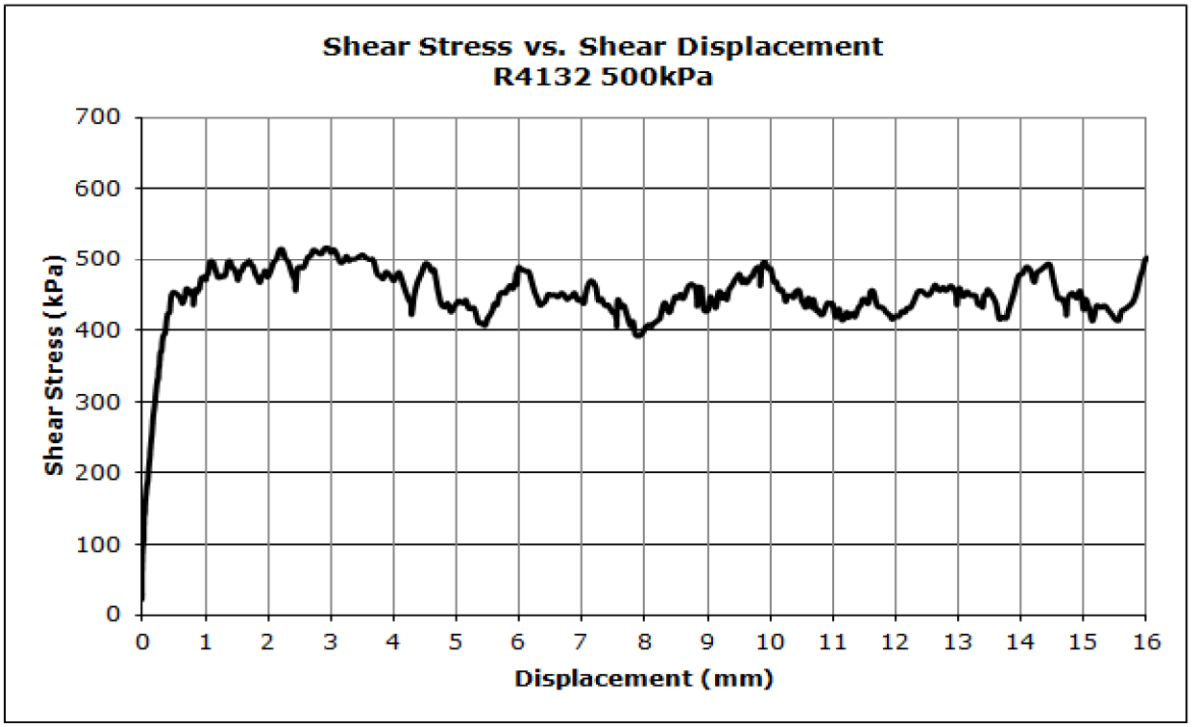
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Depth: 59.68m	**Lab #:** R4132

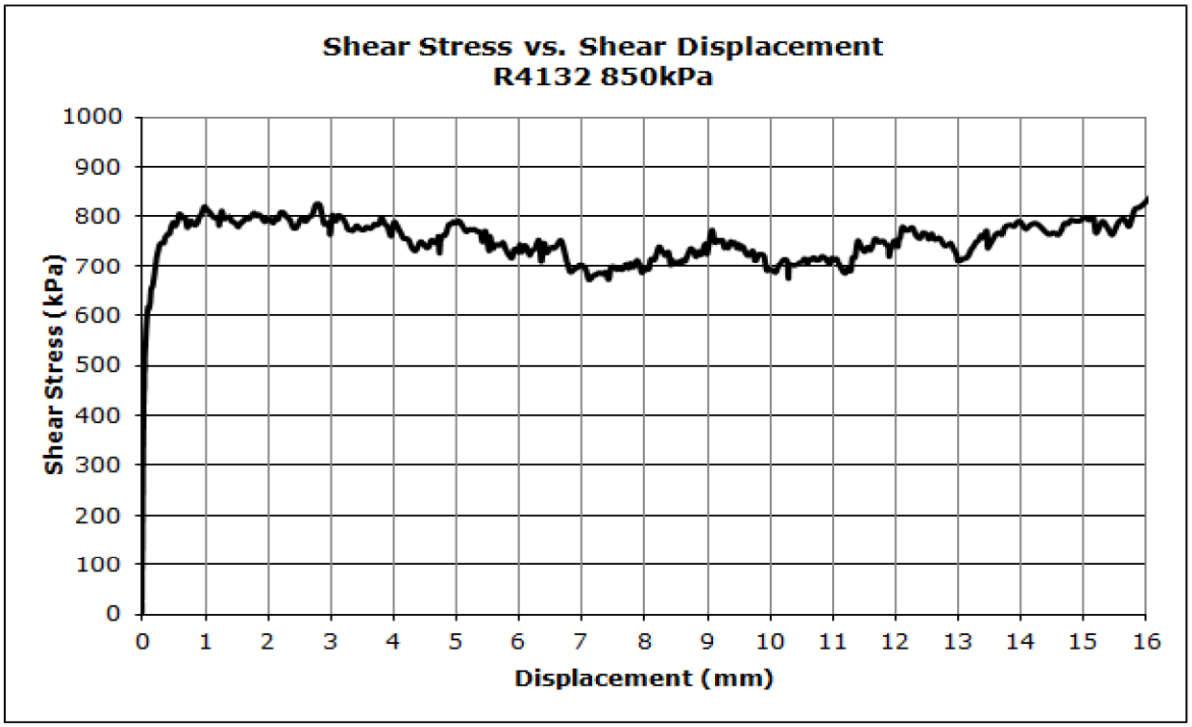




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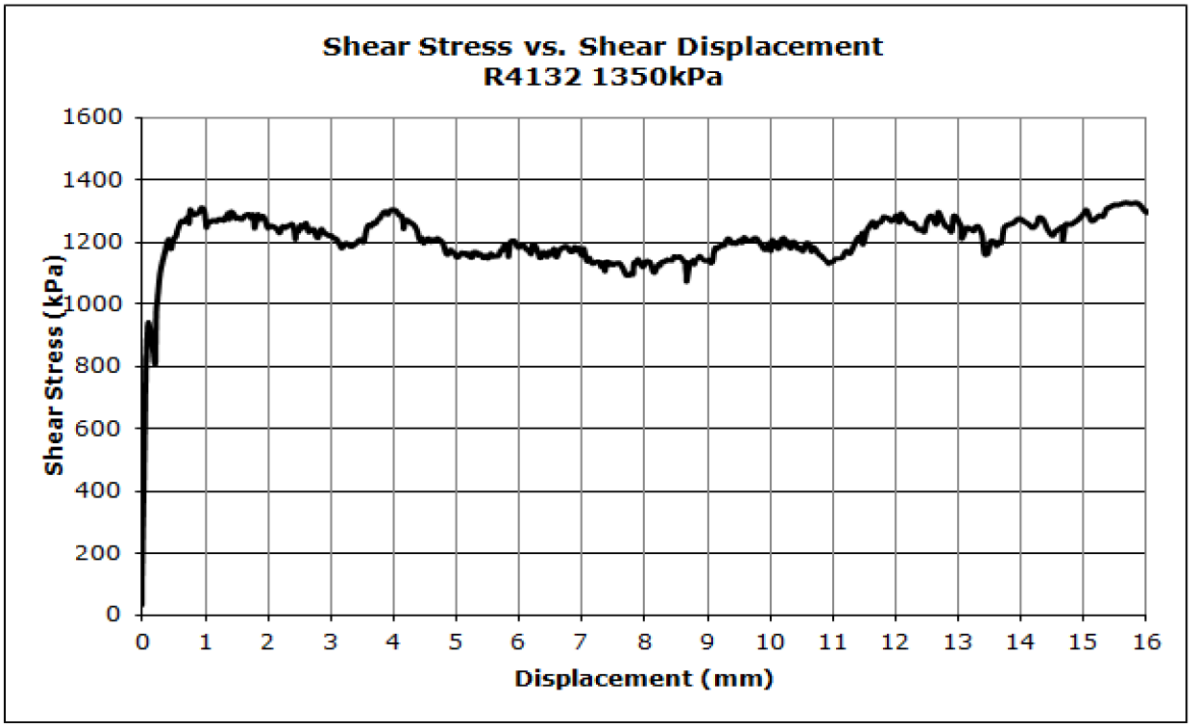
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Sample ID: DS-I002A-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 59.68m	**Lab #:** R4132





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I002A-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 59.68m	**Lab #:** R4132



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Hamilton Rock Mechanics Lab

Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I007-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 162.87m	**Lab #:** R4133

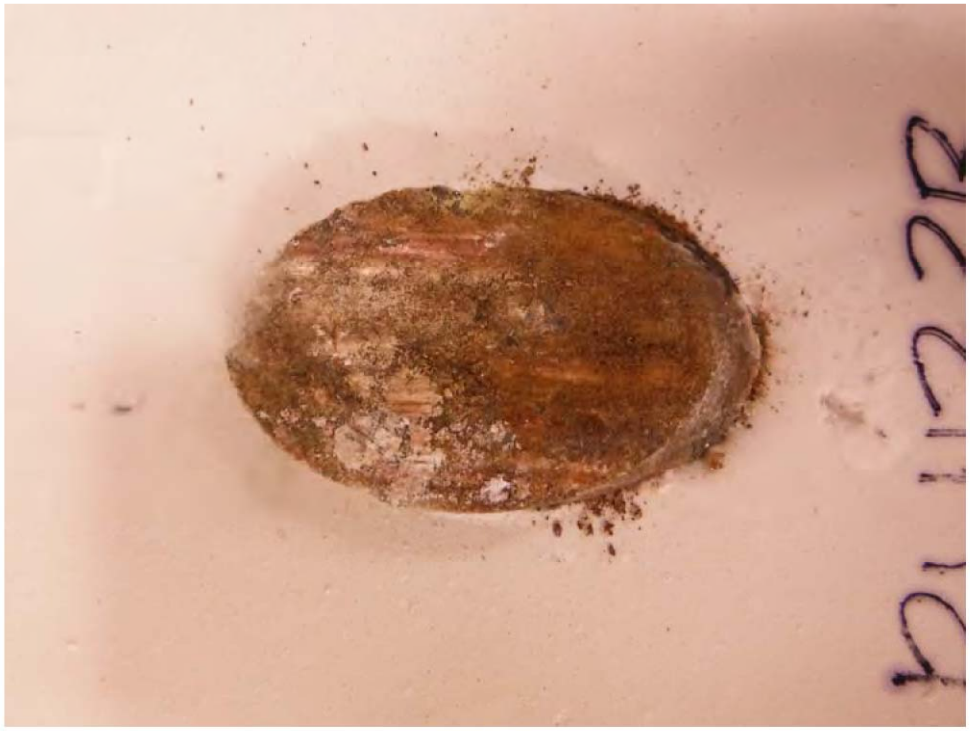




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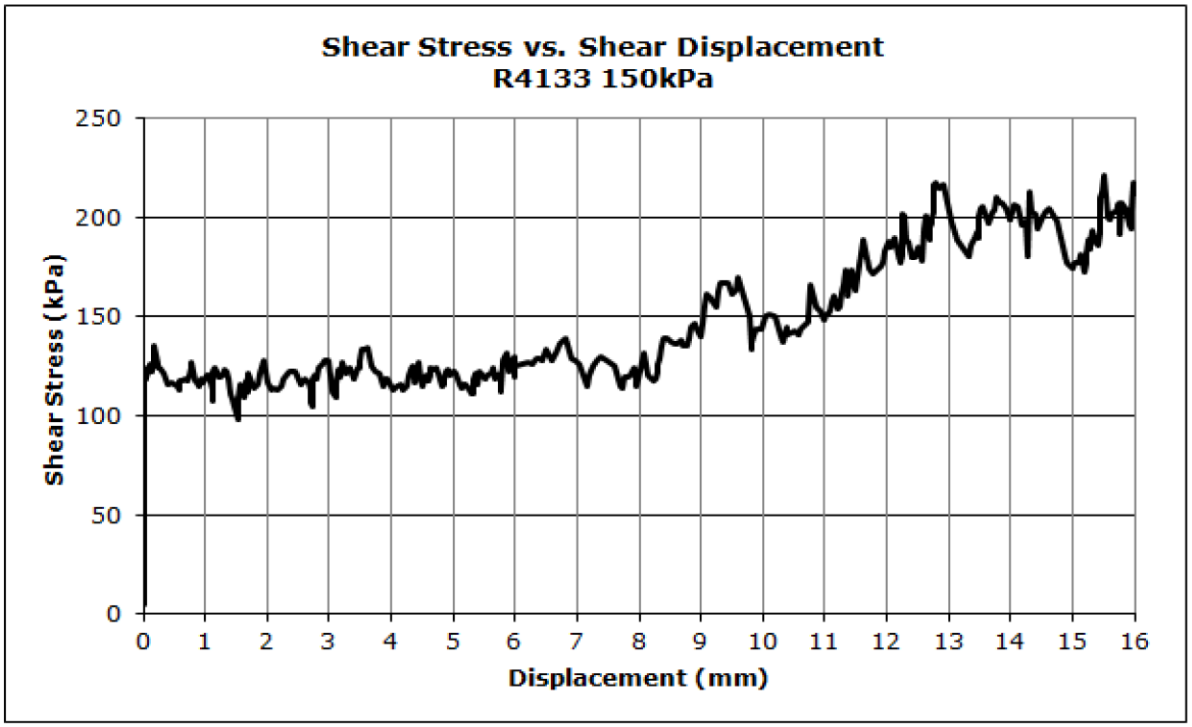
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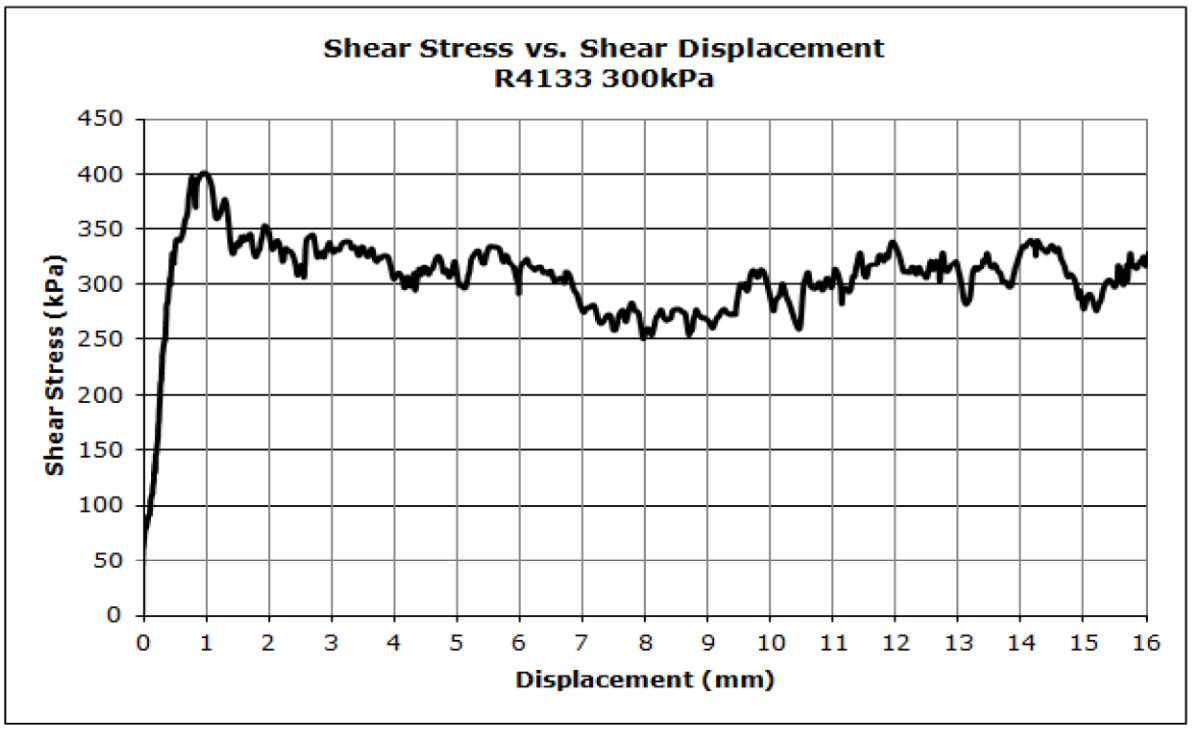




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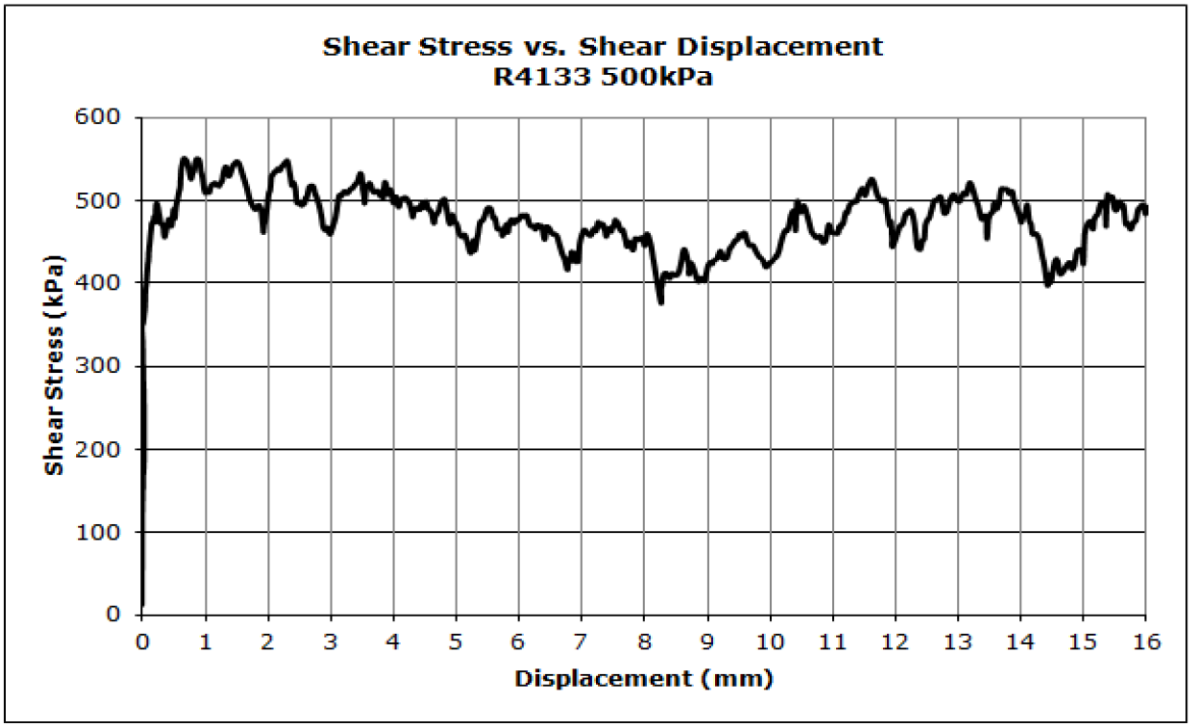
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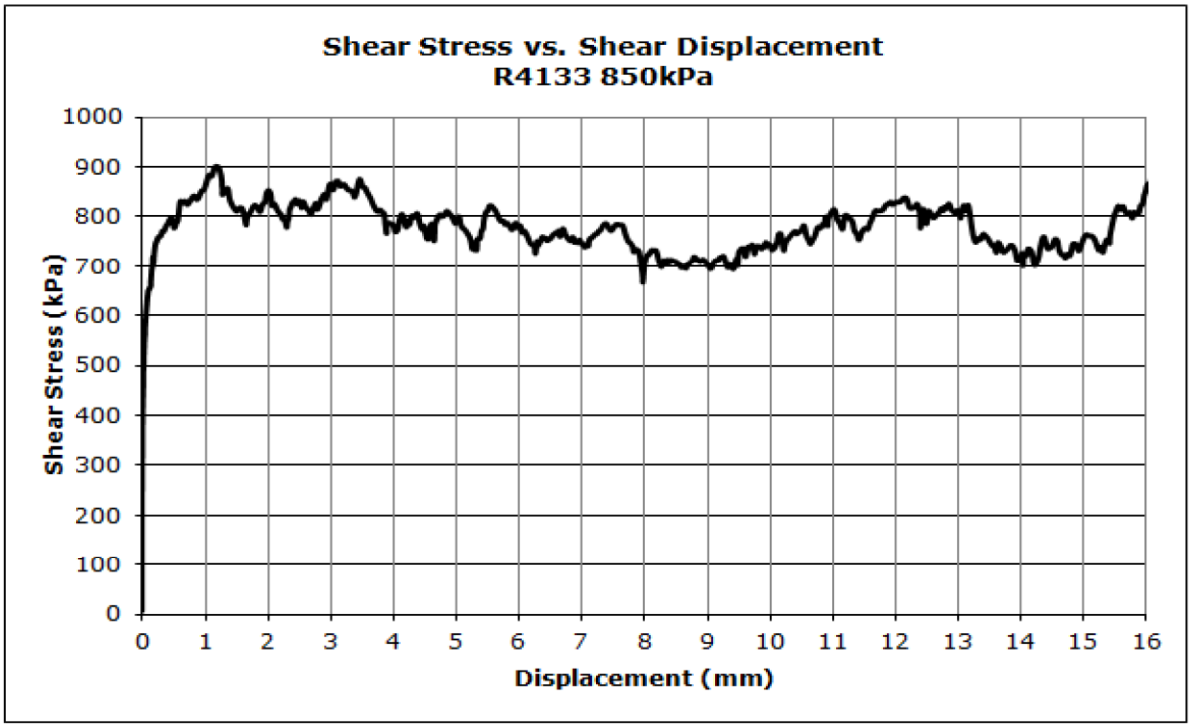




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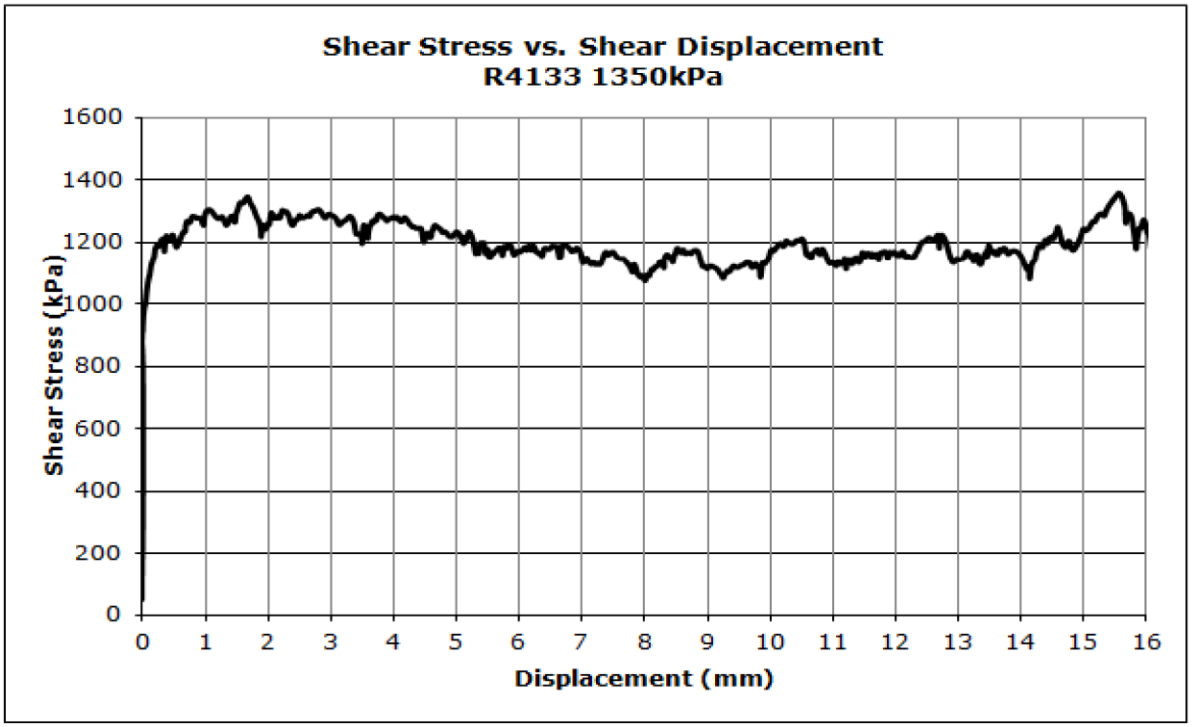
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Sample ID: DS-I007-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 162.87m	**Lab #:** R4133





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I007-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 162.87m	**Lab #:** R4133



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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I010-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 147.46m	**Lab #:** R4134





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Hamilton Rock Mechanics Lab

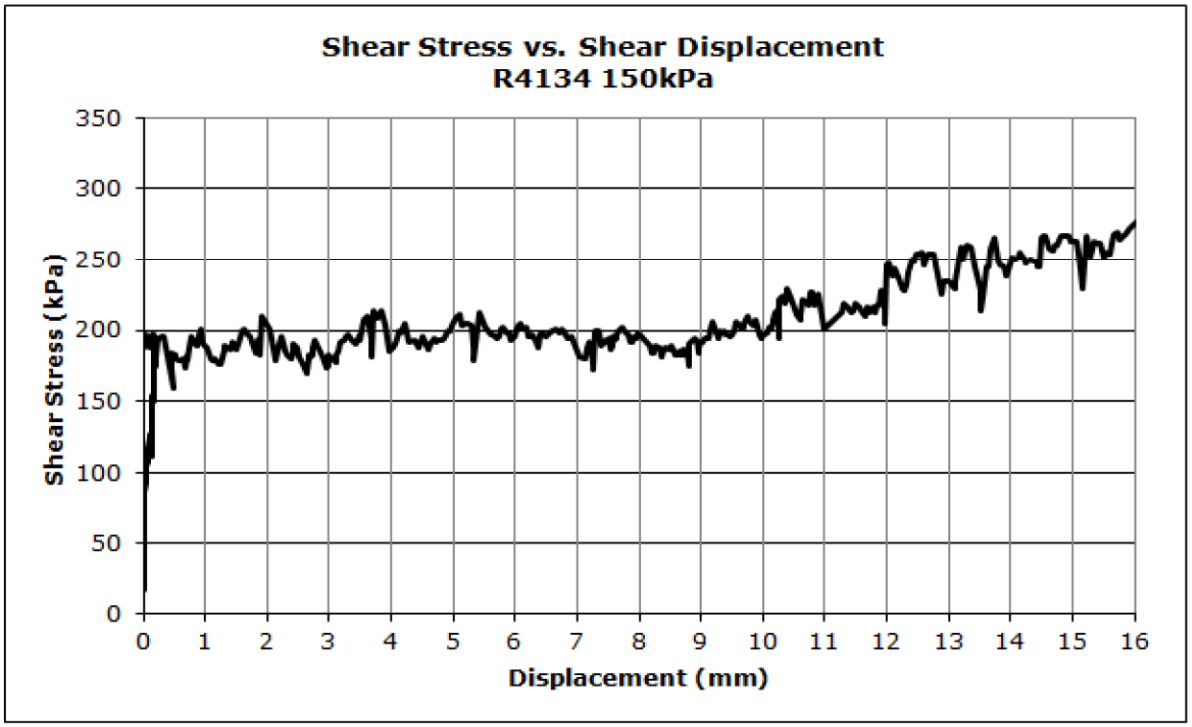
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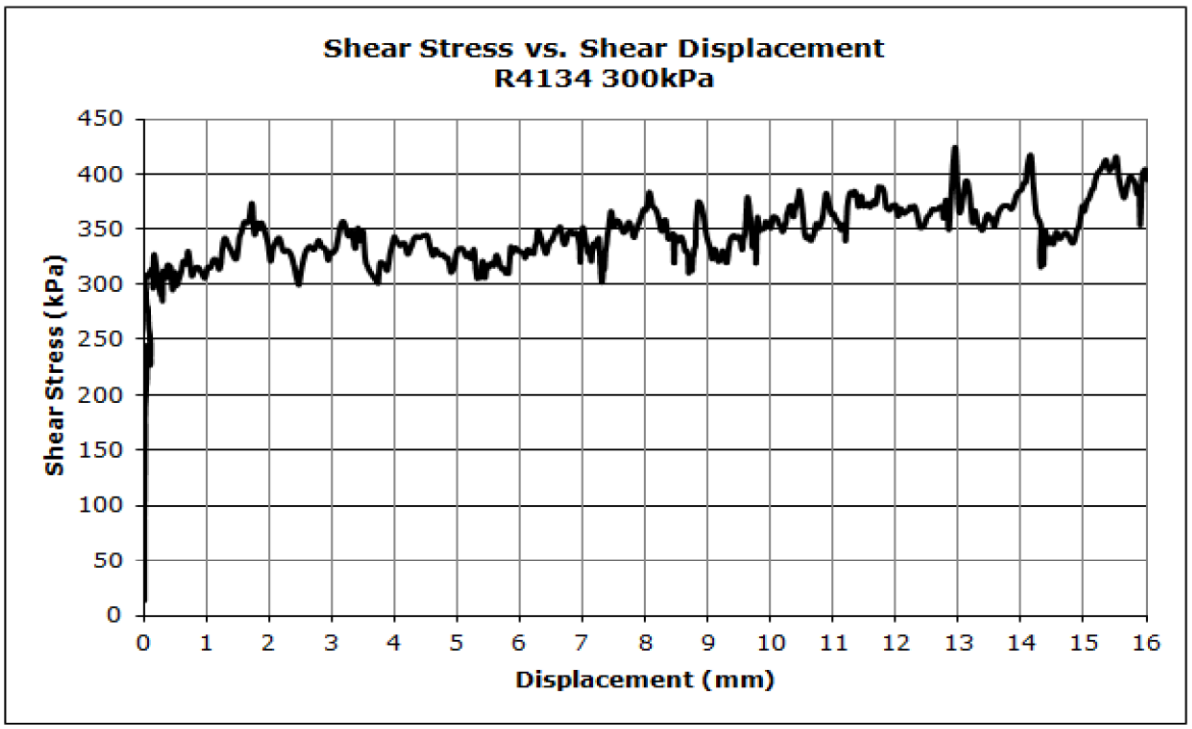




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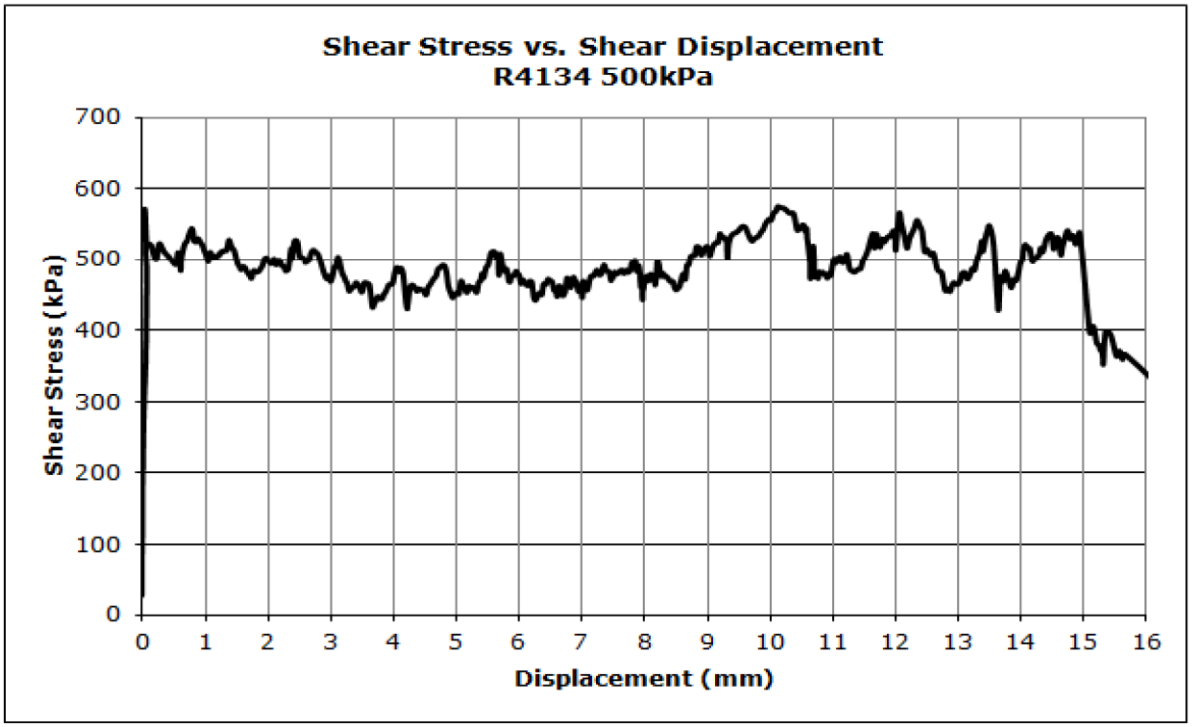
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Depth: 147.46m	**Lab #:** R4134

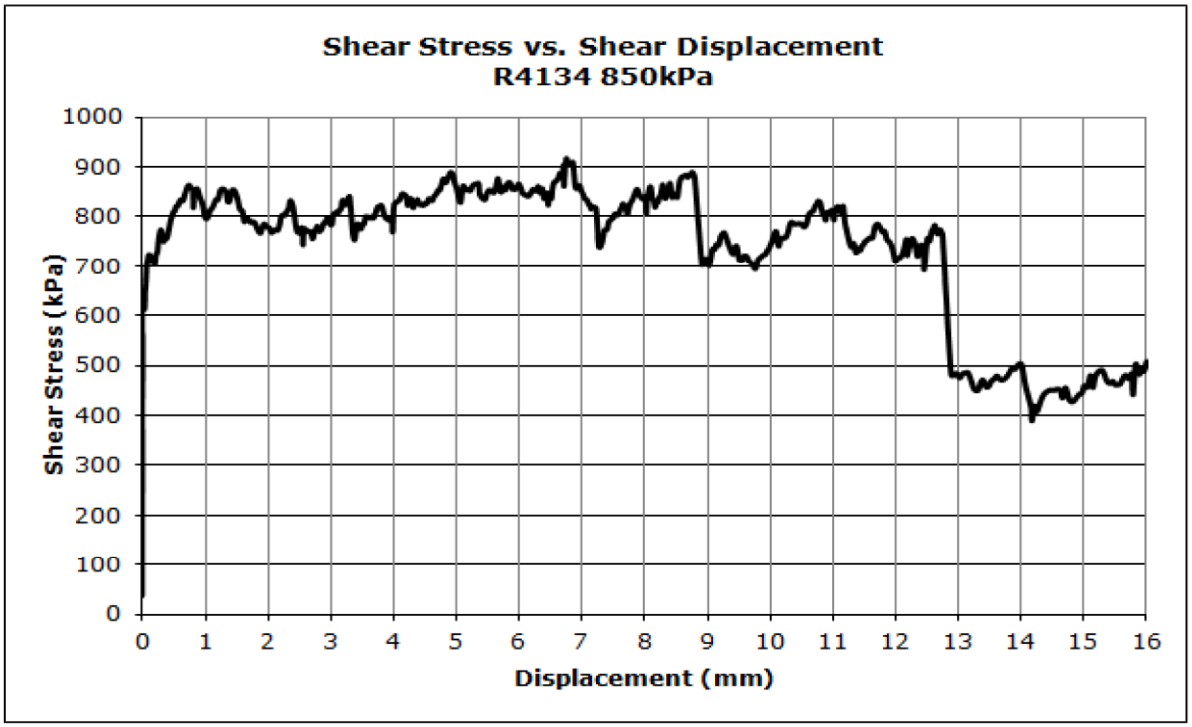




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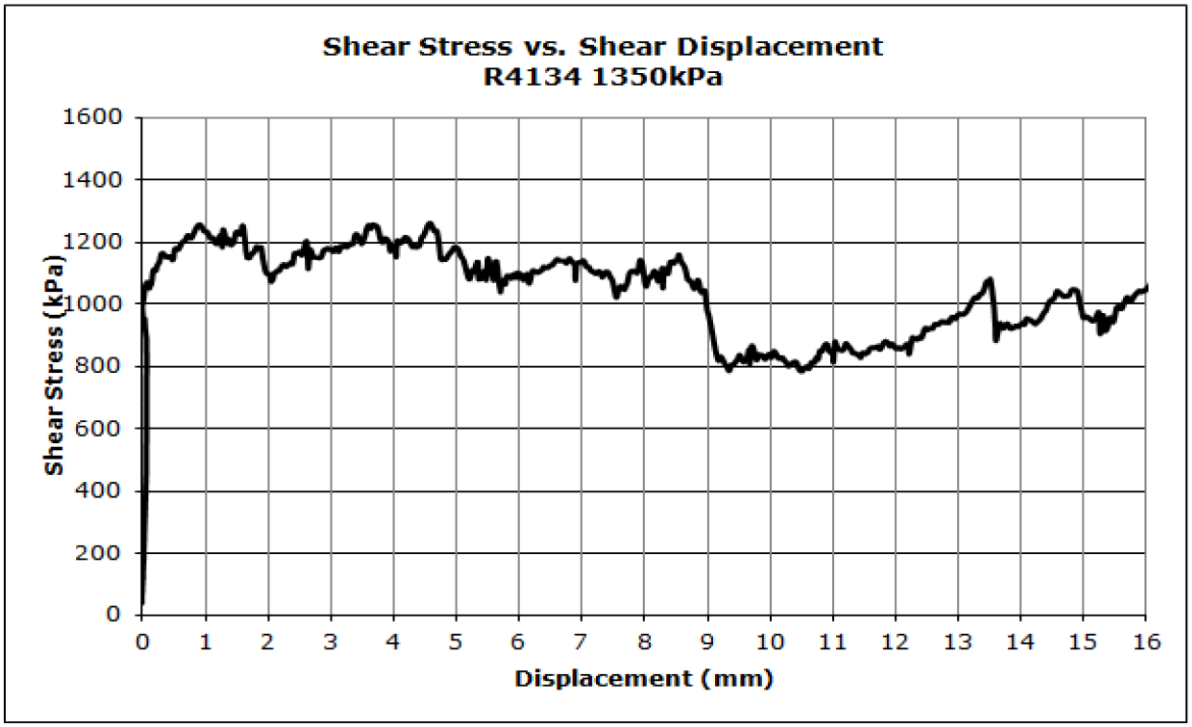
Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I010-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 147.46m	**Lab #:** R4134





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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I010-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 147.46m	**Lab #:** R4134



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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I008-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 126.02m	**Lab #:** R4135

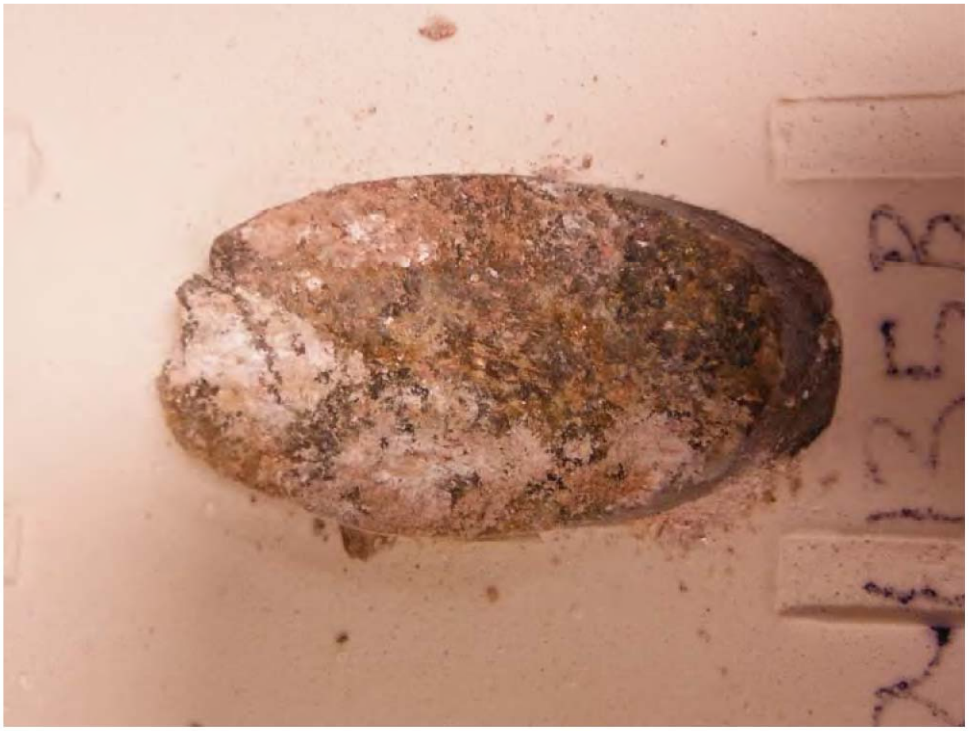




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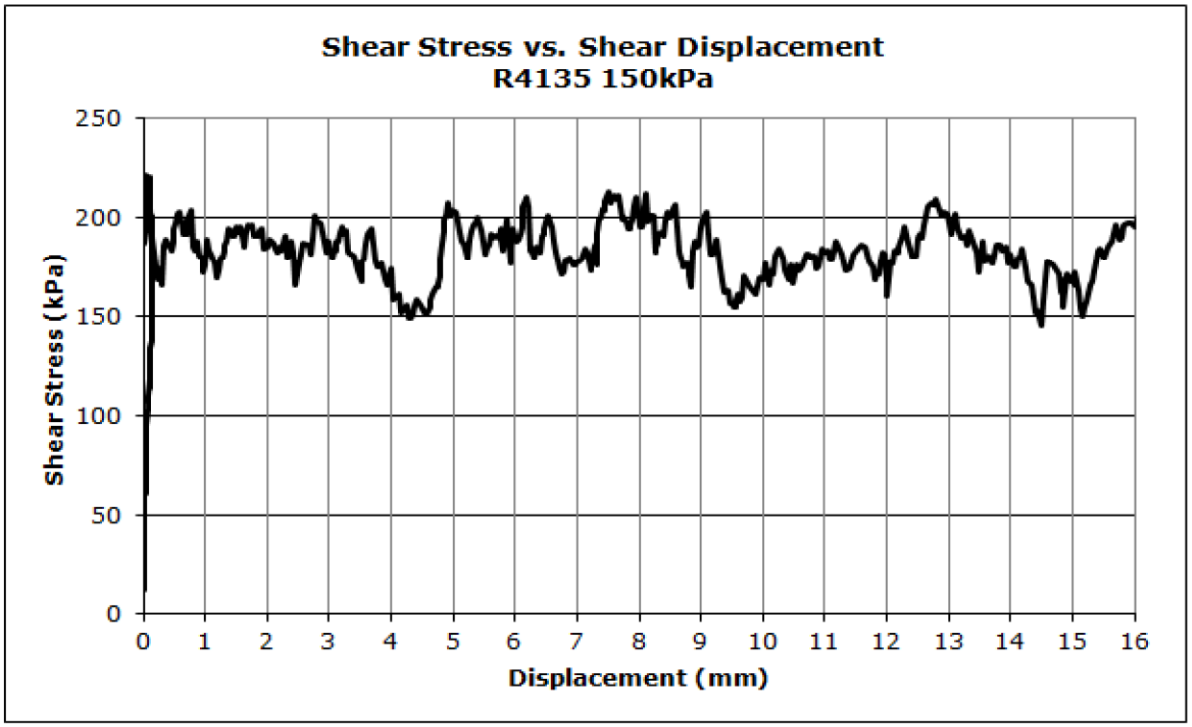
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Sample ID: DS-I008-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 126.02m	**Lab #:** R4135

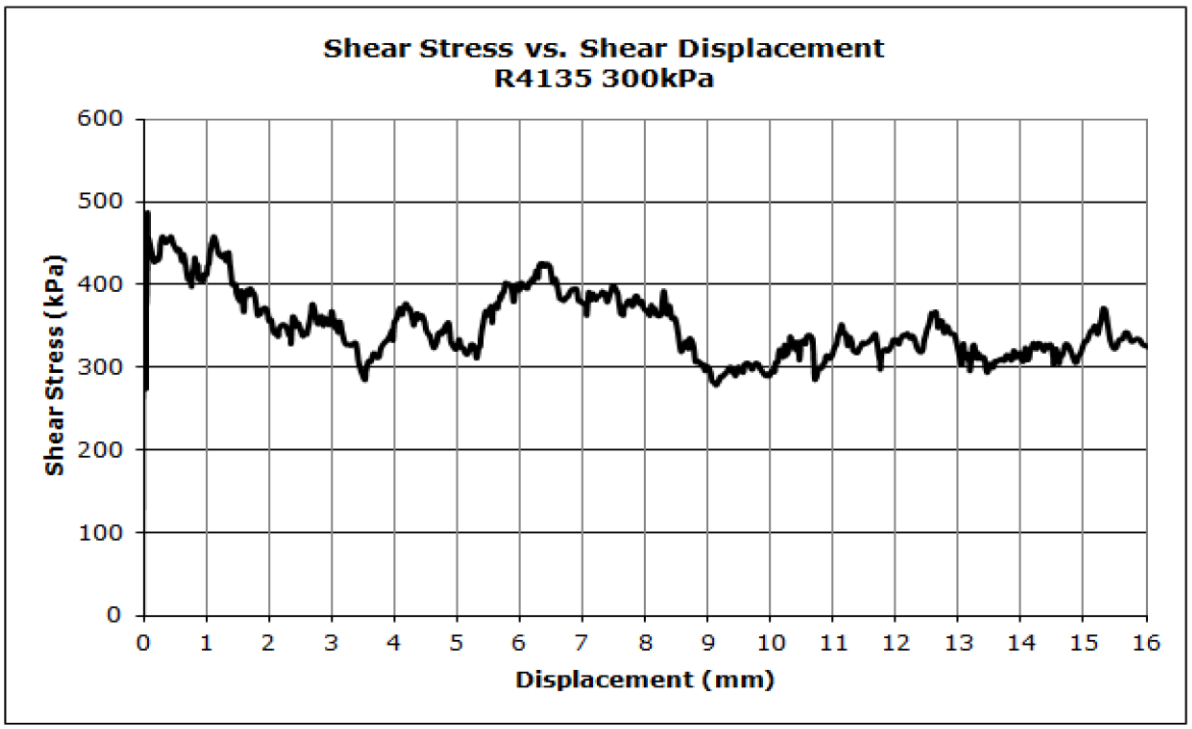




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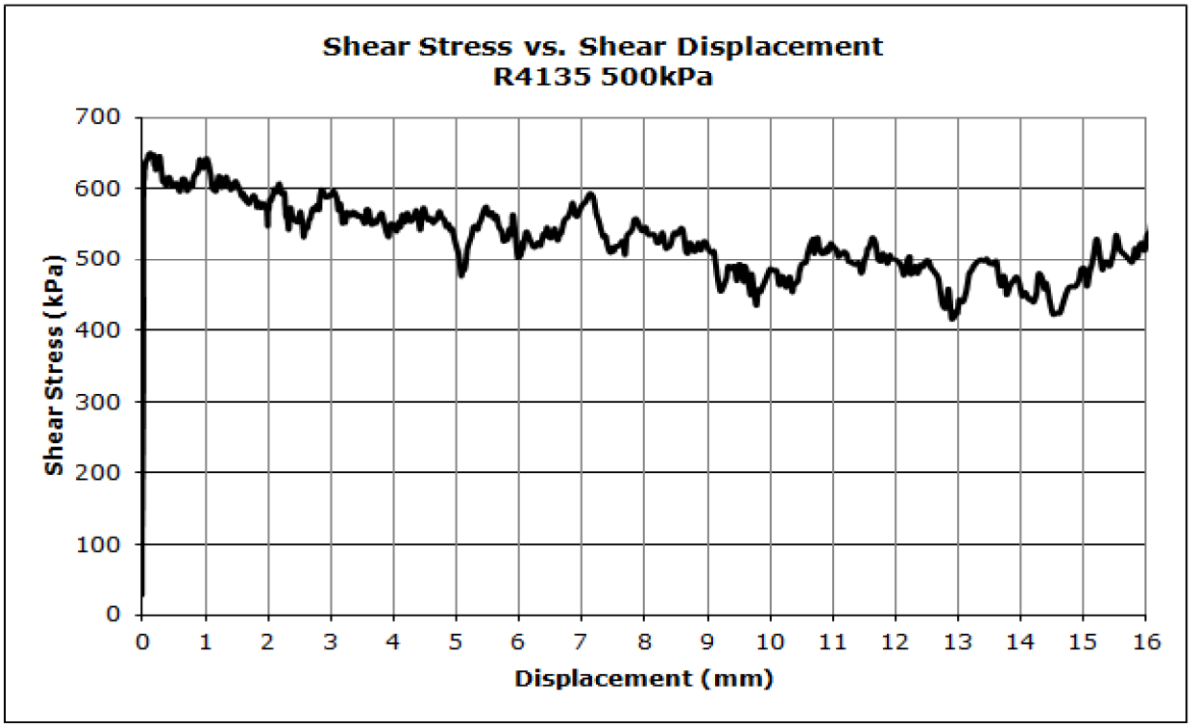
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Sample ID: DS-I008-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 126.02m	**Lab #:** R4135

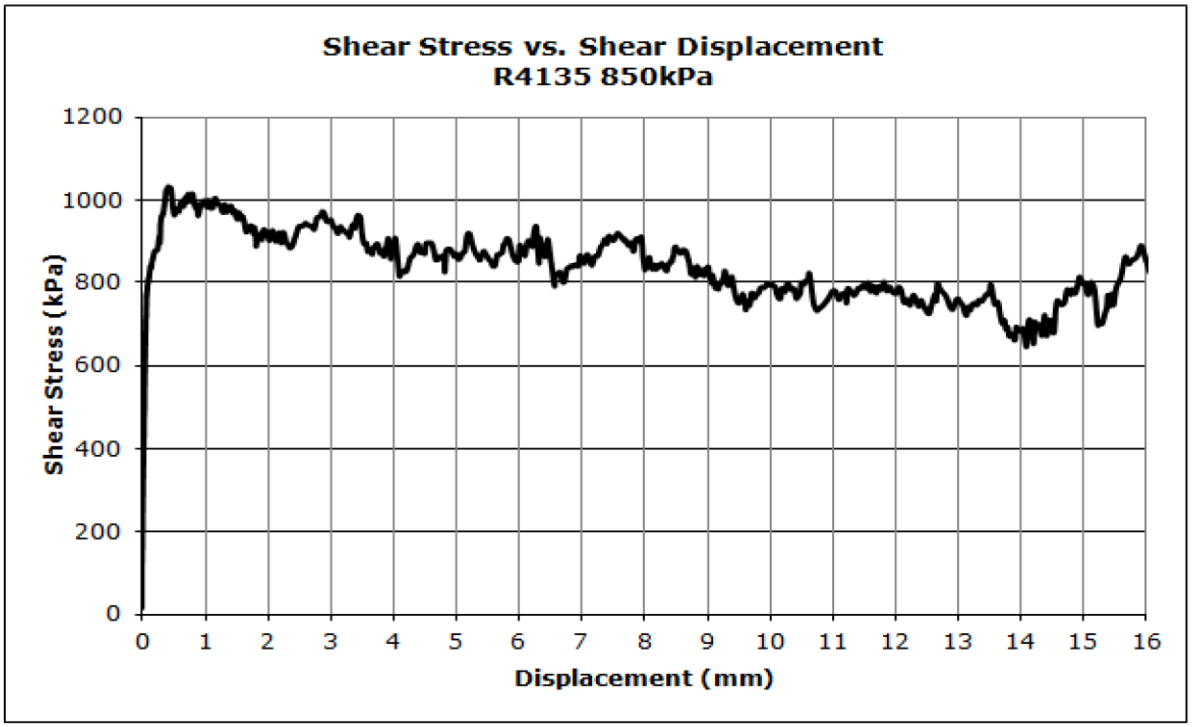




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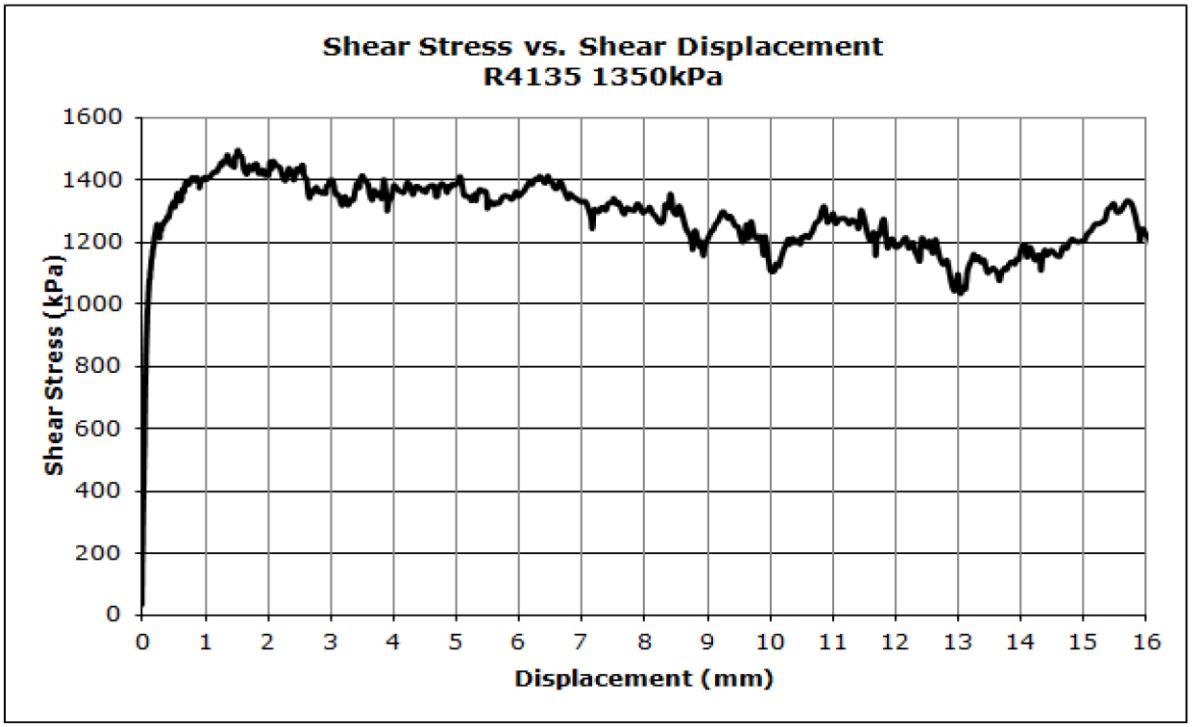
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Sample ID: DS-I008-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 126.02m	**Lab #:** R4135





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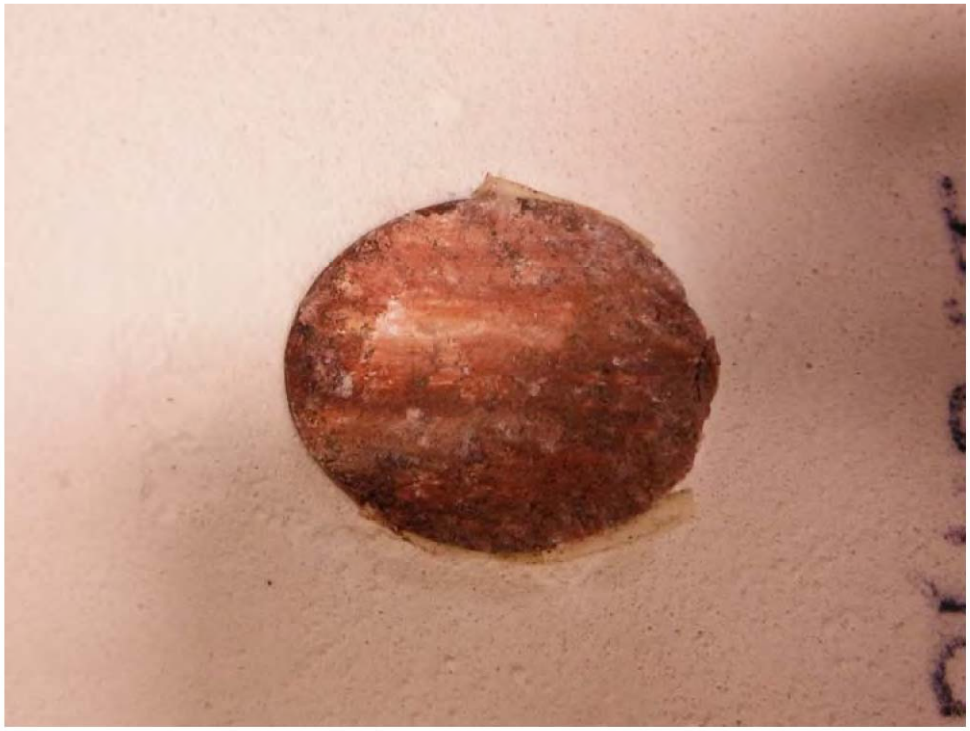
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Sample ID: DS-I008-02	**Project Name:** Piteau Associates Rock Mechanics
Depth: 126.02m	**Lab #:** R4135



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Client: Piteau Associates	**Project No.:** TB152053
Sample ID: DS-I012-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 123.34m	**Lab #:** R4136

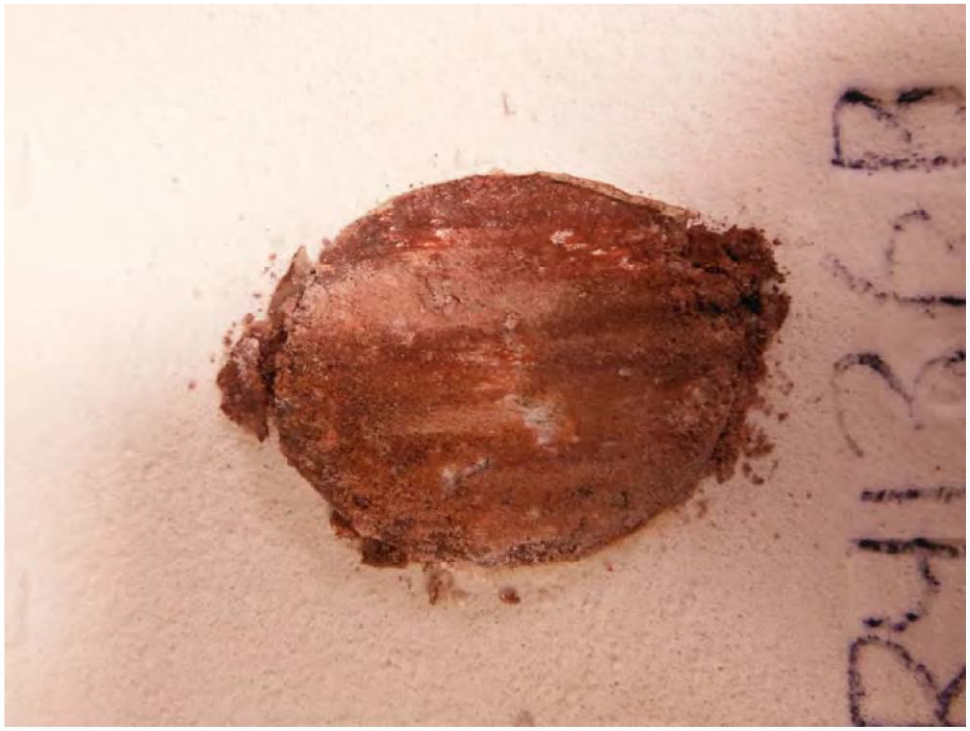




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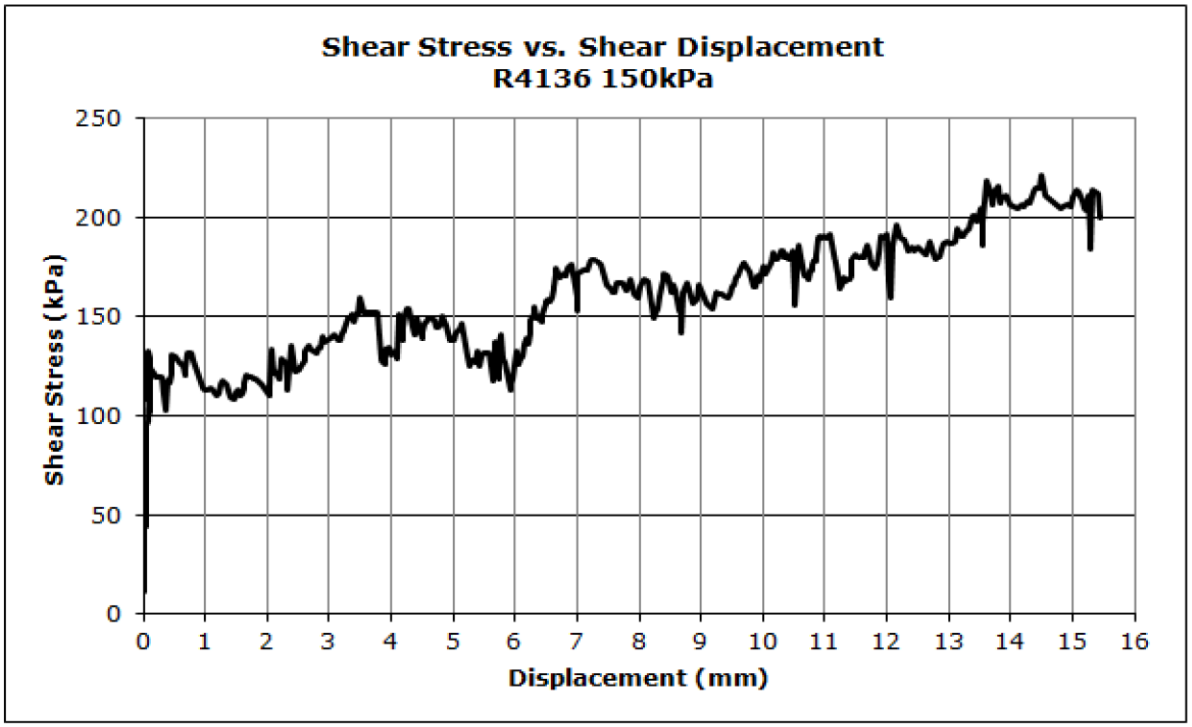
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Depth: 123.34m	**Lab #:** R4136

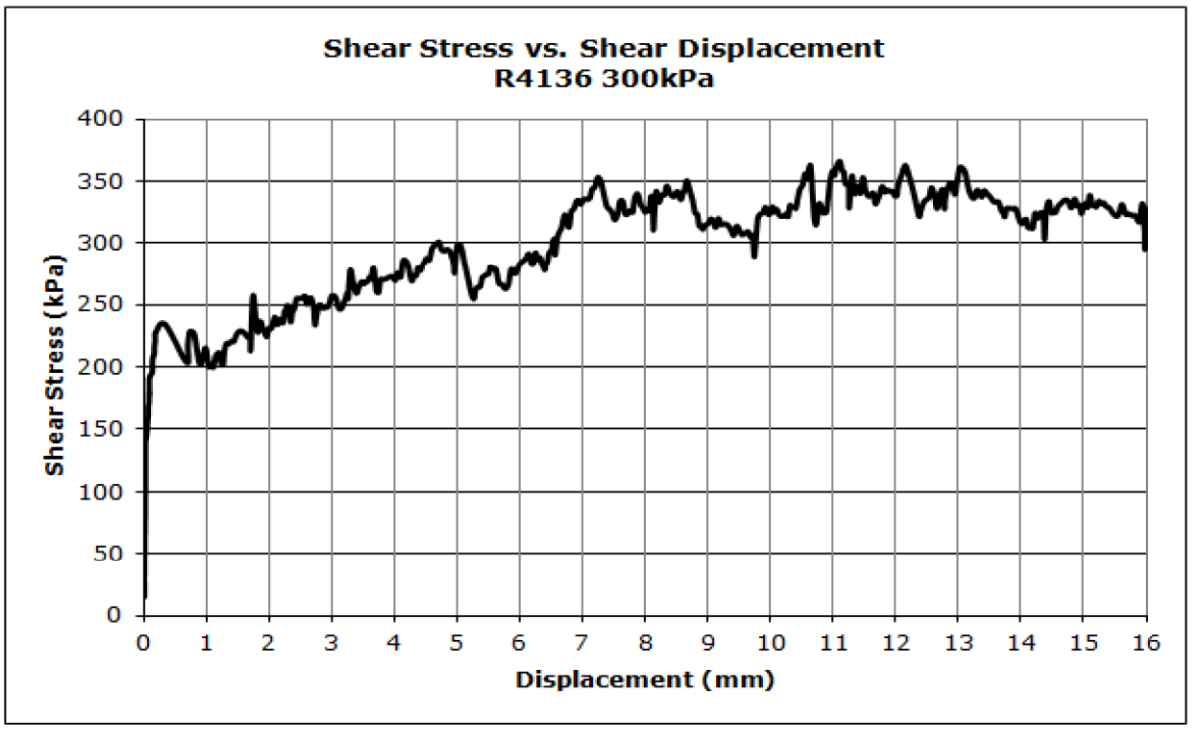




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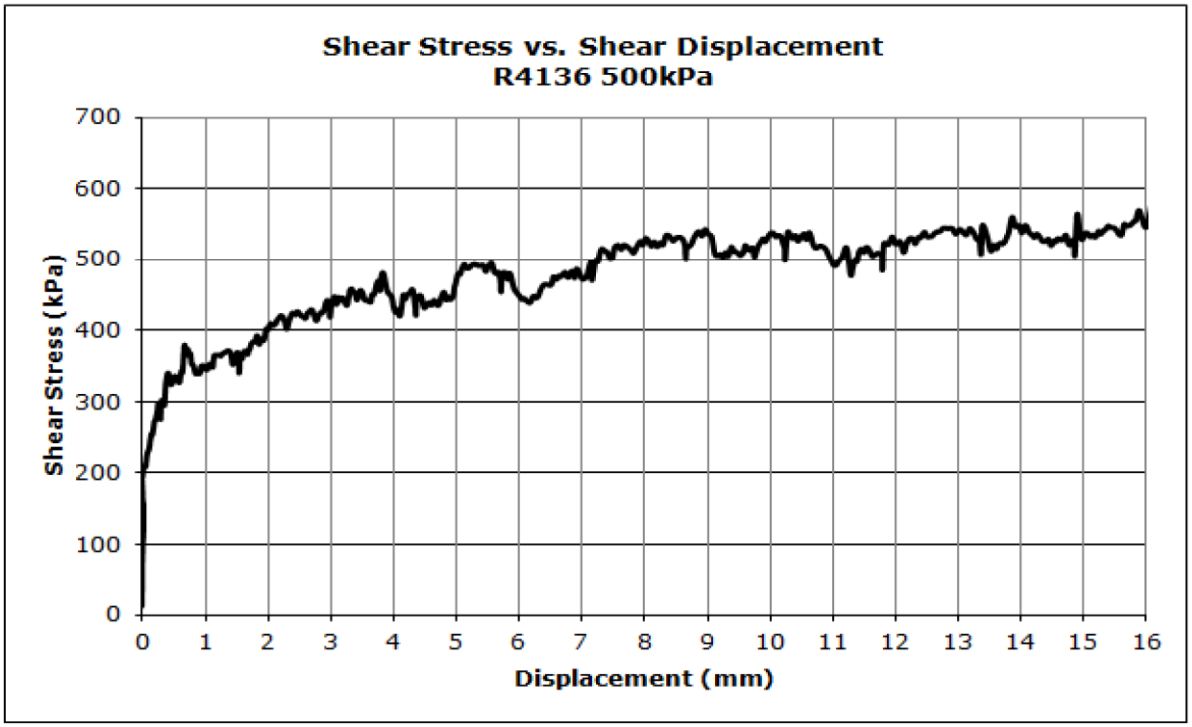
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Sample ID: DS-I012-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 123.34m	**Lab #:** R4136

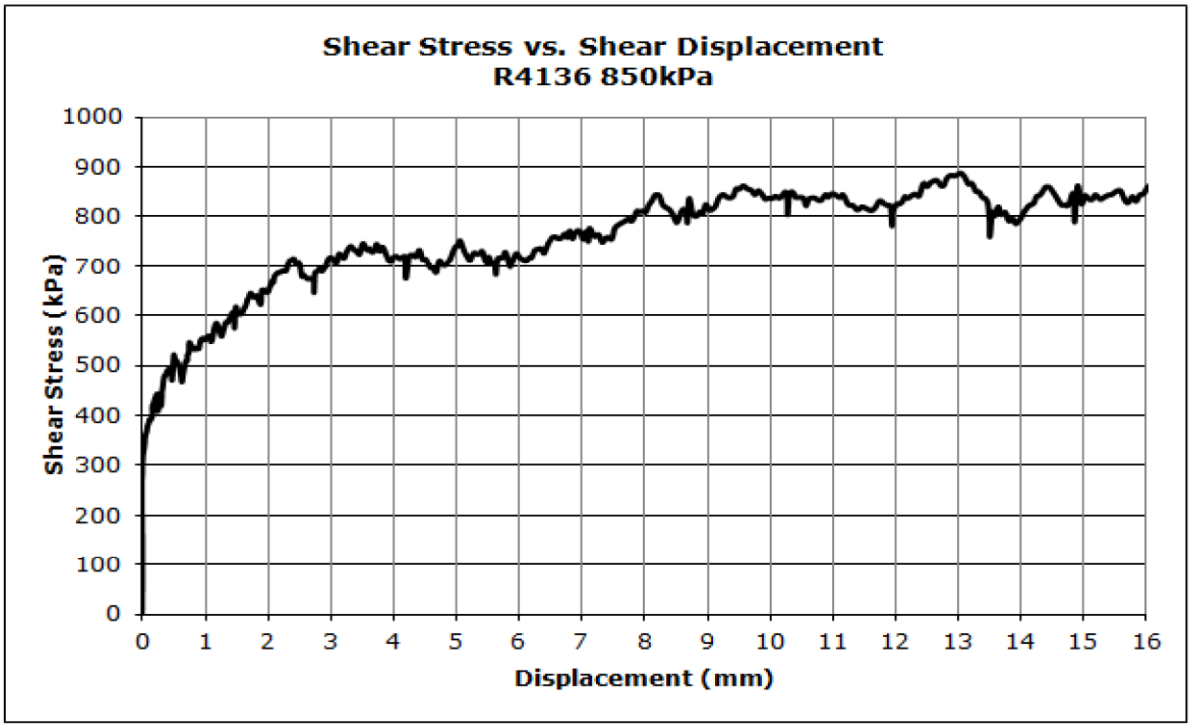




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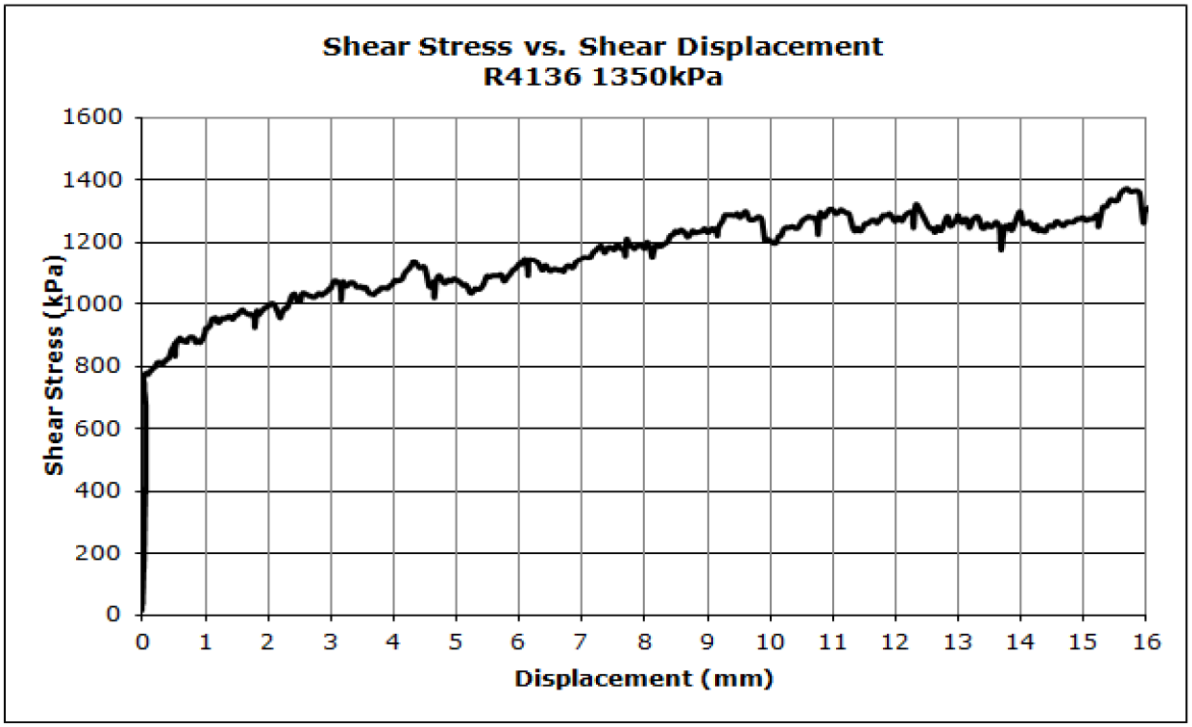
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Sample ID: DS-I012-01	**Project Name:** Piteau Associates Rock Mechanics
Depth: 123.34m	**Lab #:** R4136





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Hamilton Rock Mechanics Lab

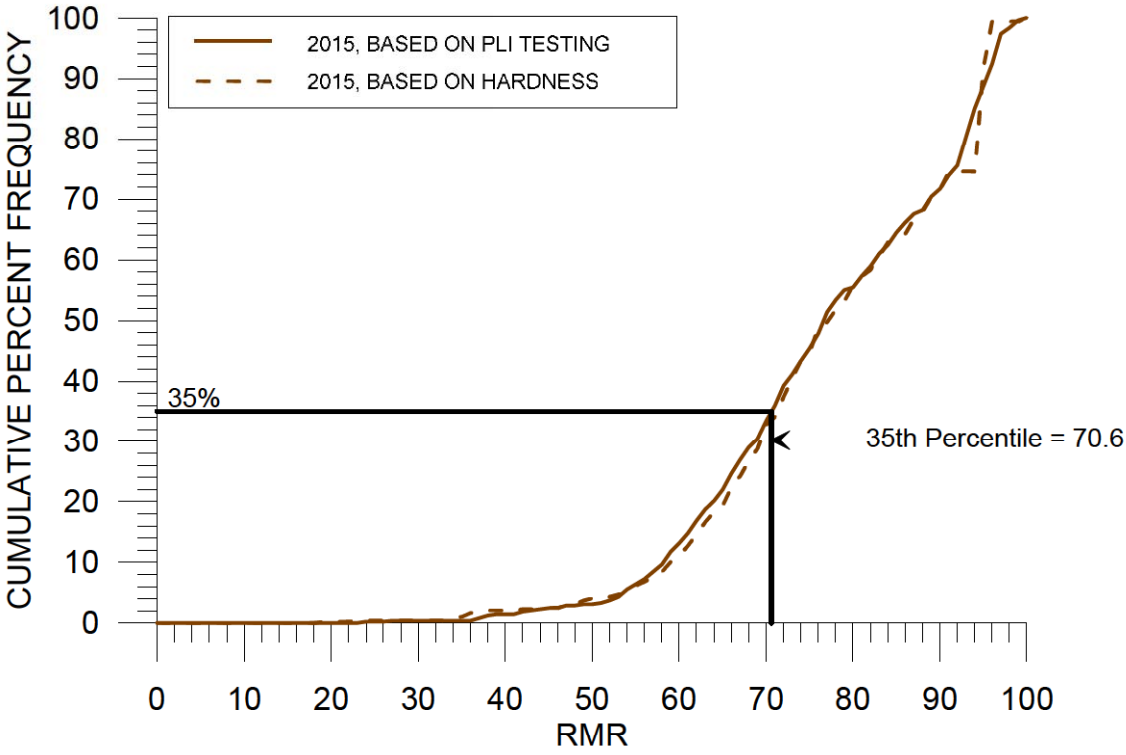
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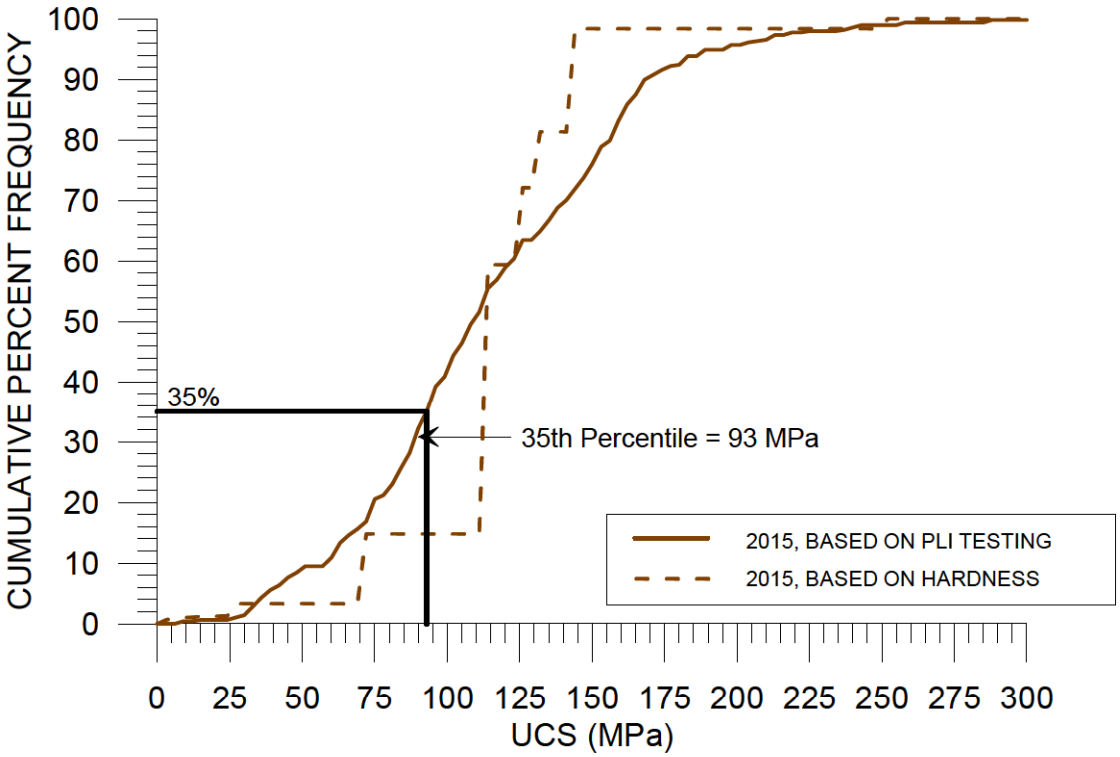


APPENDIX E

CUMULATIVE FREQUENCY DISTRIBUTIONS OF RMR AND UCS BASED ON PLI TESTING AND HARDNESS ASSESSMENTS

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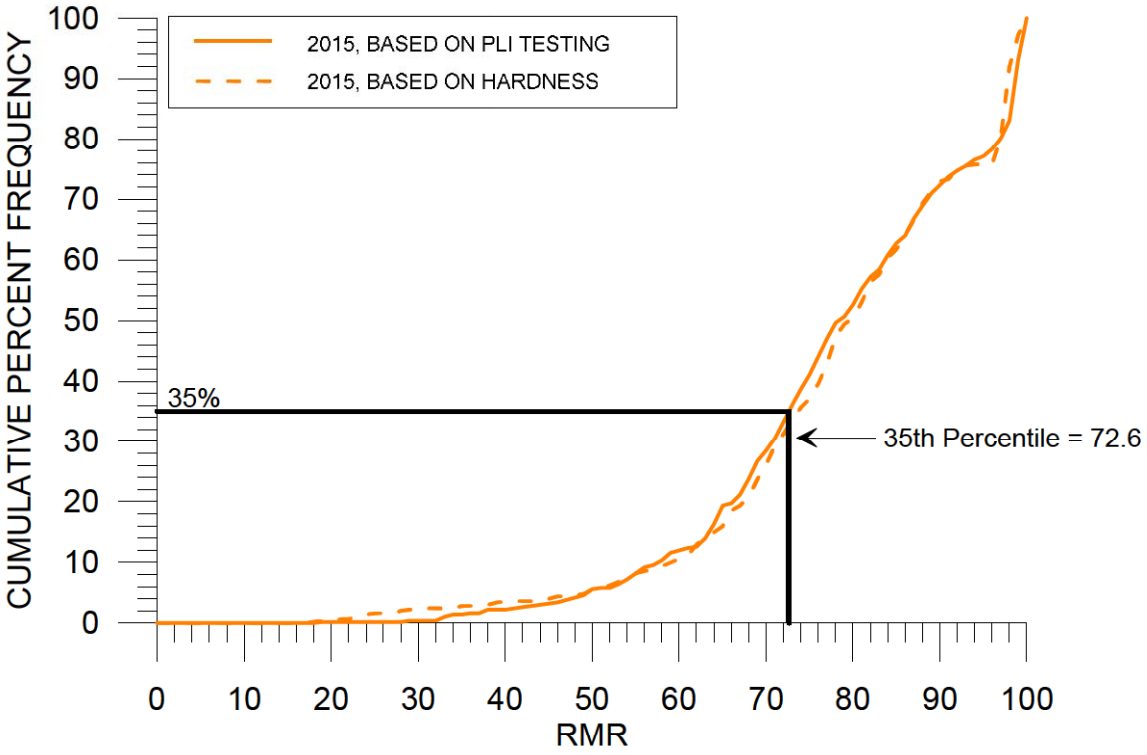
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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

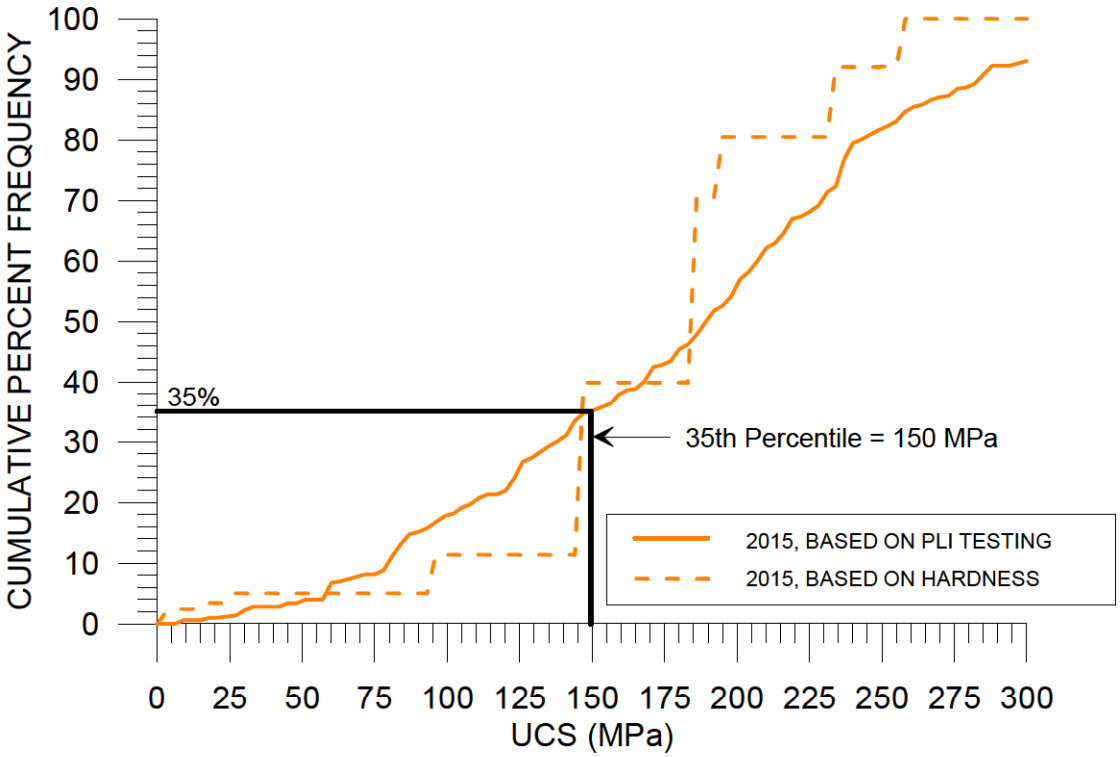
PITEAU ASSOCIATES
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR AMPHIBOLITE (AMP)

BY:	DATE:
IAL	JAN 16
APPROVED:	FIG:
GG	E1

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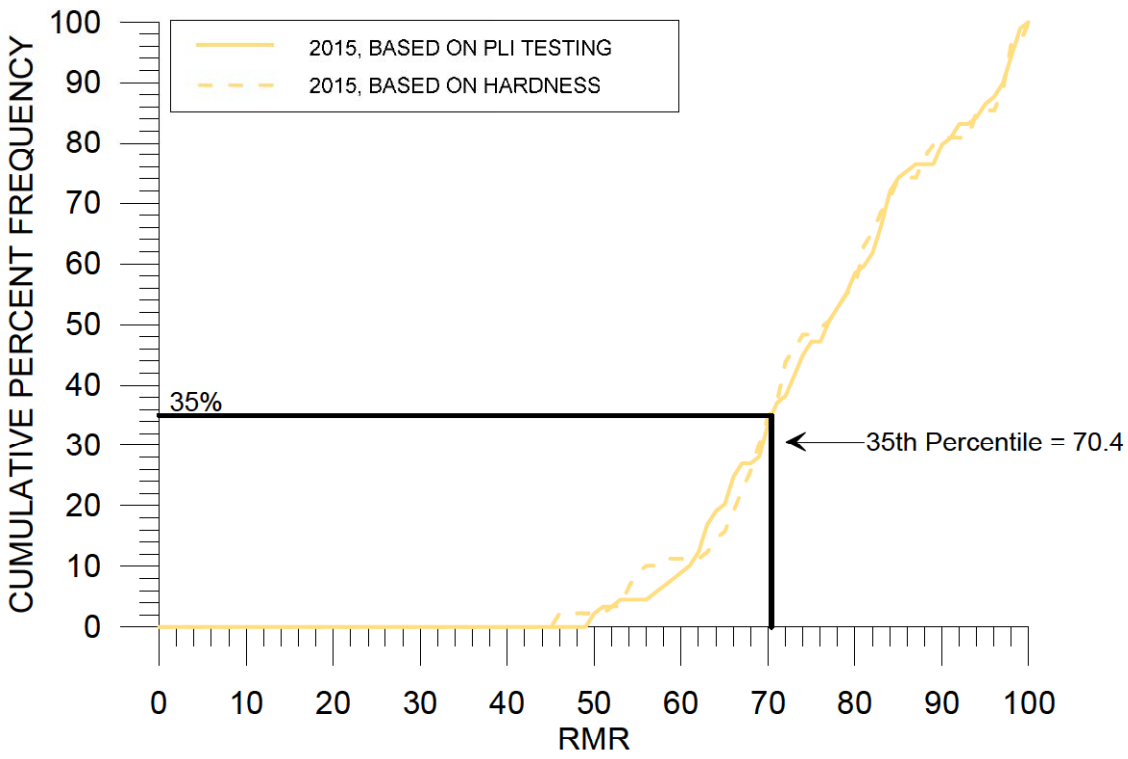
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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

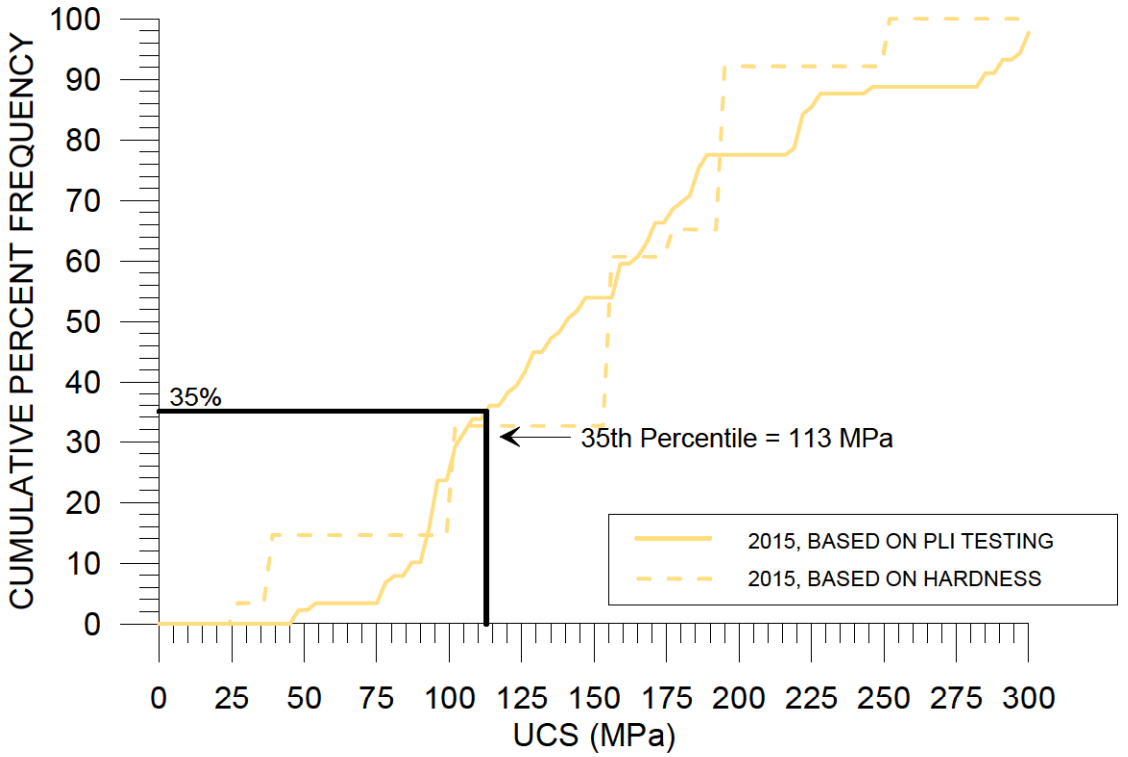
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR IRON FORMATION (IF)

BY:	DATE:
IAL	JAN 16
APPROVED:	FIG:
GG	E2

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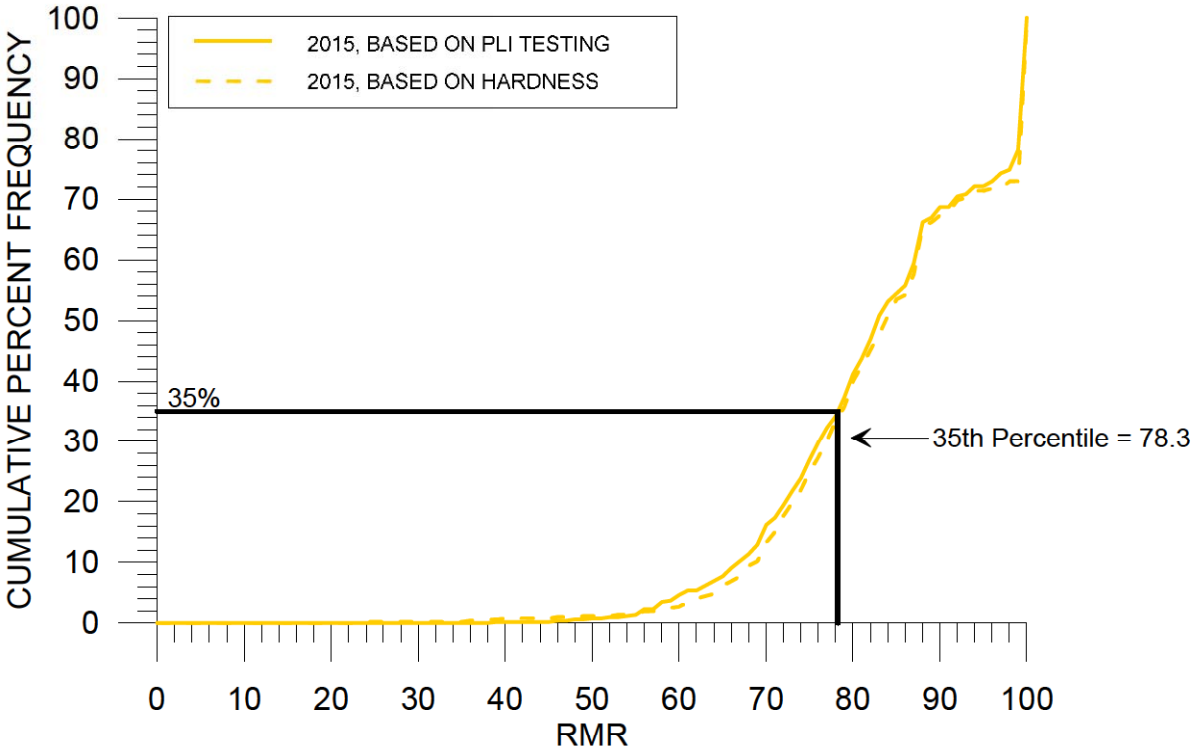
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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

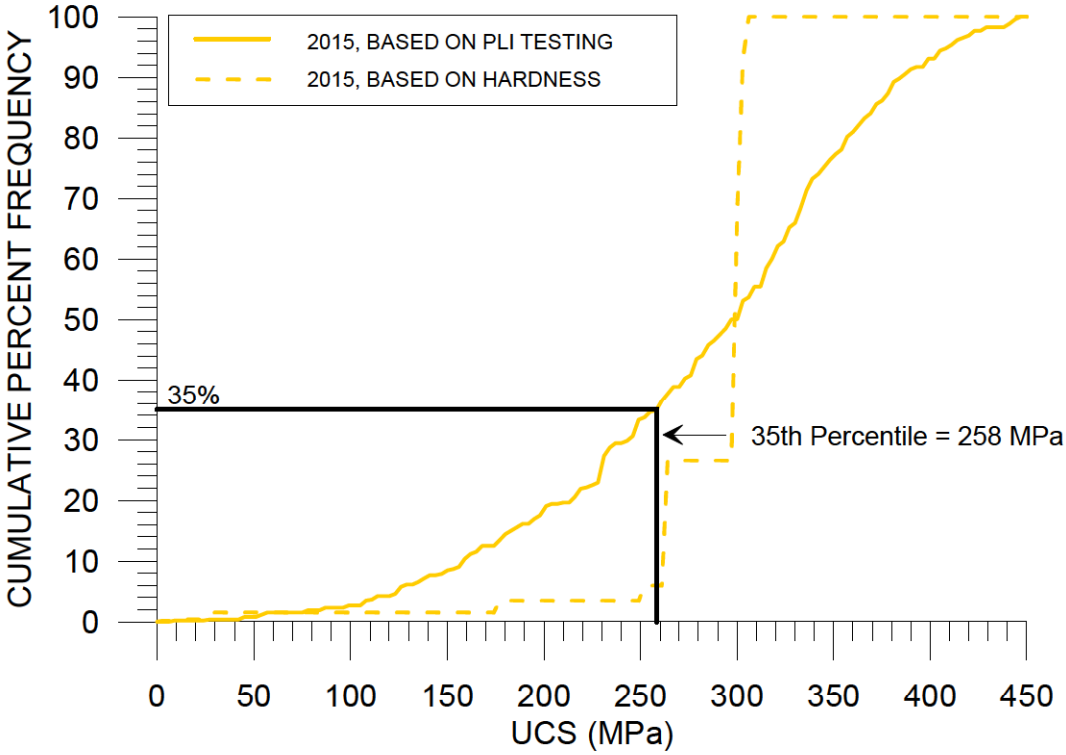
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZ ROCK MICA SCHIST (QRMS)

BY:	DATE:
IAL	JAN 16
APPROVED:	FIG:
GG	E3

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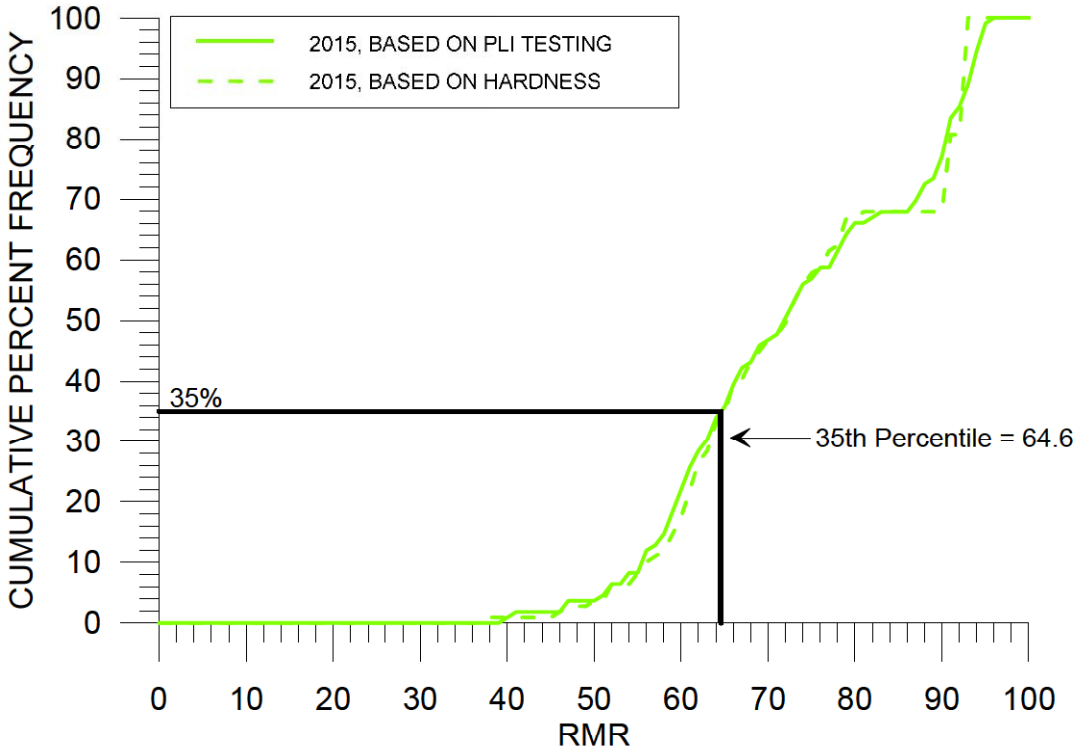
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

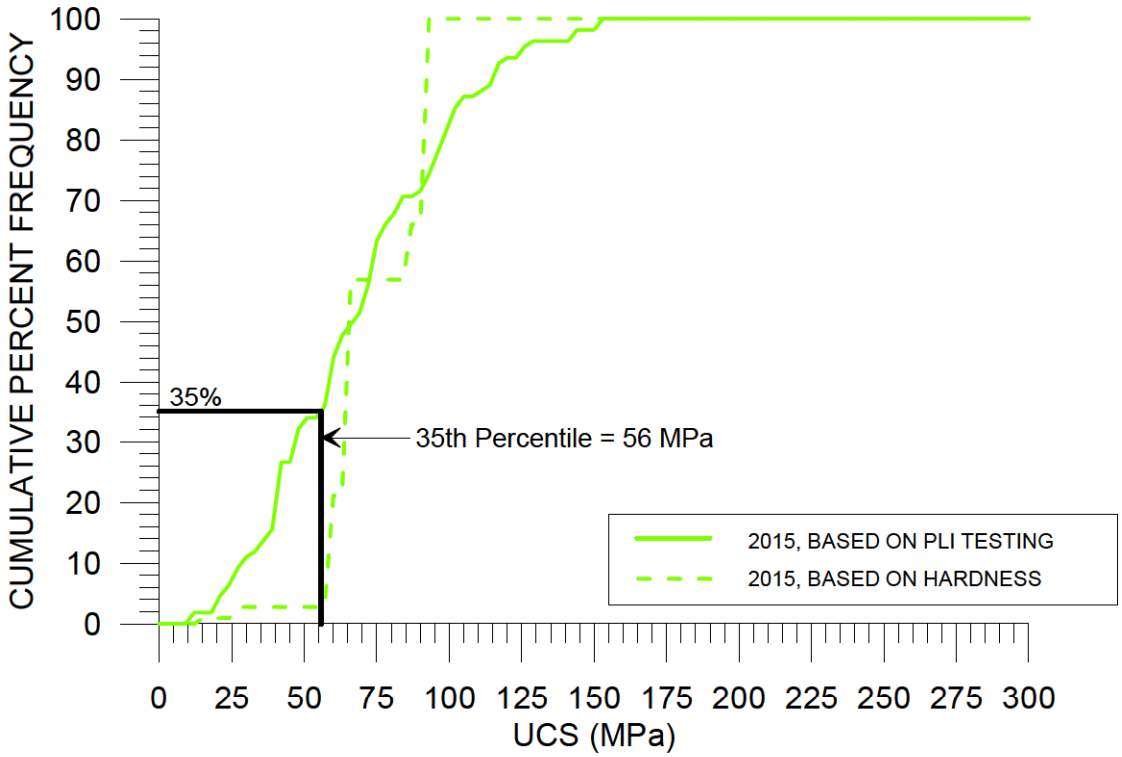
PITEAU ASSOCIATES
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR QUARTZ ROCK (QR)

BY:	DATE:
IAL	JAN 16
APPROVED:	FIG:
GG	E4

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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
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CUMULATIVE FREQUENCY DISTRIBUTIONS OF UCS AND RMR FOR GNEISS (GN)

BY:	DATE:
IAL	JAN 16
APPROVED:	FIG:
GG	E5

APPENDIX F

ASSESSMENT OF KINEMATICALLY POSSIBLE FAILURE MODES BASED ON PHOTOGRAMMETRIC AND ORIENTED CORE LOGGING DATA

TABLE F1
SUMMARY OF ALLOWABLE BENCH AND INTERRAMP SLOPE ANGLES FOR THE HANGING WALL OF THE PIT IRÈNE
BASED ON ASSESSMENTS OF KINEMATICALLY POSSIBLE FAILURE MODES IN THE SOUTHEAST AND CENTRAL DOMAINS[1]

KINEMATICALLY POSSIBLE FAILURES AFFECTING INTERRAMP AND OVERALL SLOPES

KINEMATICALLY POSSIBLE FAILURES AFFECTING BENCHES

STRUCTURAL AREA[2] (DOMAIN)	KINEMATIC SECTOR DIP DIRECTION (°)	MAXIMUM INTERRAMP (OVERALL) SLOPE HEIGHT[2] (m)	ASSESSMENT OF PLANAR SLIDING SET[1]	DIP (°)	WEIGHT[3]	ASSESSMENT OF TOPPLING SET[1]	DIP (°)	WEIGHT[3]	POSSIBLE WEDGES INVOLVING MAJOR STRUCTURES (FAULTS AND BEDDING-JOINTS) DEPRESSURIZED, FS < 1.2 STRUCTURAL COMBINATION[1]	SLOPE ANGLE REQUIRED (c' = 0 kPa)[4] (°)	WEIGHT[3]	ALLOWABLE SLOPE HEIGHT (m) BASED ON INTERRAMP ANGLE (°)[4] FAULTS (c' = 110 kPa and φ' = 25.2°), BEDDING-JOINTS: (c'=110 kPa, and φ' = 35.2°) ASSUMING 10% ROCK BRIDGING 40	41	42	43	44	45	46	47	48	49	50	51	52	53	Friction (°)	Cohesion (kPa)	Toppling Potential	ESTIMATED BREAKBACK ANGLE BASED ON 30% CFA VALUES FROM THE FOLLOWING DATA SOURCES: COMBINED PHOTO	CORE	ESTIMATED BREAKBACK ANGLE BASED ON 50% CFA VALUES FROM THE FOLLOWING DATA SOURCES: COMBINED PHOTO	CORE	DOCUMENTED BREAKBACK ANGLE: 30% CFA (°)	50% CFA (°)	AVERAGE COMBINED KINEMATIC DATABSE CFA: 30% CFA (°)	50% CFA (°)	BACK CALCULATED BENCH LOSS BASED ON 30% BENCH DOCUMENTATION (M) 28m BENCH HEIGHT	ALLOWABLE IRA (°) BASED ON 30% CFA[5] 28m (DOUBLE) BENCH HEIGHT 13m CATCHMENT	ALLOWABLE IRA BASED ON KINEMATICS RESULTS (°) 28m DOUBLE BENCH
SOUTHEAST	270	84 *(196)*	JS1 - (P)	28	W				No critical combinations for the range of slopes analyzed																38	75	LOW	- *(0)*	- *(0)*	- *(0)*	- *(0)*	-	-	-	-	-	-		
	310	-	JS5 - (P) JS4 - (P)	52 74	M S	JS11 - (C) JS9 - (C) JS10 - (C) JS8 - (P)	67 75 82 87	M M M M	No critical combinations for the range of slopes analyzed																38	75	LOW	*67.4 (36)*	- *(0)*	*71.3 (36)*	- *(0)*	-	-	*67.4*	*71.3*	-	48.6	
	315	56 *(56)*	JS5 - (P) JS4 - (P)	52 74	M S	JS11 - (C) JS9 - (C) JS10 - (C) JS8 - (P)	67 75 82 87	M M M M	No critical combinations for the range of slopes analyzed																38	75	LOW	*73.9 (43.0)*	-	*76.6 (73.9)*	-	-	-	*73.9*	*76.6*	-	53.0	
	325	*196 (196)*	JS6 - (P) JS5 - (P) JS4 - (P)	50 52 74	M M S	JS11 - (C) JS9 - (C) JS10 - (C) JS8 - (P)	67 75 82 87	M M M M	No critical combinations for the range of slopes analyzed																38	75	LOW	*74.9 (49)*	- *(0)*	*76.4 (49)*	- *(0)*	*66.4 (24)*	*72.0 (24)*	*74.9*	*76.4*	7.3	48.0	IRA: 48° BENCH WIDTH: 20.3m IRH: 210m
	350	210 *(210)*	JS6 - (P) JS5 - (P) JS4 - (P)	50 52 74	M M S	JS9 - (C) JS10 - (C) JS8 - (P)	75 82 87	M M M	No critical combinations for the range of slopes analyzed																38	75	LOW	*74.5 (48)*	- *(0)*	*76.3 (48)*	- *(0)*	*66.6 (45)*	*71.5 (45)*	*74.5*	*76.3*	7.2	48.1	
	355	*98 (98)*	JS6 - (P) JS5 - (P) JS4 - (P)	50 52 74	M M S	JS9 - (C) JS10 - (C) JS8 - (P)	75 82 87	M M M	No critical combinations for the range of slopes analyzed																38	75	LOW	*75.4 (46)*	- *(0)*	*76.6 (46)*	- *(0)*	*66.8 (44)*	*71.7 (44)*	*75.4*	*76.6*	7.1	48.2	
CENTRAL	310	210 *(210)*	JS5 - (A) JS4 - (A)	45 62	S S	JS11 - (C) JS6 - (A)	76 82	M S	No critical combinations for the range of slopes analyzed																38	75	LOW	*74.2 (69)*	- *(0)*	*74.7 (69)*	- *(0)*	*71.4 (34)*	*73.2 (34)*	*74.2*	*74.7*	4.5	51.3	
	320	196 *(196)*	JS5 - (A) JS4 - (A)	45 62	S S	JS11 - (C) JS6 - (A)	76 82	M S	No critical combinations for the range of slopes analyzed																38	75	LOW	*73.2 (41)*	- *(0)*	*75.9 (41)*	- *(0)*	*71.4 (34)*	*73.2 (34)*	*73.2*	*75.9*	4.5	51.3	IRA: 51° BENCH WIDTH: 17.7m IRH: 210m
	325	-	JS5 - (A) JS4 - (A)	45 62	S S	JS11 - (C) JS6 - (A)	76 82	M S	No critical combinations for the range of slopes analyzed																38	75	LOW	*72.4 (33)*	- *(0)*	*74.6 (33)*	- *(0)*	*71.7 (38)*	*73.5 (38)*	*72.4*	*74.6*	4.3	51.5	
	335	-	JS5 - (A) JS4 - (A)	45 62	S S	JS6 - (A)	82	S	No critical combinations for the range of slopes analyzed																38	75	LOW	*71.8 (33.0)*	*69.1 (2.0)*	*74.4 (33.0)*	*71.8 (2.0)*	-	-	*70.5*	*73.1*	-	50.7	
	350	140 *(140)*	F1 - (C) JS5 - (A) JS4 - (A)	19 45 62	M S S	JS6 - (A)	82	S	F1 - (C)	19	M	-	-	-	-	-	-	-	-	-	-	-	-	-	38 38 38	0 50 75	LOW	*71.8 (29.0)*	*69.2 (6.0)*	*72.7 (29.0)*	*72.4 (6.0)*	-	-	*70.5*	*72.6*	-	50.7	IRA: 52° BENCH WIDTH: 16.9m IRH: 210m

H:\Project\1846\2015-05 slope design updates\Kinematics\[Kinematic_Bench_and Interramp_Summary_rev2b.xls]Central+Southeast

Notes:
1. Kinematic analyses are based on Adamtech photogrammetric structural data (A) collected by Piteau in 2015, combined Adamtech and Sirovision photogrammetric structural data (P) collected by Piteau and ArcelorMittal in 2015, respectively, and core orientation data (C) collected by Piteau in 2015.
2. Structural areas (domains) and kinematic sectors for the Pit Irène Mine Plan (v7.0) are shown on Fig.2.
3. Weighting of wedges and planes defined by relative occurrence of discontinuity populations defined from structural mapping data (W = weak, M = moderate, S = strong).
4. Allowable interramp slope angle (IRA) based on sensitivity analyses on the effects of cohesion. The zero cohesion case assumes loss of cohesion on structural discontinuities with production blasting whereas the 110kPa case assumes nominal cohesion is preserved on discontinuity surfaces with good presplit blasting conditions.
5. Allowable interramp slope angles, based on bench geometry, were calculated using 30% cumulative frequency analysis (CFA) breakback angle from bench documentation and required 13m catch bench widths for 28m double benches. For kinematic sectors where bench documentation is not available, 30% CFA breakback angle from kinematic assesments, based on compound breakback angle, were used.
6. This table is integral part of Piteau's report dated May 2016 (file: 1846-16_R02), and must be read and intepreted in the context of that report. Provided for the exclusive use of ArcellorMittal Mines Canada and Mont-Wright Mine, and may not be modified or used for any other party without the expressed appproval from Piteau Associates Engineering Ltd.

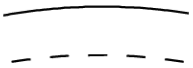
TABLE F1
SUMMARY OF ALLOWABLE BENCH AND INTERRAMP SLOPE ANGLES FOR THE HANGING WALL OF THE PIT IRÈNE BASED ON ASSESSMENTS OF KINEMATICALLY POSSIBLE FAILURE MODES IN THE SOUTHEAST AND CENTRAL DOMAINS

TABLE F2
SUMMARY OF ALLOWABLE BENCH AND INTERRAMP SLOPE ANGLES FOR THE HANGING WALL OF THE PIT IRÈNE
BASED ON ASSESSMENTS OF KINEMATICALLY POSSIBLE FAILURE MODES IN THE SOUTH AND WEST DOMAINS[1]

| KINEMATICALLY POSSIBLE FAILURES AFFECTING INTERRAMP AND OVERALL SLOPES | | |

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LEGEND

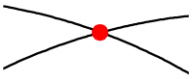


Plane projection of peak fault set orientation

Plane projection of peak joint set orientation

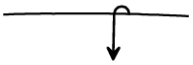


Kinematically possible wedge failure mechanism with Factor of Safety > 2.0



Kinematically possible wedge failure mechanism with Factor of Safety defined as follows:

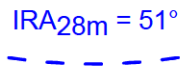
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- FS>1.00 TO FS<=1.20
- FS>1.20 TO FS<=2.00



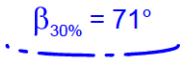
Kinematically possible toppling failure mechanism



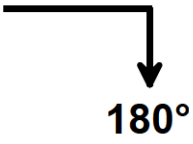
Kinematically possible plane failure mechanism with Factor of Safety defined as per colour scheme defined for wedges



Apparent dip or plunge considered to control interramp slope angle for 28m bench (IRA)



Apparent dip or plunge considered to control bench face angle (β or BFA)



General Wall Orientation

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LEGEND FOR LOWER HEMISPHERE EQUAL AREA PROJECTIONS ILLUSTRATING KINEMATICALLY POSSIBLE FAILURE MODES

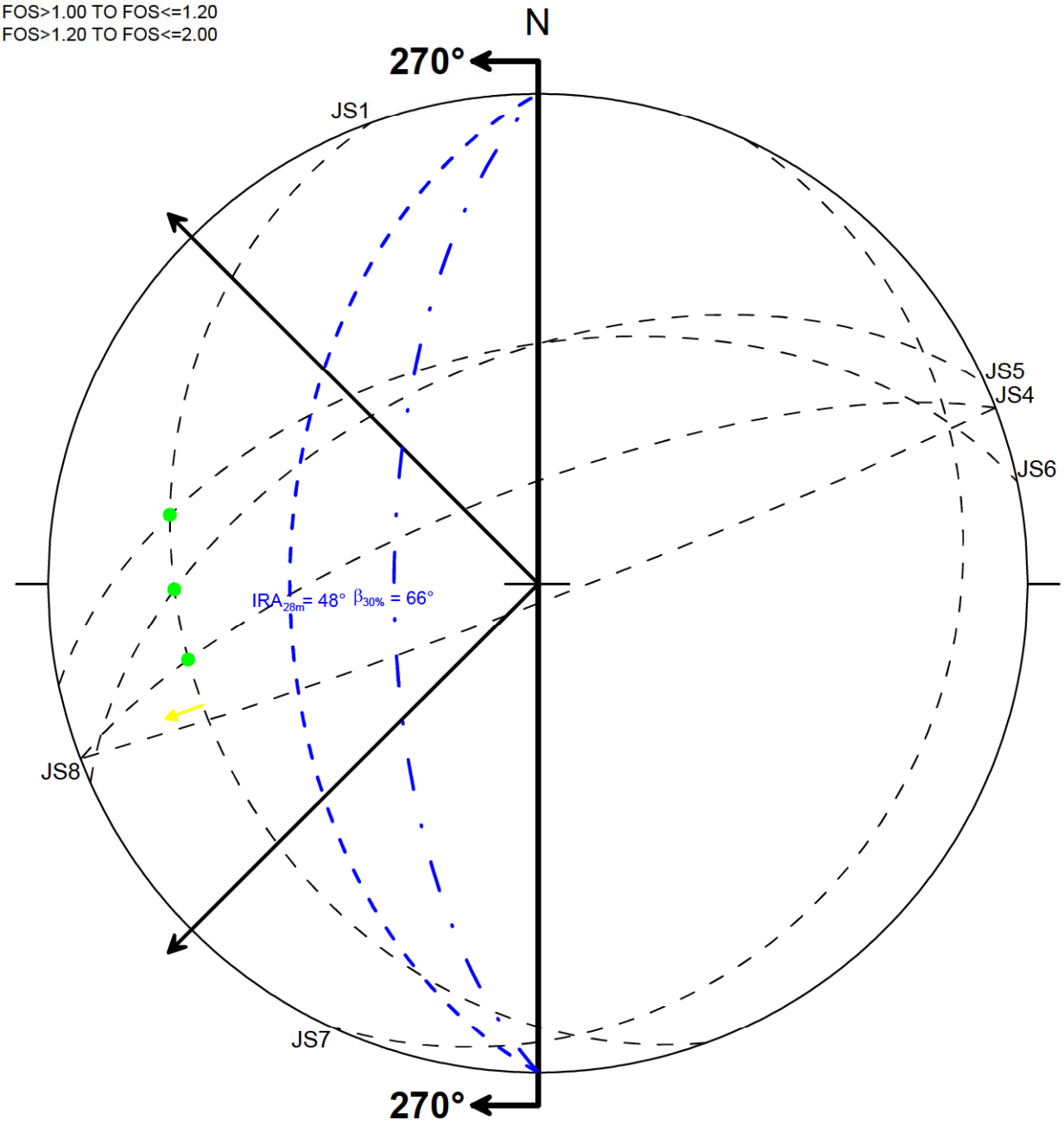
BY:	DATE:
LCS	FEB 16
APPROVED:	FIG:
GG	F1

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southeast-270.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

SOUTHEAST 270°



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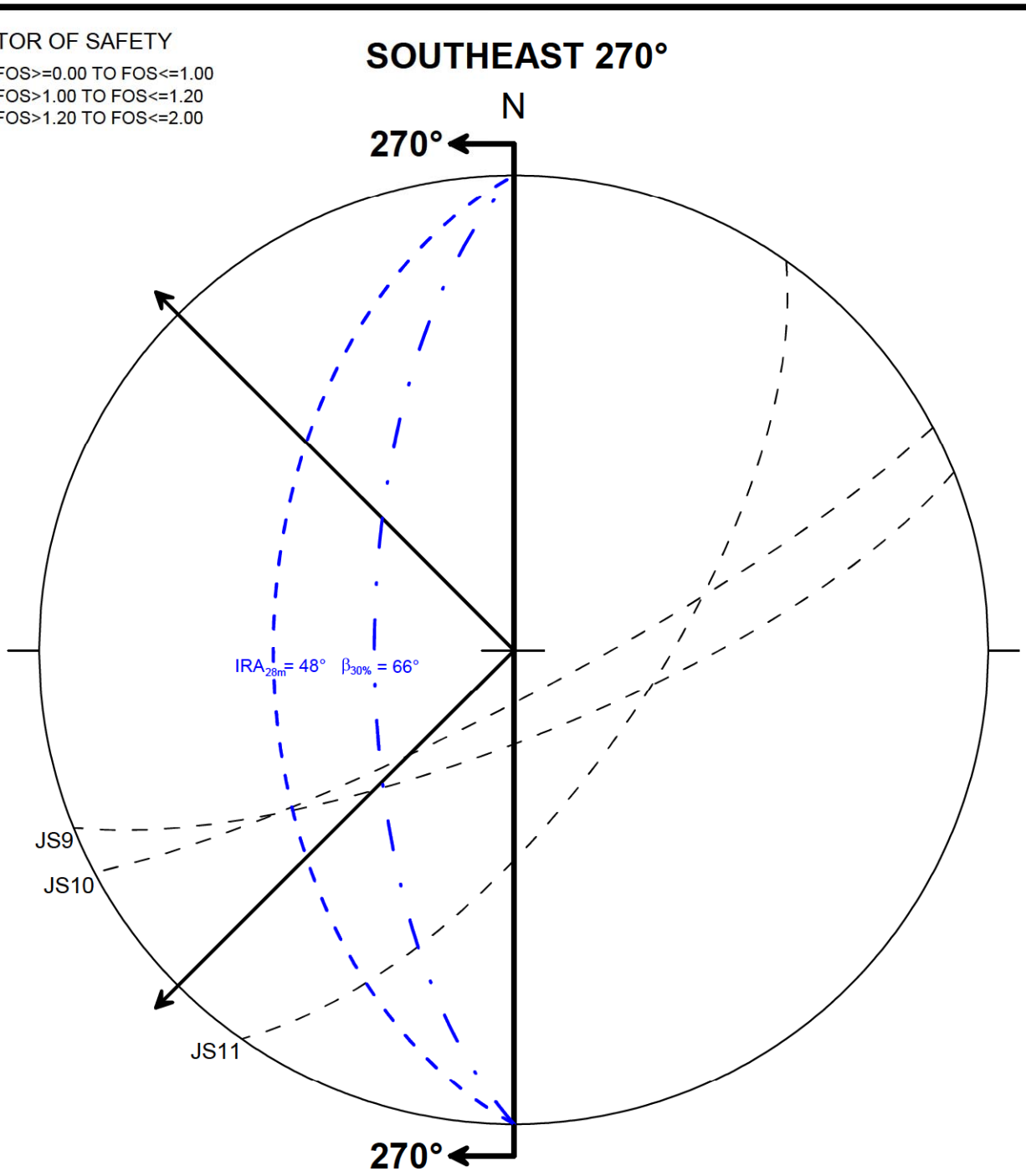
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTHEAST 270°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F2

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southeast-270.grf



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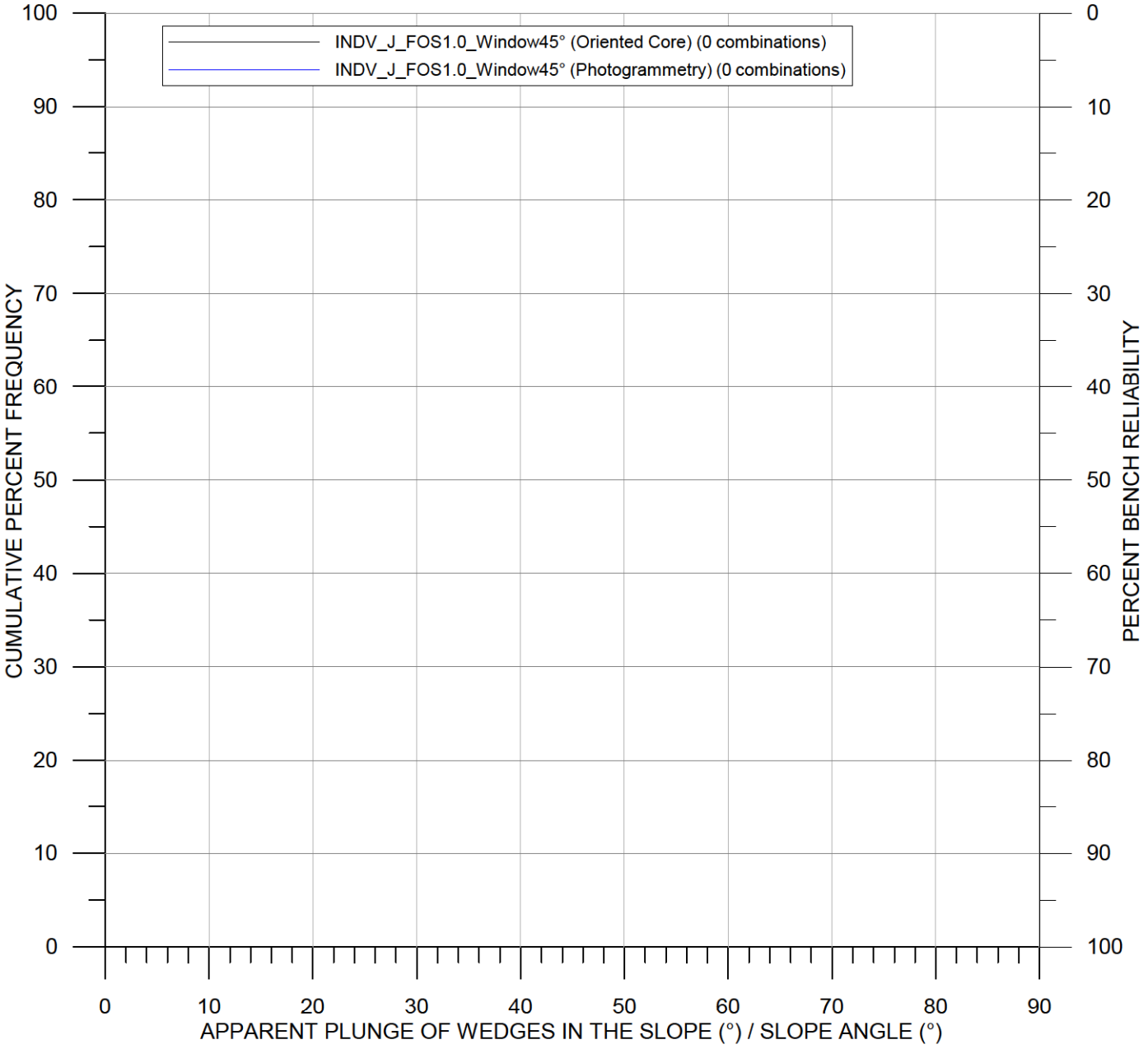
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTHEAST 270°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F3

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SOUTHEAST 270°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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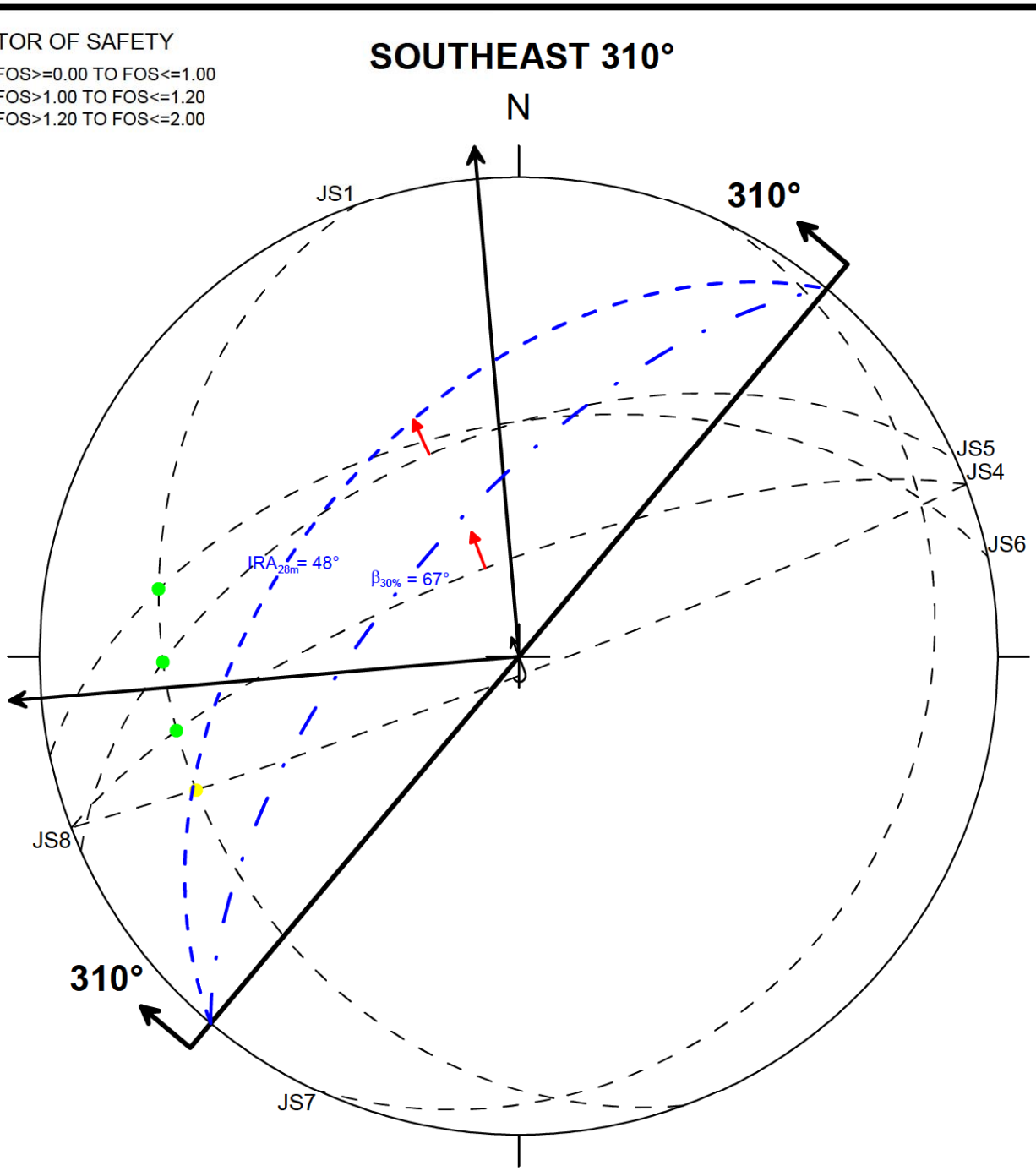
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CUMULATIVE FREQUENCY PLOT
SOUTHEAST 270° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F4

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southeast-310.grf



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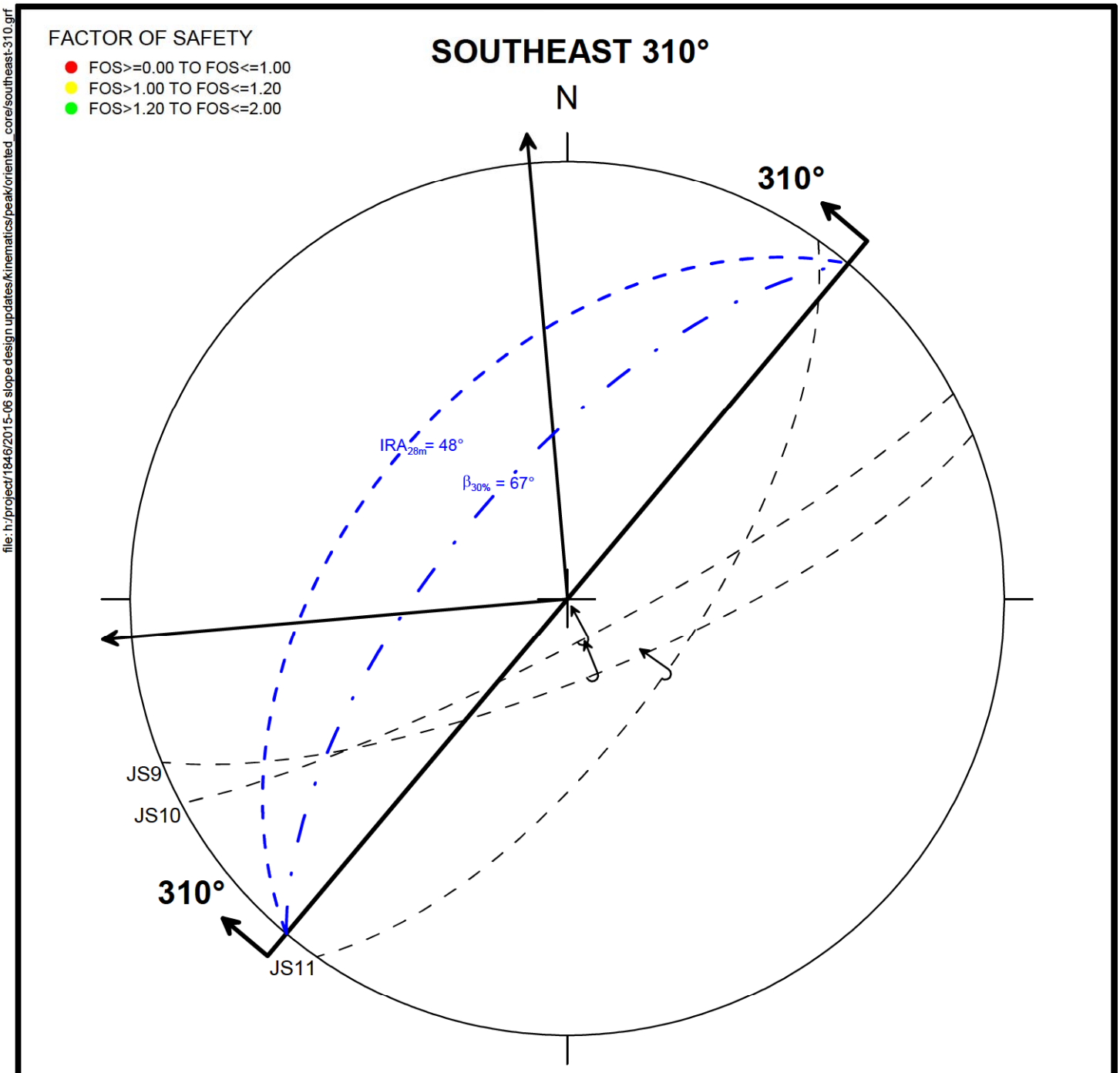
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTHEAST 310°

BY:	DATE:
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APPROVED:	FIG:
GG	F5

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southeast-310.grf



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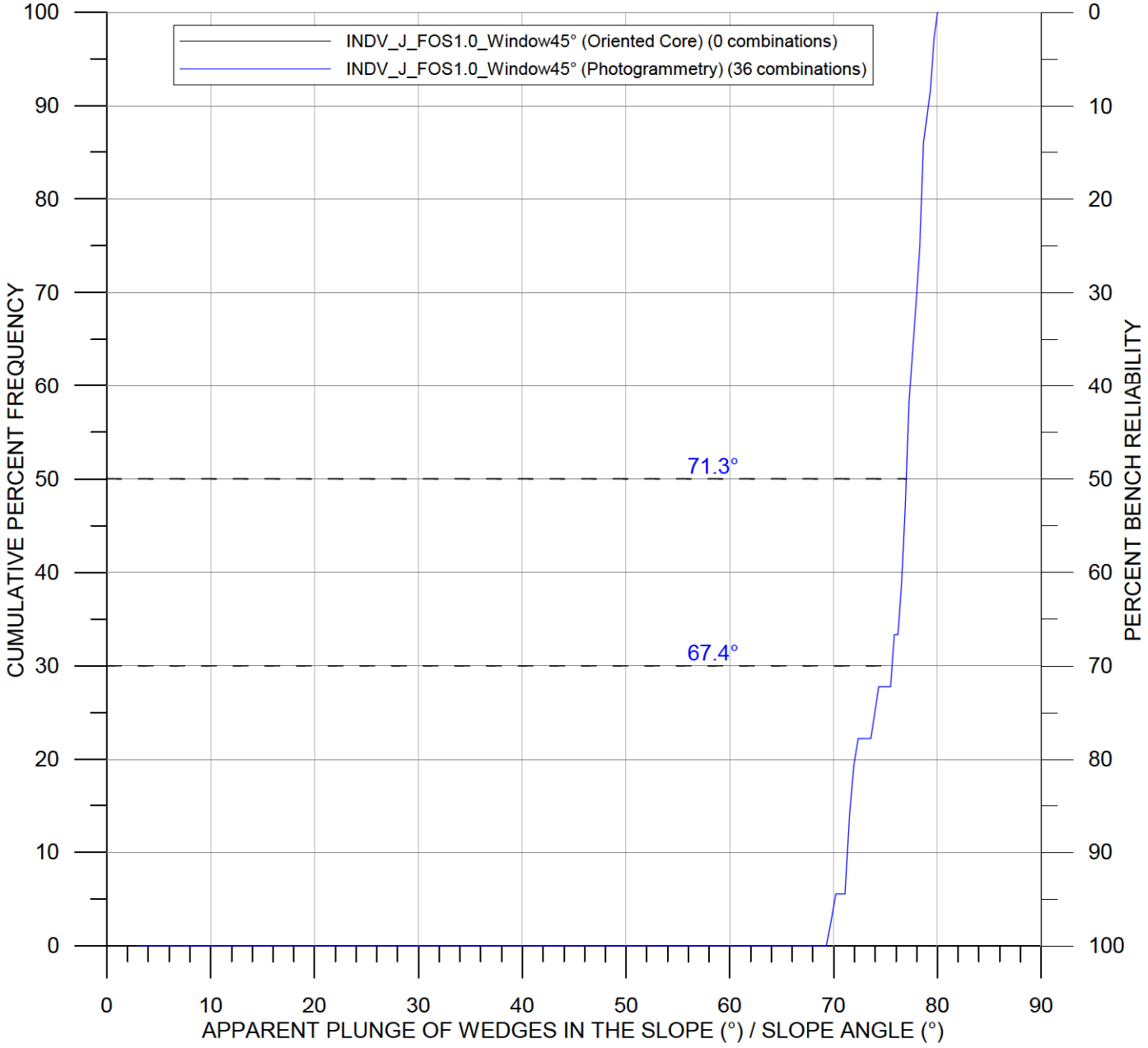
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTHEAST 310°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F6

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SOUTHEAST 310°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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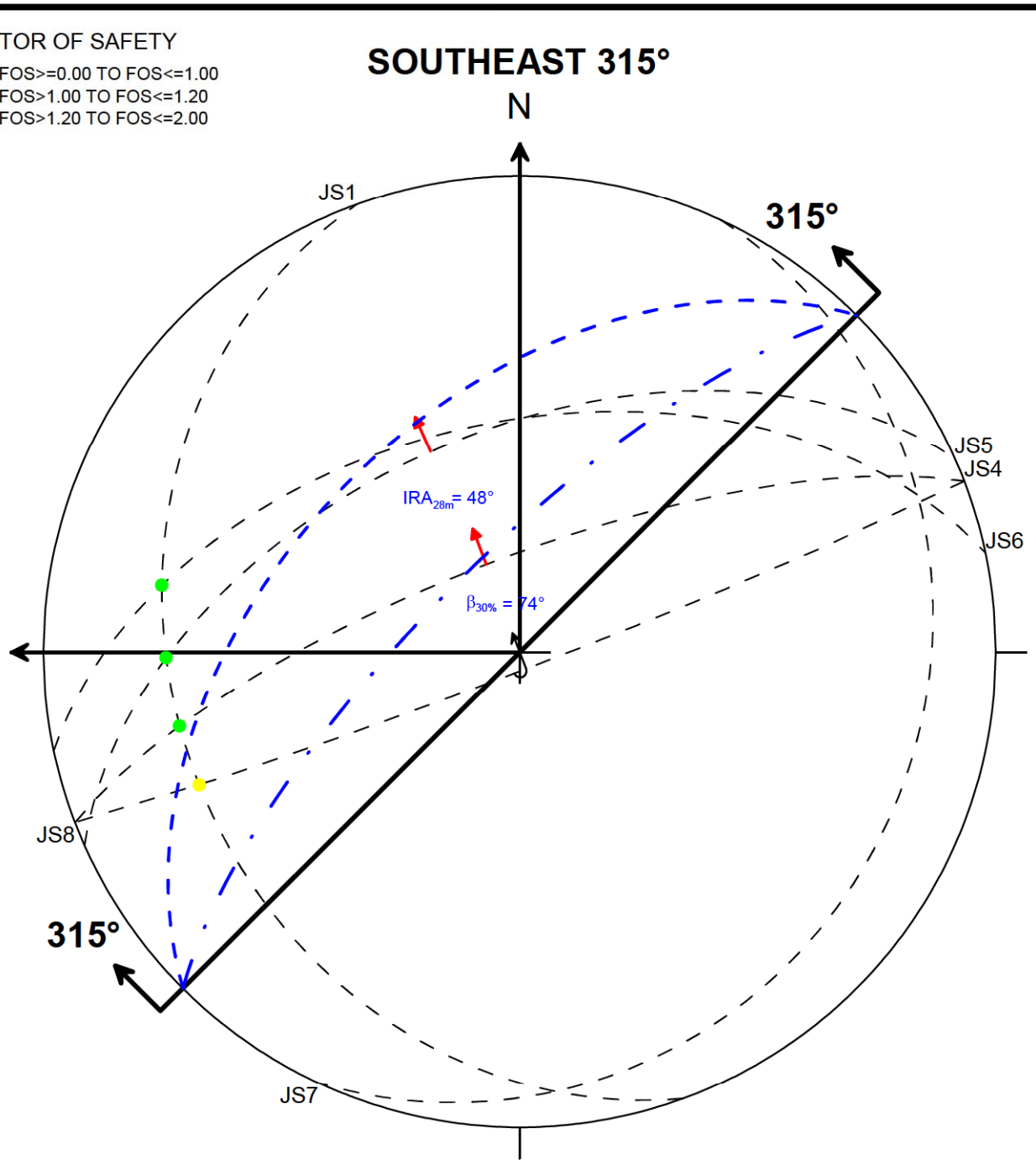
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CUMULATIVE FREQUENCY PLOT
SOUTHEAST 310° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F7

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southeast-315.grf



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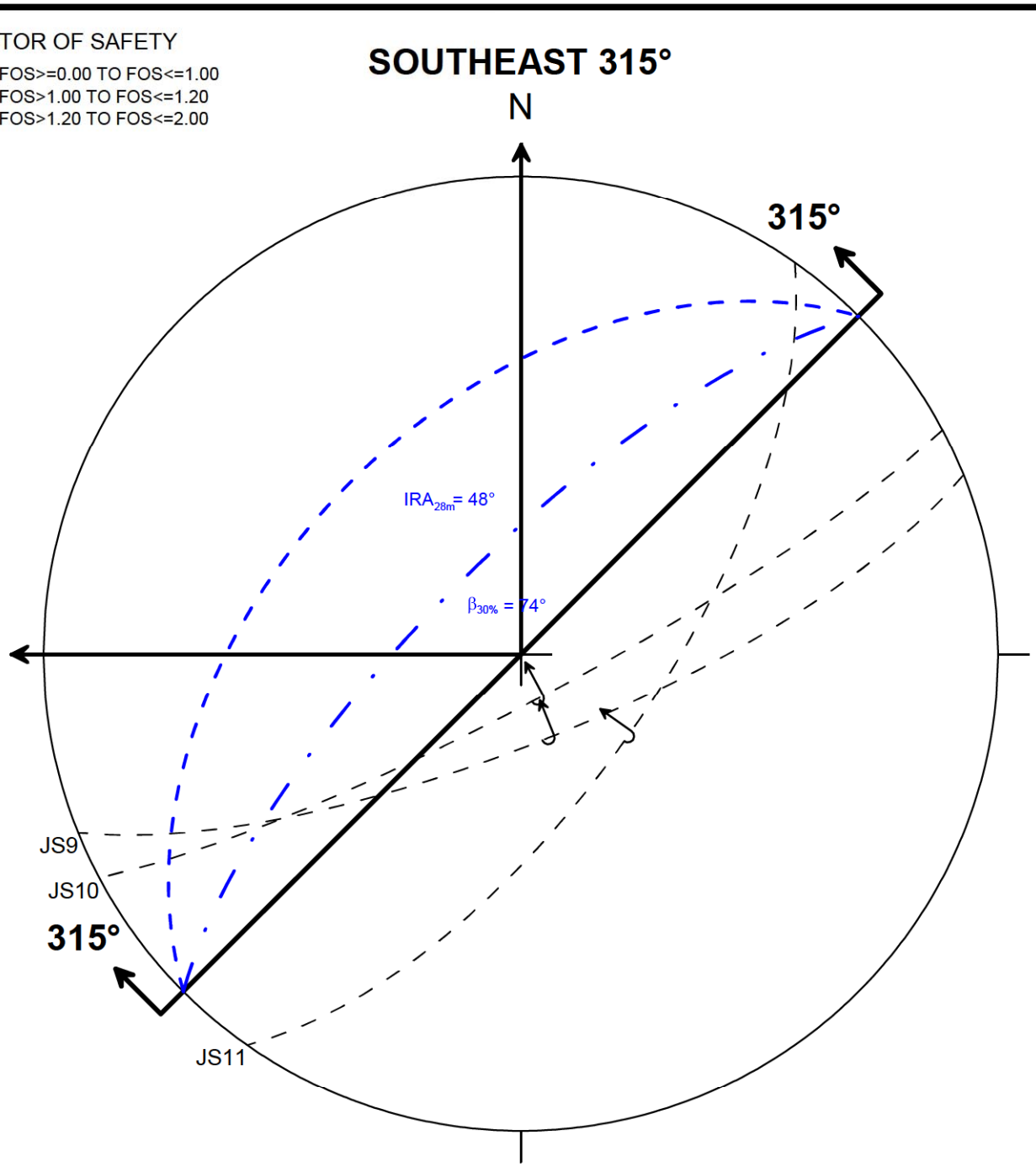
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTHEAST 315°

BY:	DATE:
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GG	F8

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southeast-315.grf



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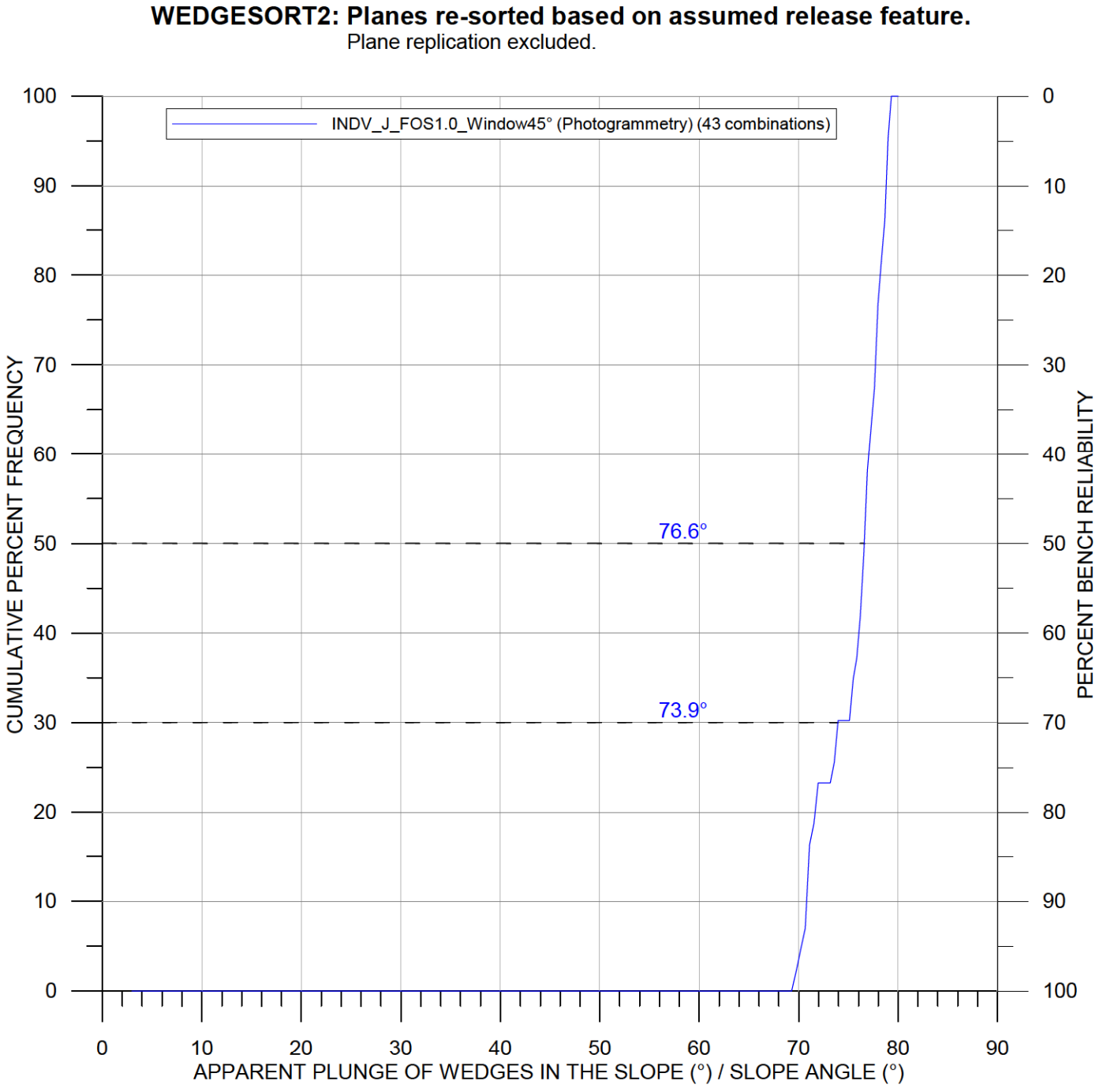
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTHEAST 315°

BY:	DATE:
JL	JAN 16
APPROVED:	FIG:
GG	F9

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SOUTHEAST 315°



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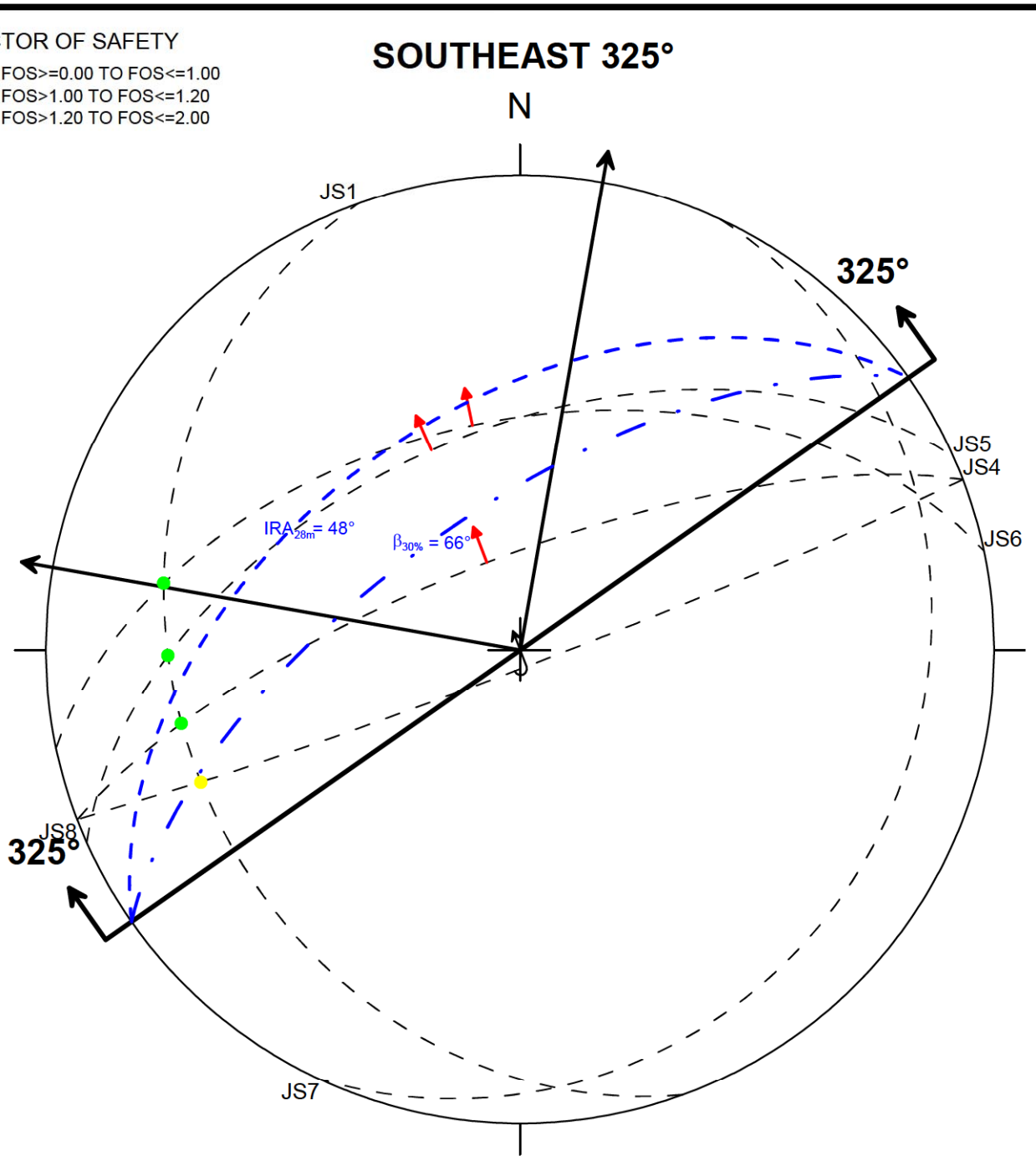
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CUMULATIVE FREQUENCY PLOT
SOUTHEAST 315° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F10

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southeast-325.grf



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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTHEAST 325°

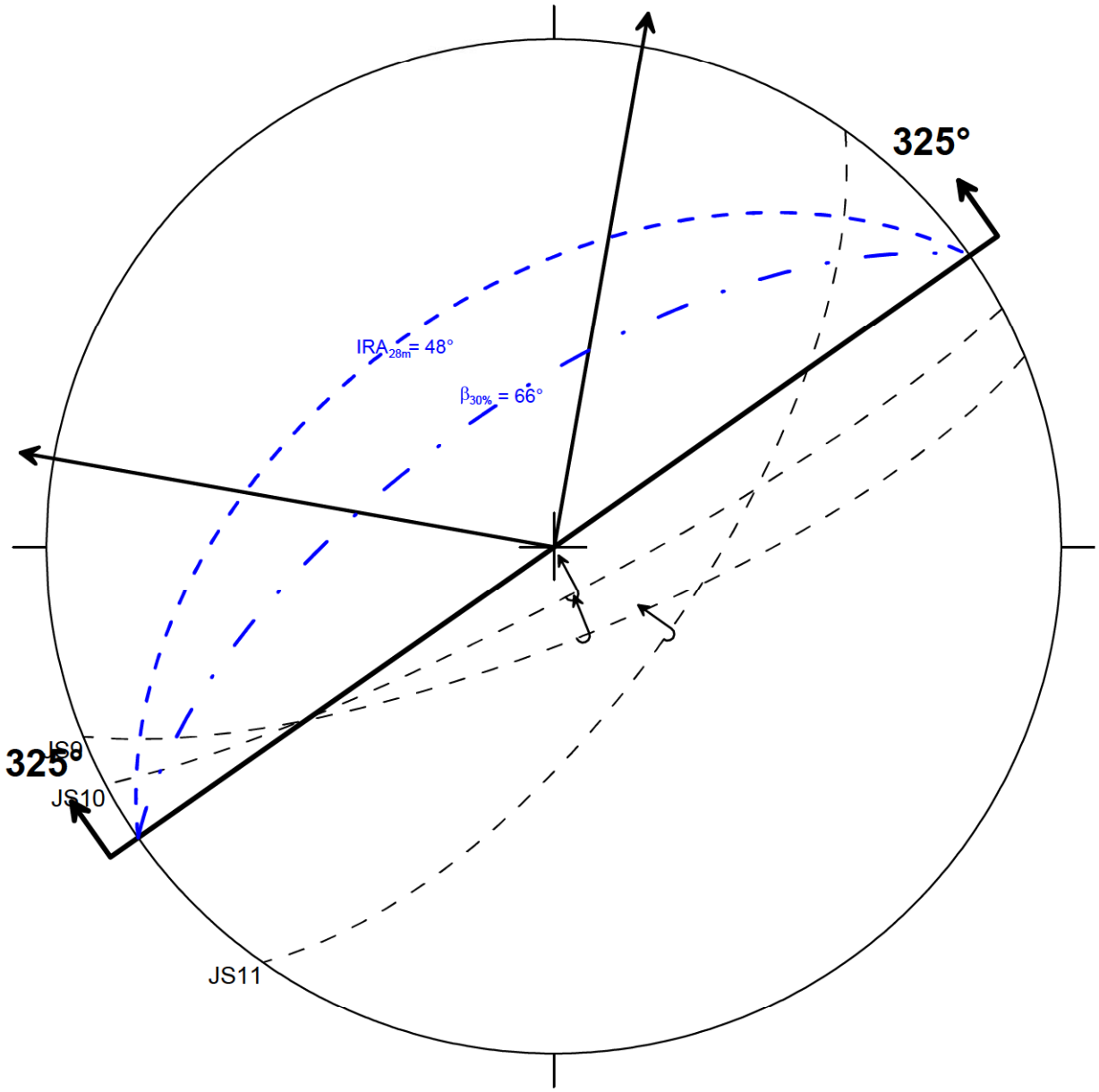
BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F11

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southeast-325.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

SOUTHEAST 325°



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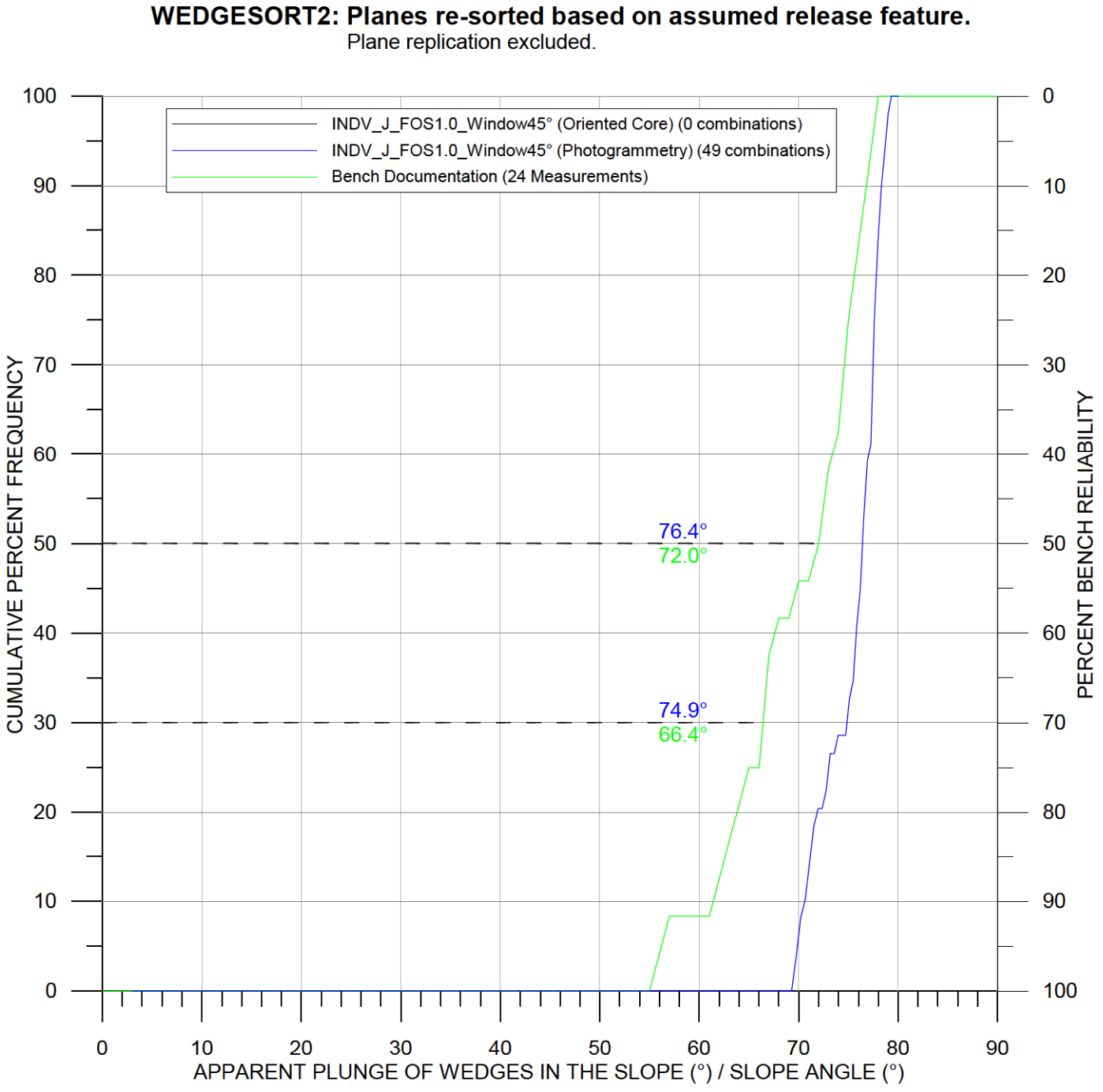
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTHEAST 325°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F12

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SOUTHEAST 325°



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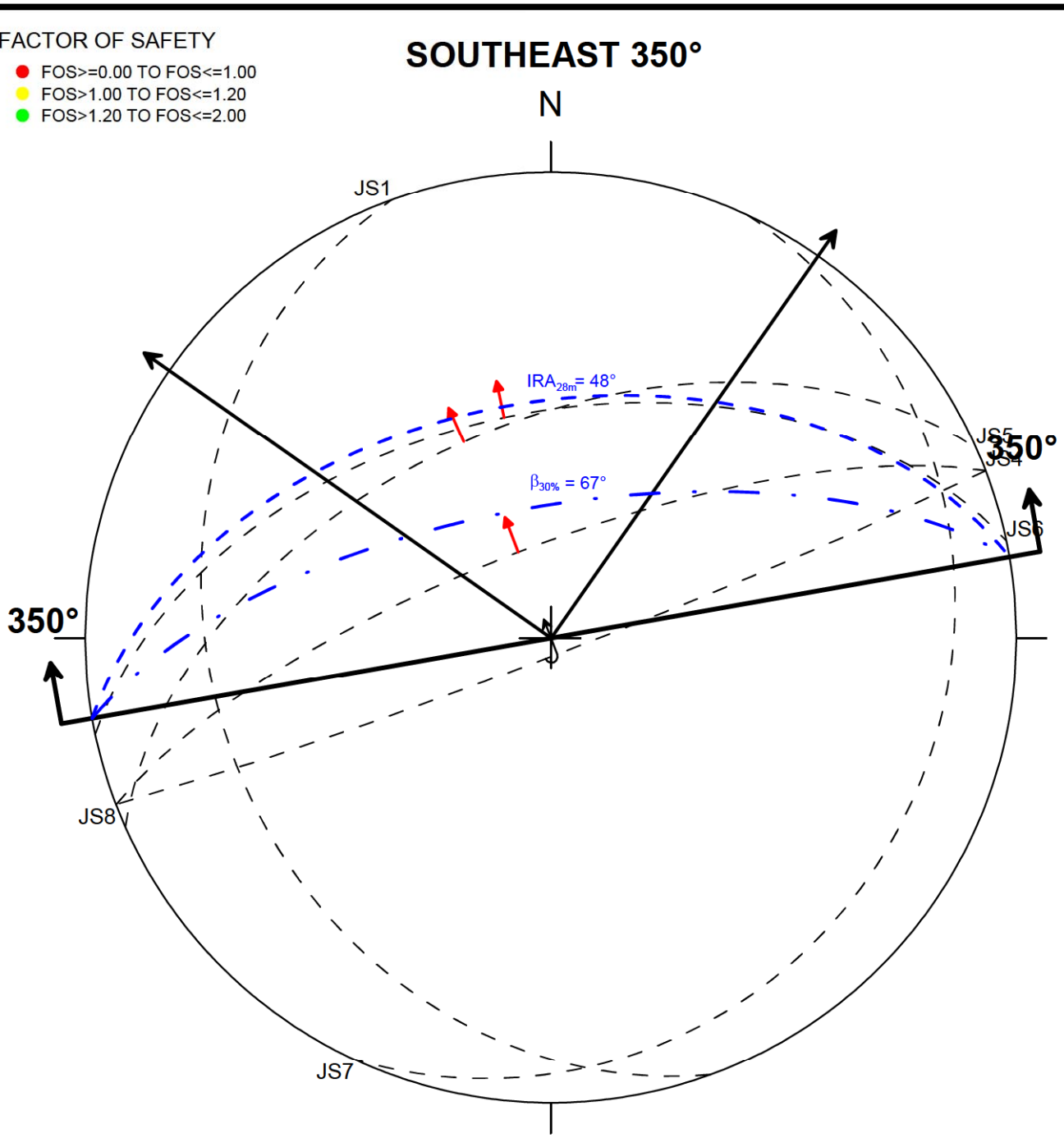
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MONT-WRIGHT - PIT IRÈNE
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CUMULATIVE FREQUENCY PLOT
SOUTHEAST 325° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
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GG	F13

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southeast-350.grf



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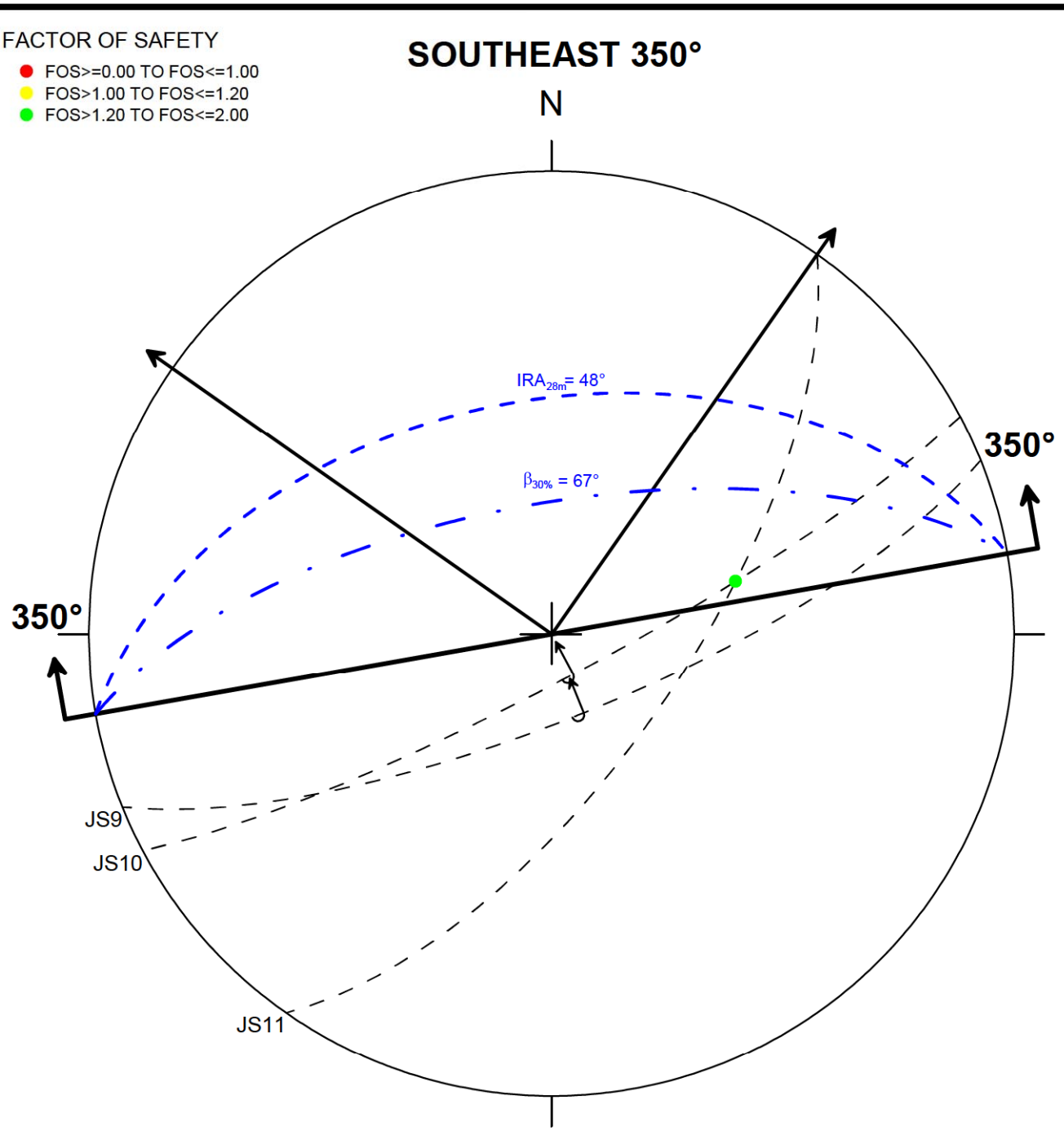
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTHEAST 350°

BY:	DATE:
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APPROVED:	FIG:
GG	F14

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southeast-350.grf



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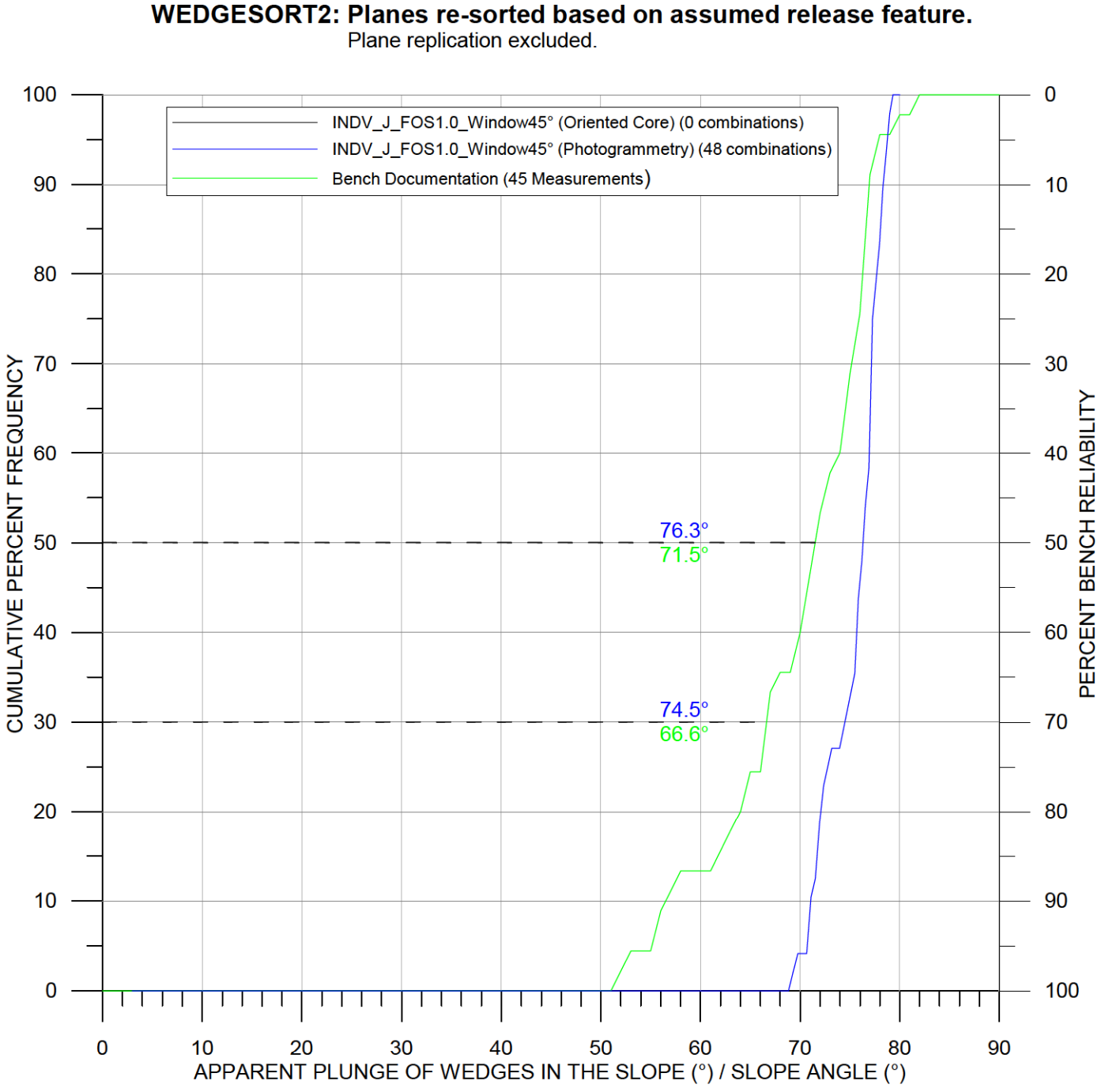
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTHEAST 350°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F15

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_all\Cohesion_75kPa_compound-angle\Southeast-350-cf75.grf

SOUTHEAST 350°



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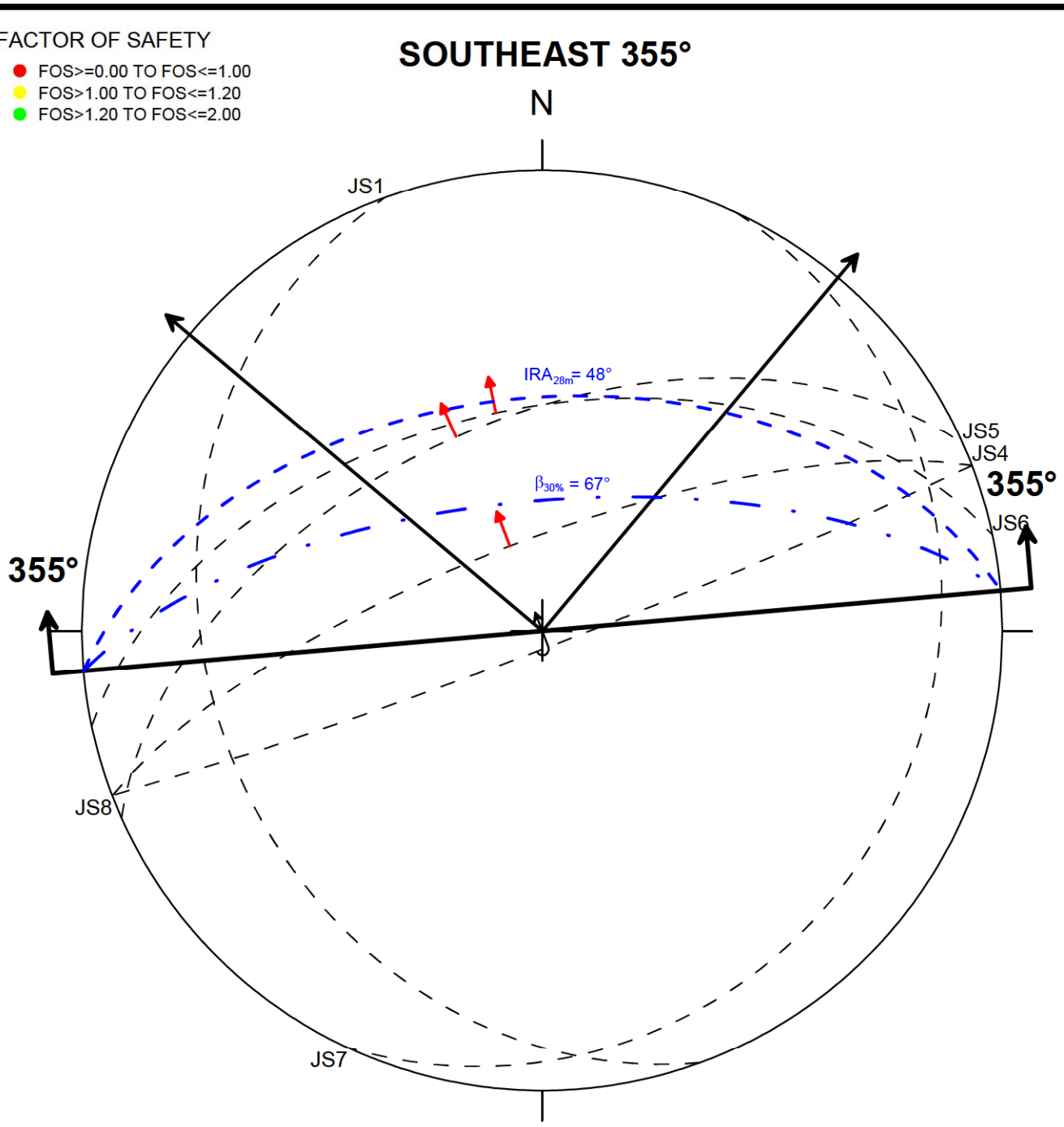
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MONT-WRIGHT - PIT IRÈNE
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CUMULATIVE FREQUENCY PLOT
SOUTHEAST 350° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
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APPROVED:	FIG:
GG	F16

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southeast-355.grf



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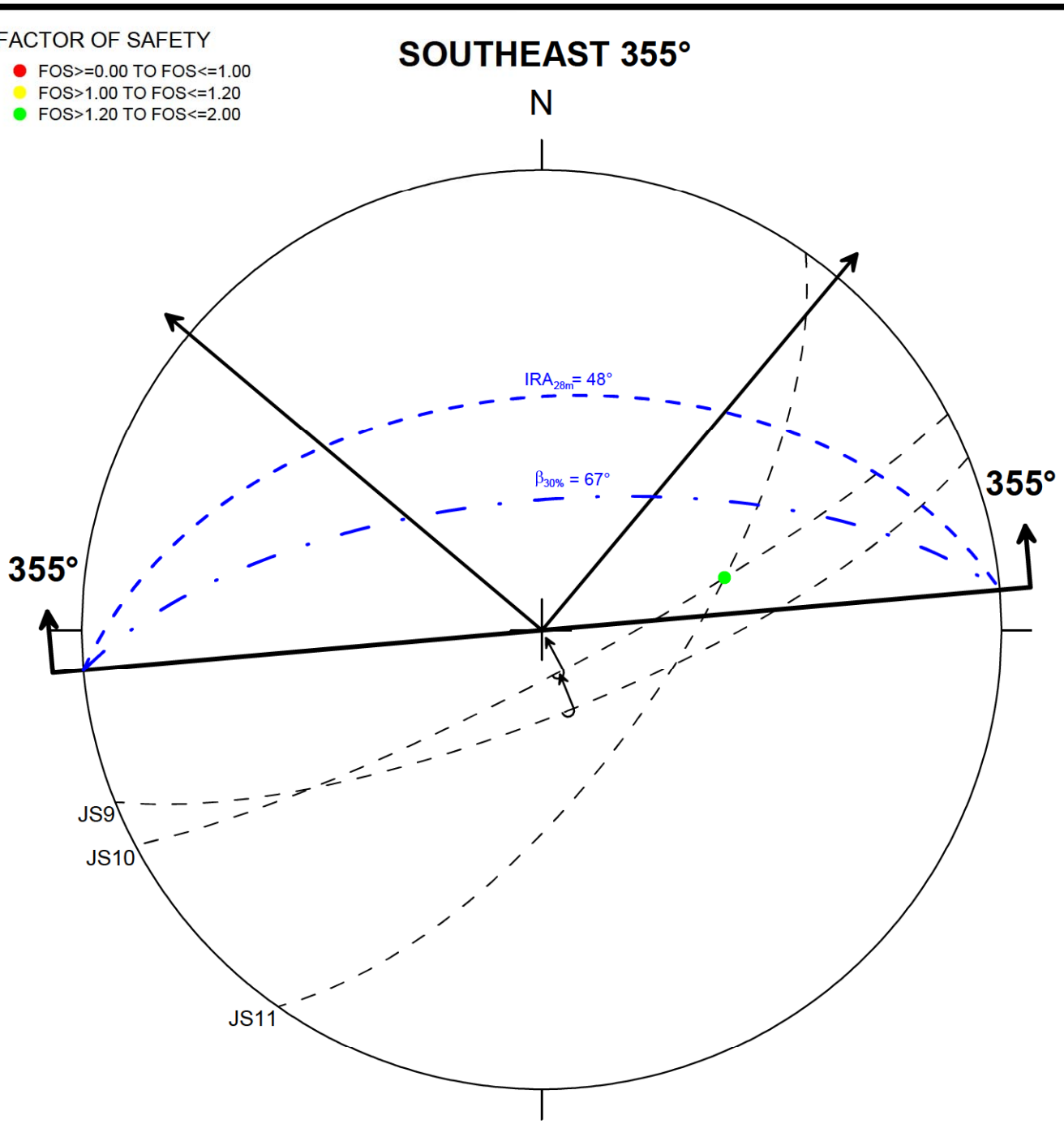
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTHEAST 355°

BY:	DATE:
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GG	F17

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MONT-WRIGHT - PIT IRÈNE
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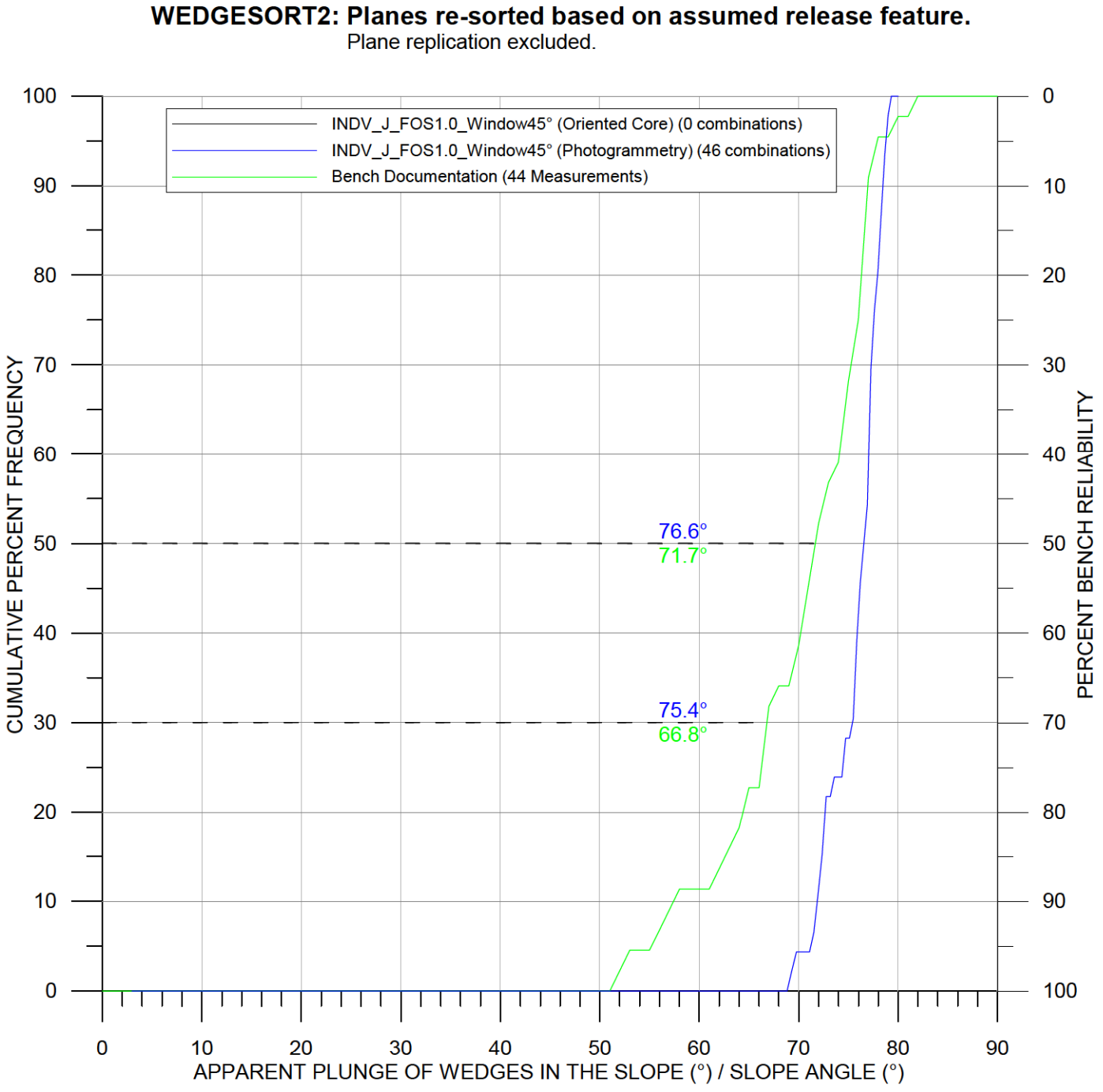
PITEAU ASSOCIATES
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTHEAST 355°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F18

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_all\Cohesion_75kPa_compound-angle\Southeast-355-cf75.grf

SOUTHEAST 355°



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CUMULATIVE FREQUENCY PLOT
SOUTHEAST 355° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

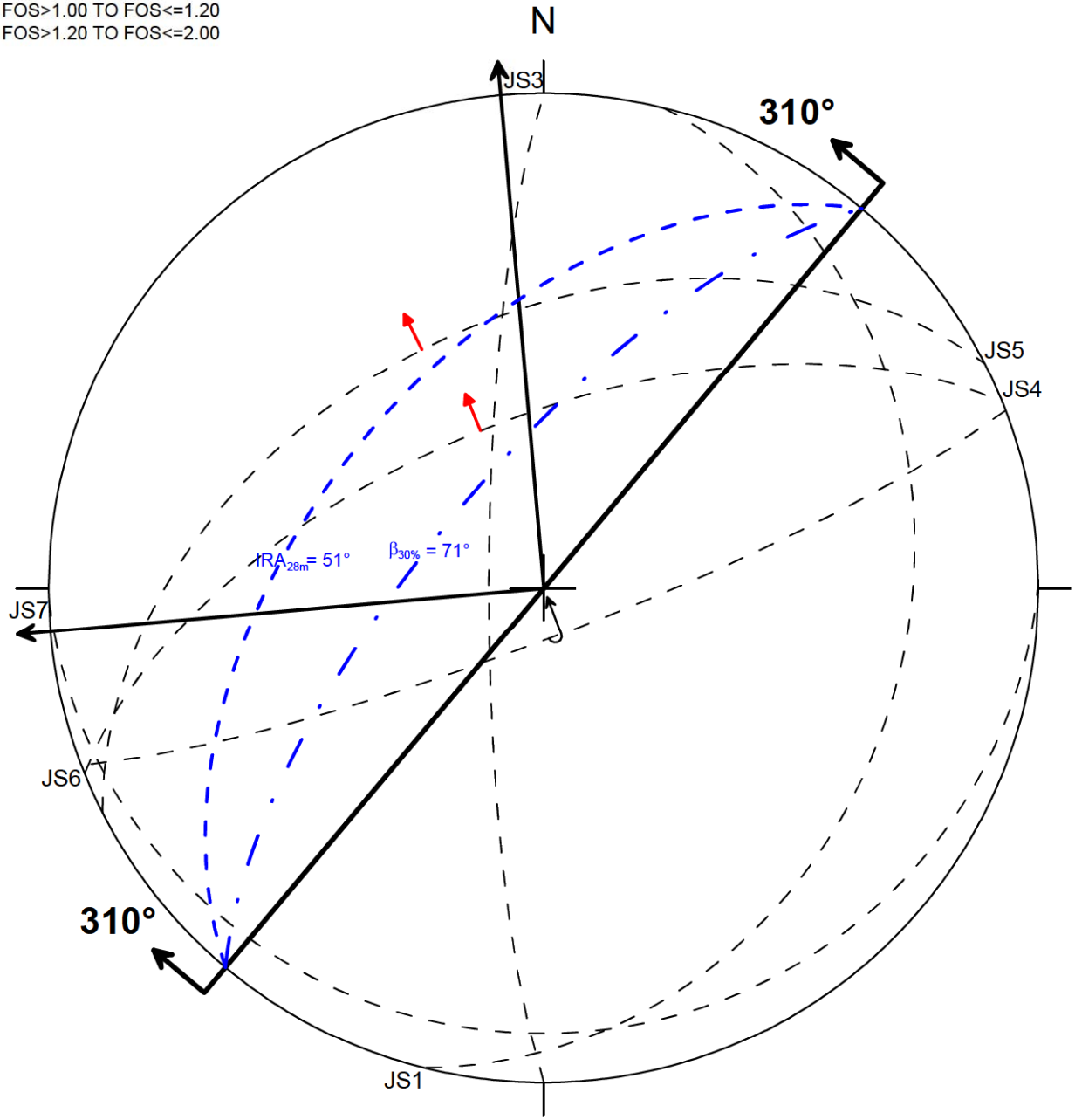
BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F19

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/adamtech/central-310.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

CENTRAL 310°



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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ADAMTECH PHOTOGRAMMETRY - CENTRAL 310°

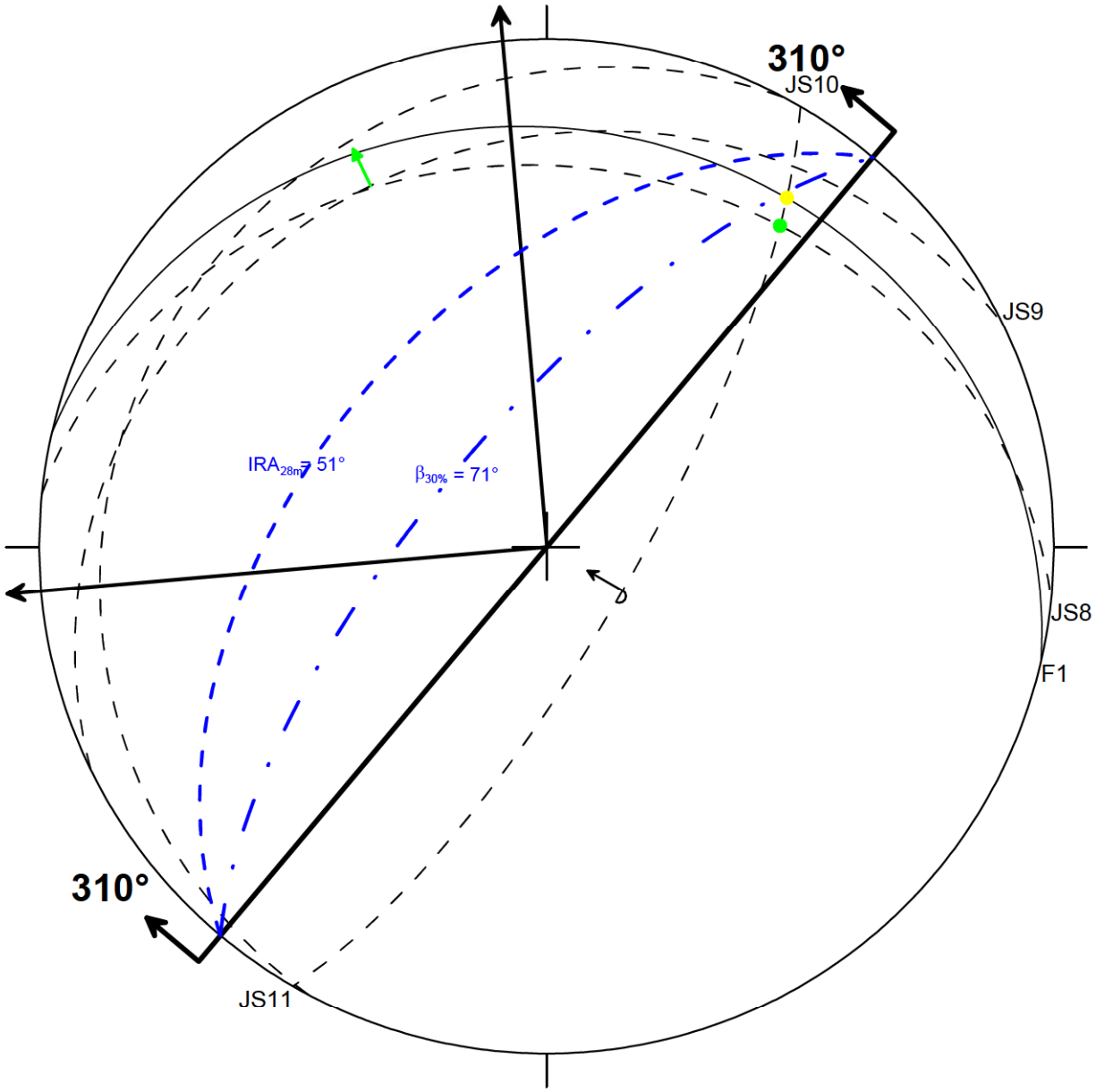
BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F20

file: h:/project/18446/2015-06 slope design updates/kinematics/peak/oriented_core/central-310.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

CENTRAL 310°



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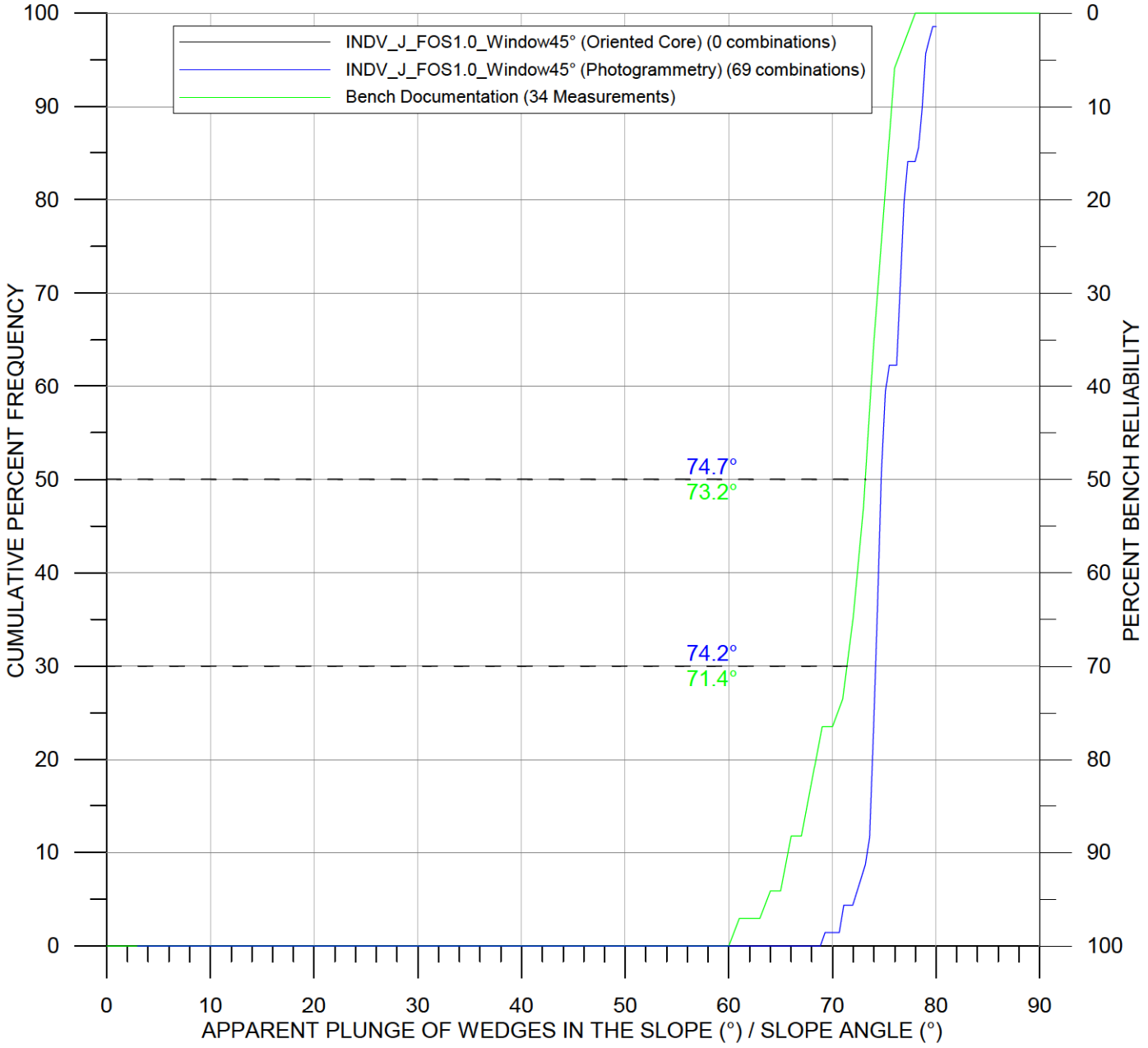
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - CENTRAL 310°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F21

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\Central-310-cf75.grf

CENTRAL 310°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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CUMULATIVE FREQUENCY PLOT
CENTRAL 310° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

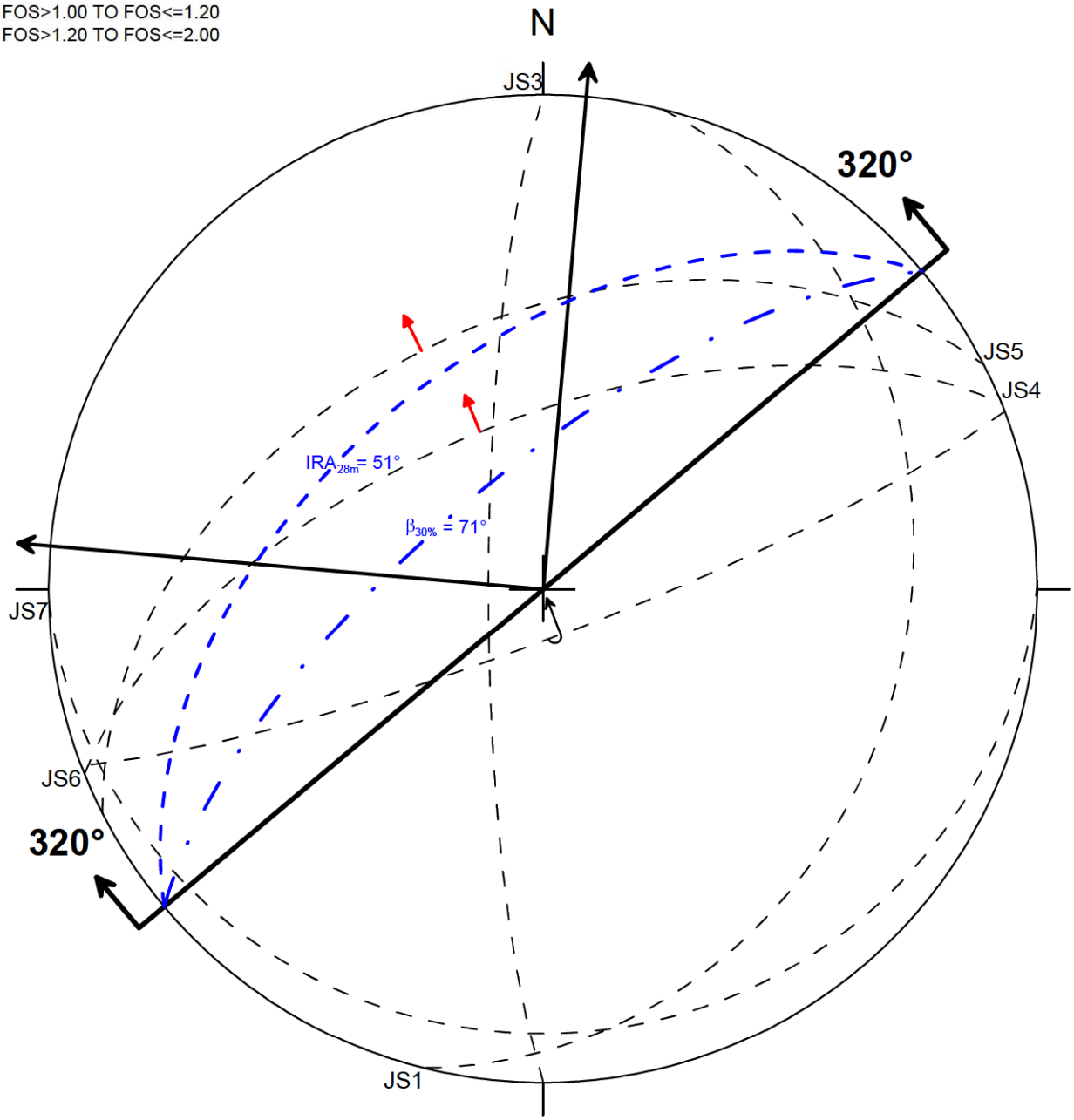
BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F22

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/adamtech/central-320.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

CENTRAL 320°



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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ADAMTECH PHOTOGRAMMETRY - CENTRAL 320°

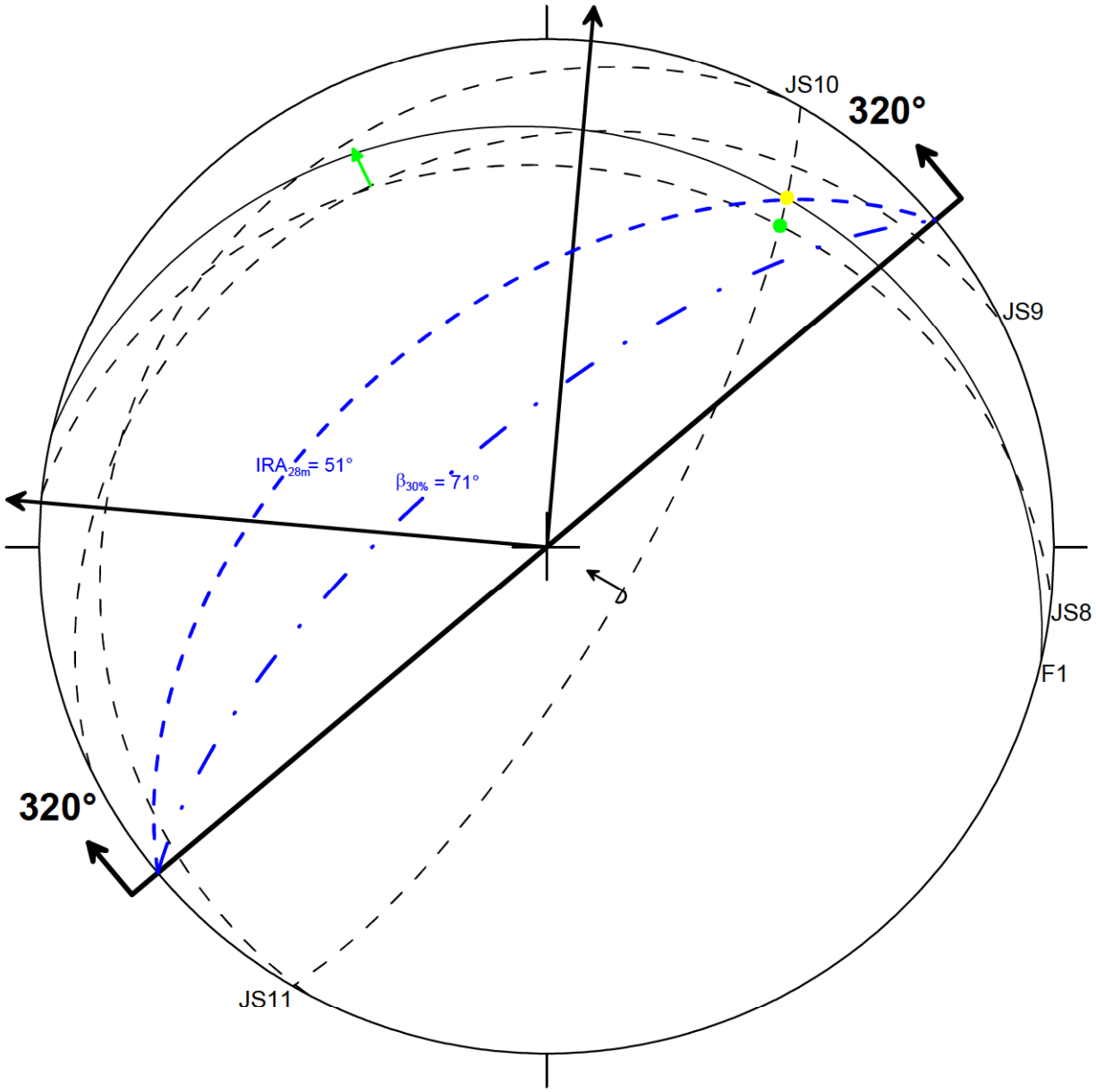
BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F23

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/central-320.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

CENTRAL 320°



PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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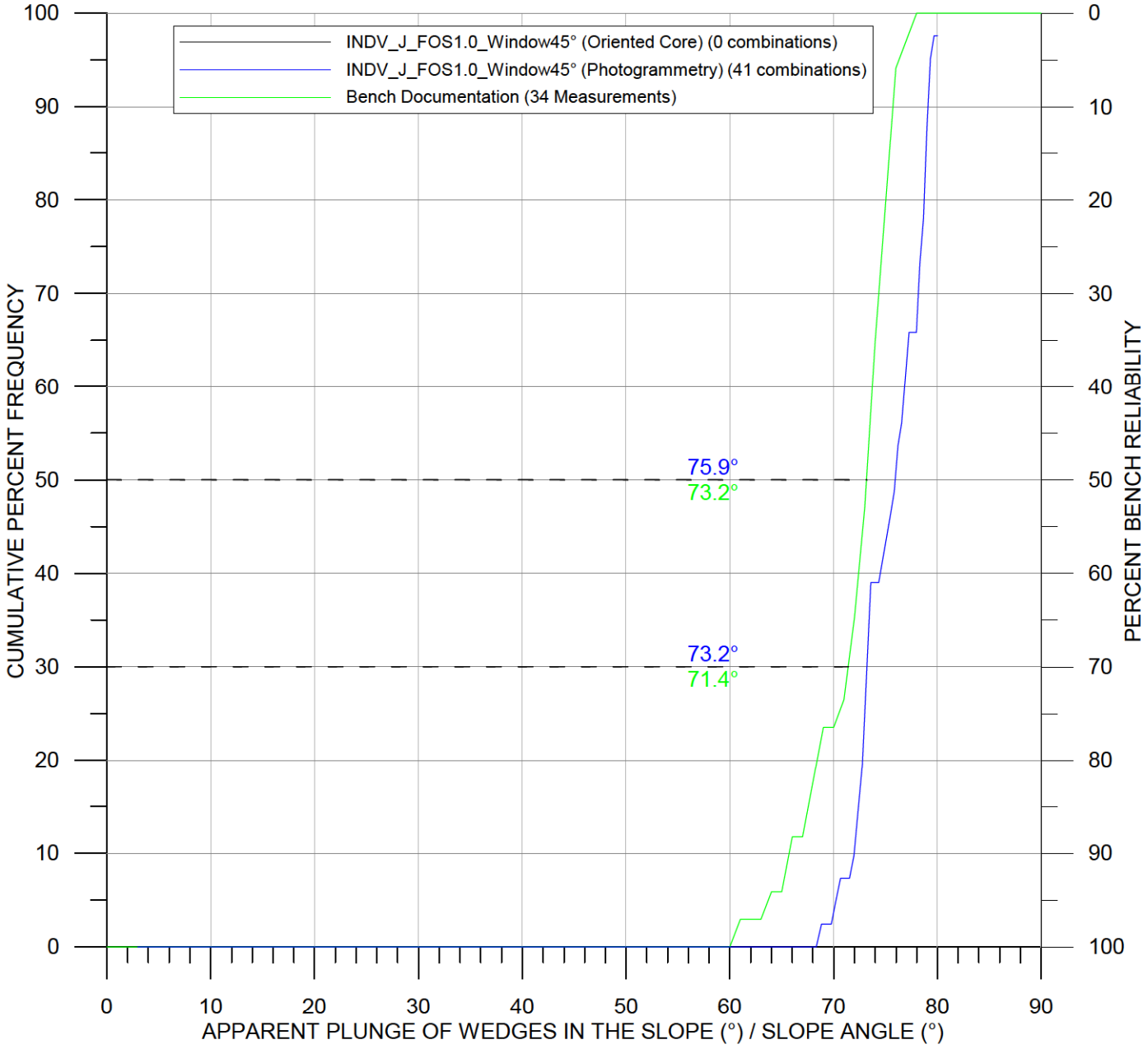
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - CENTRAL 320°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F24

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\Central-320-cf75.grf

CENTRAL 320°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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CUMULATIVE FREQUENCY PLOT
CENTRAL 320° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

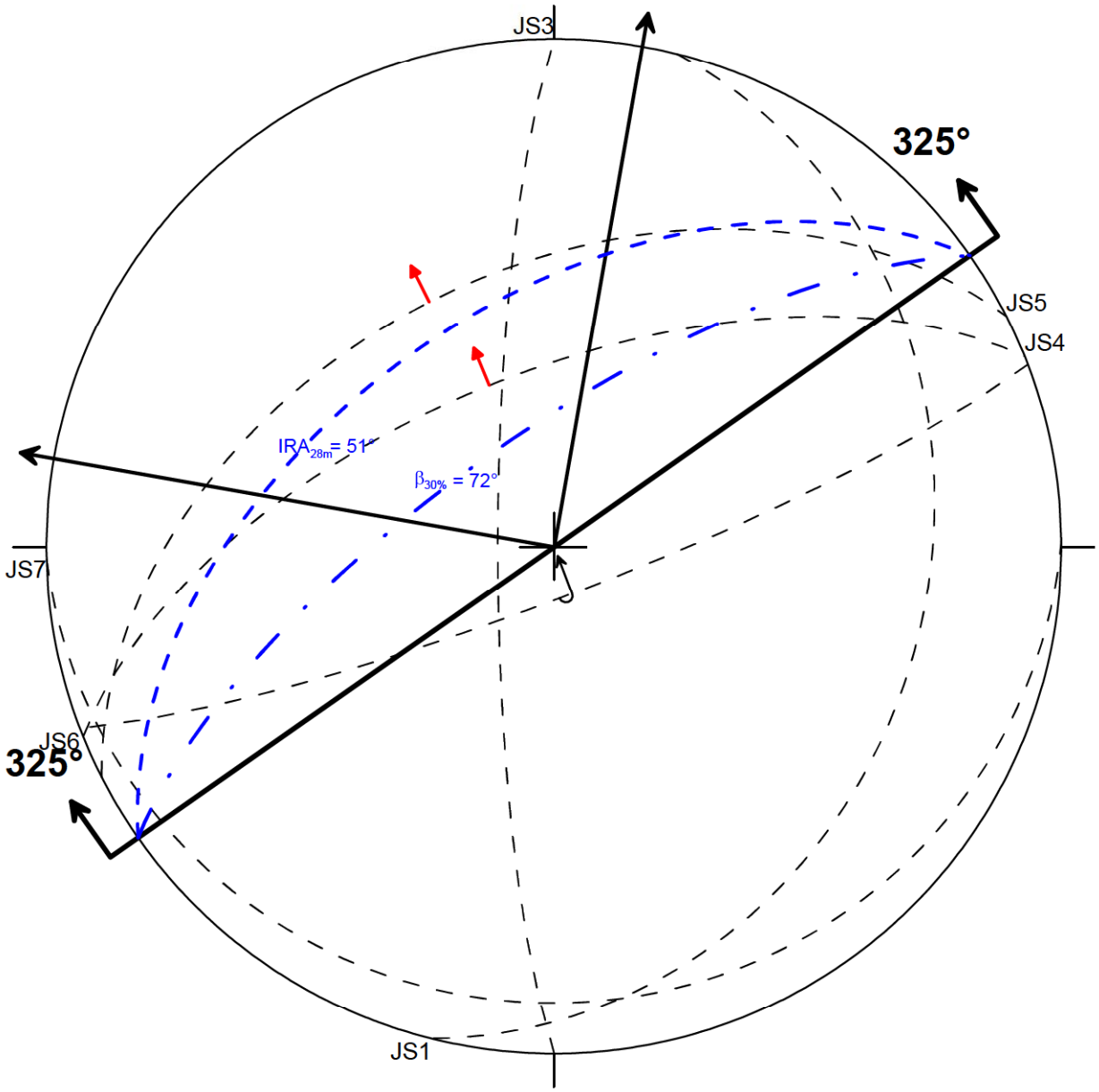
BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F25

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/adamtech/central-325.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

CENTRAL 325°



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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ADAMTECH PHOTOGRAMMETRY - CENTRAL 325°

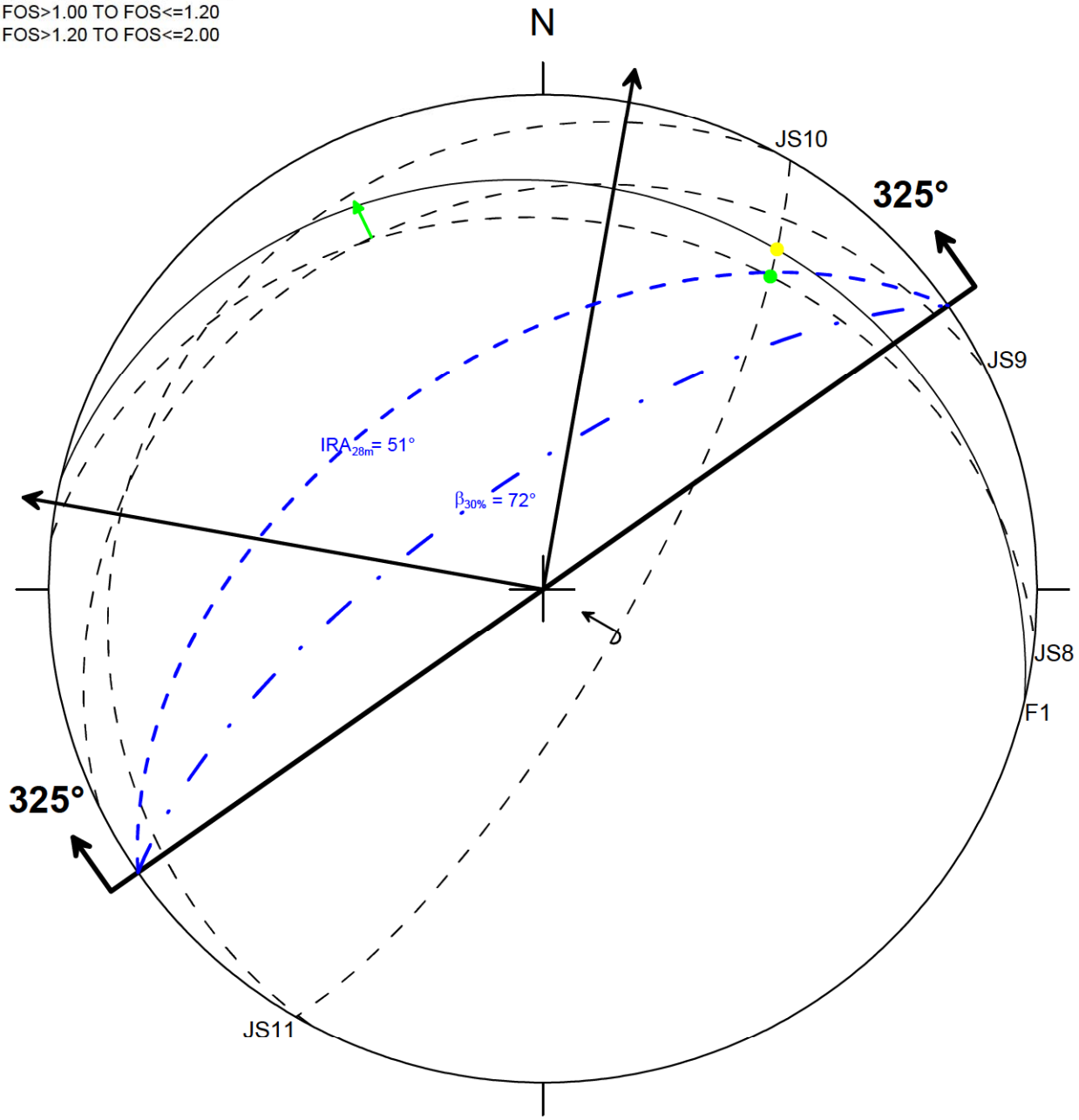
BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F26

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/central-325.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

CENTRAL 325°



PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

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MONT-WRIGHT - PIT IRÈNE
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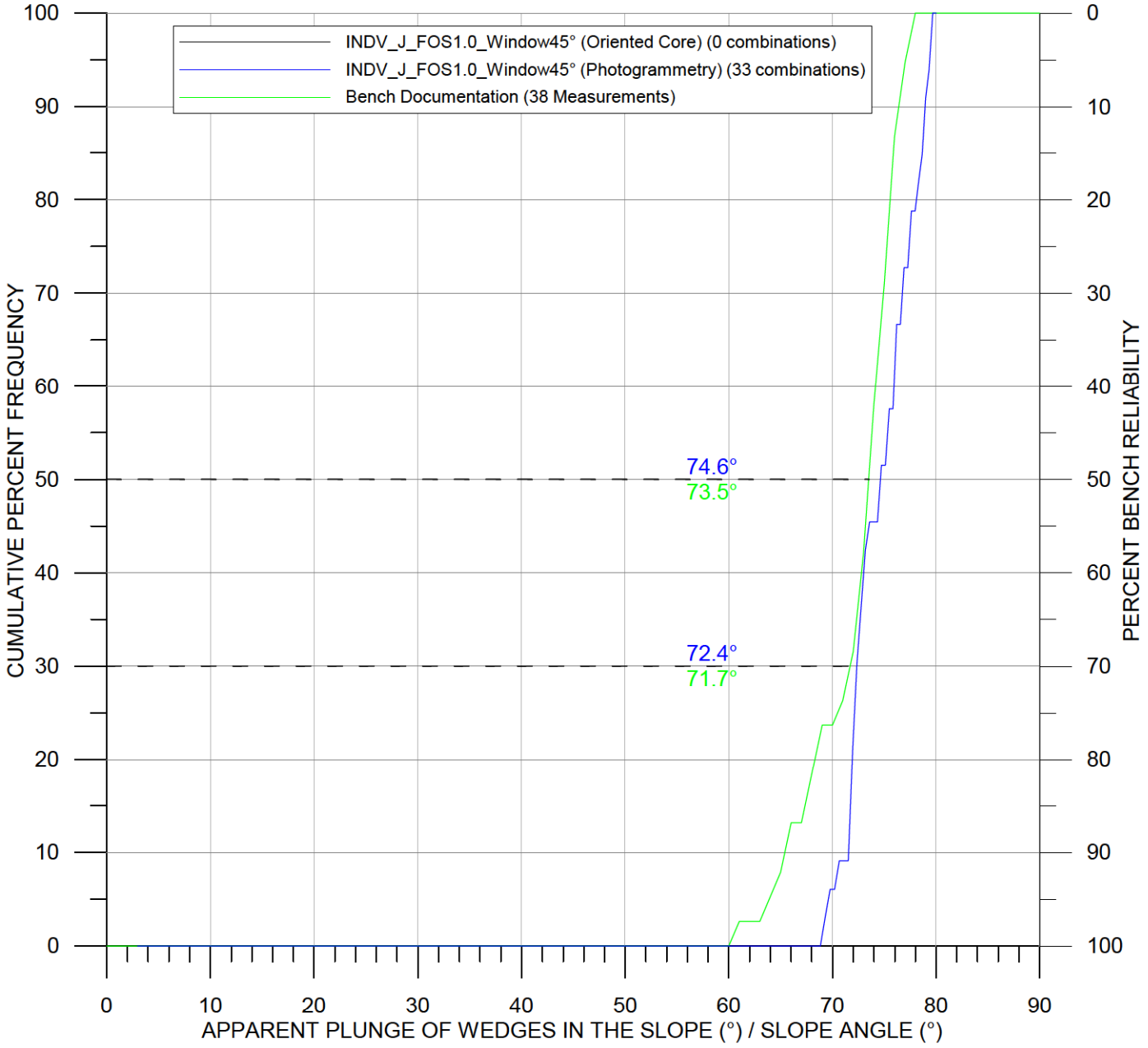
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - CENTRAL 325°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F27

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\Central-325-cf75.grf

CENTRAL 325°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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CUMULATIVE FREQUENCY PLOT
CENTRAL 325° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

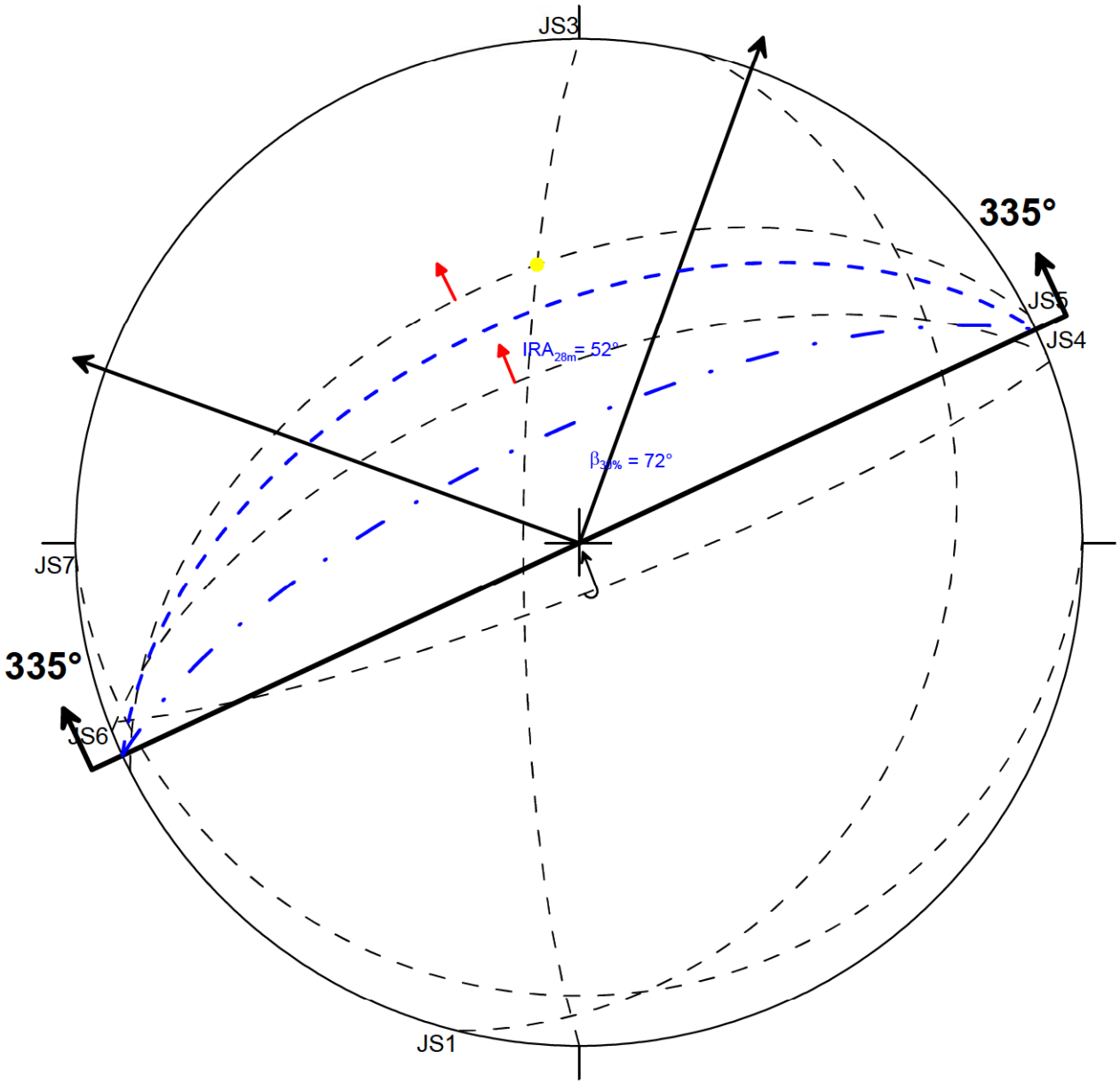
BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F28

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/adamtech/central-335.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

CENTRAL 335°



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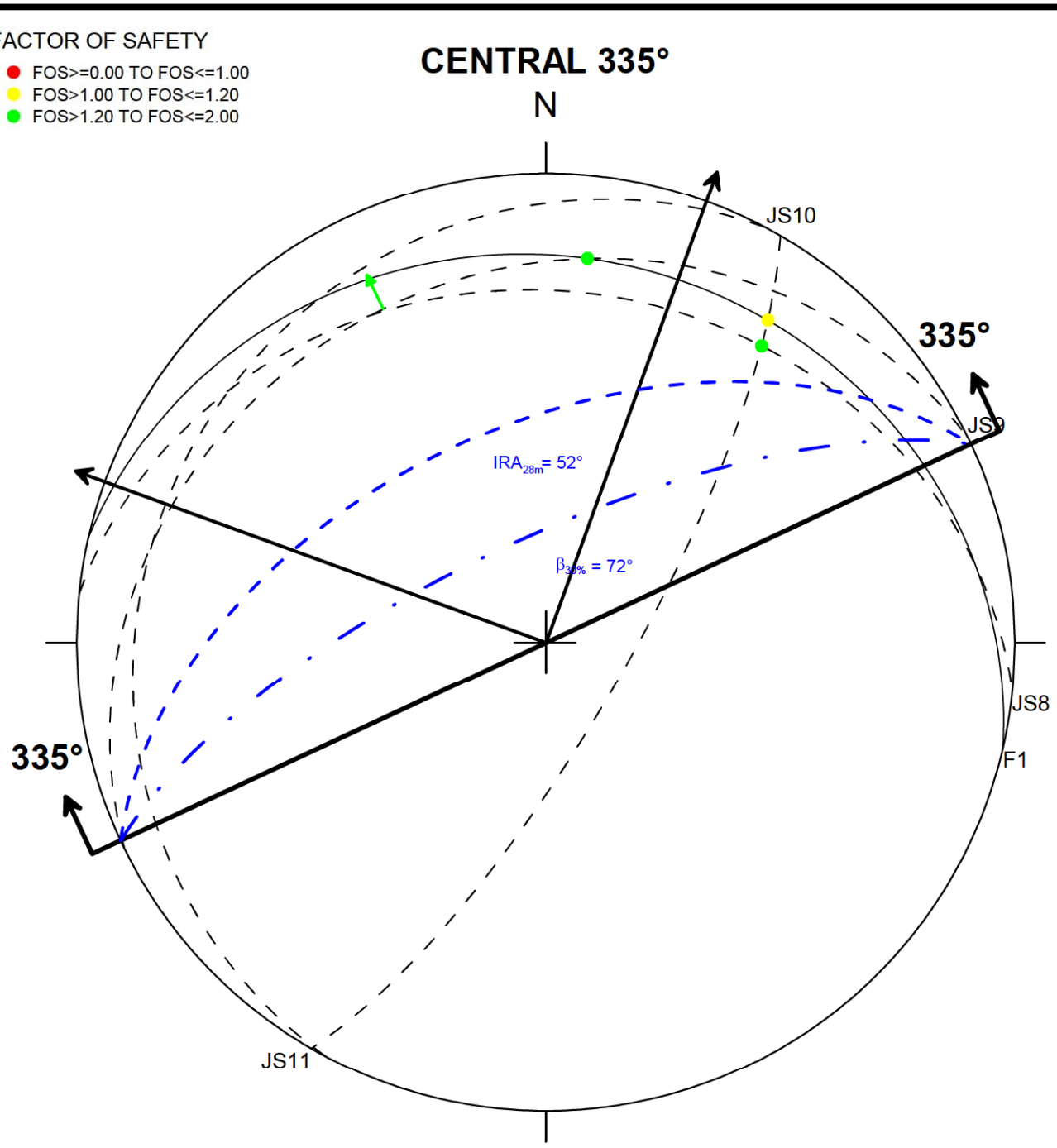
ARCELORMITTAL MINES CANADA
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2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ADAMTECH PHOTOGRAMMETRY - CENTRAL 335°

BY:	DATE:
JL	JAN 16
APPROVED:	FIG:
GG	F29

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/central-335.grf



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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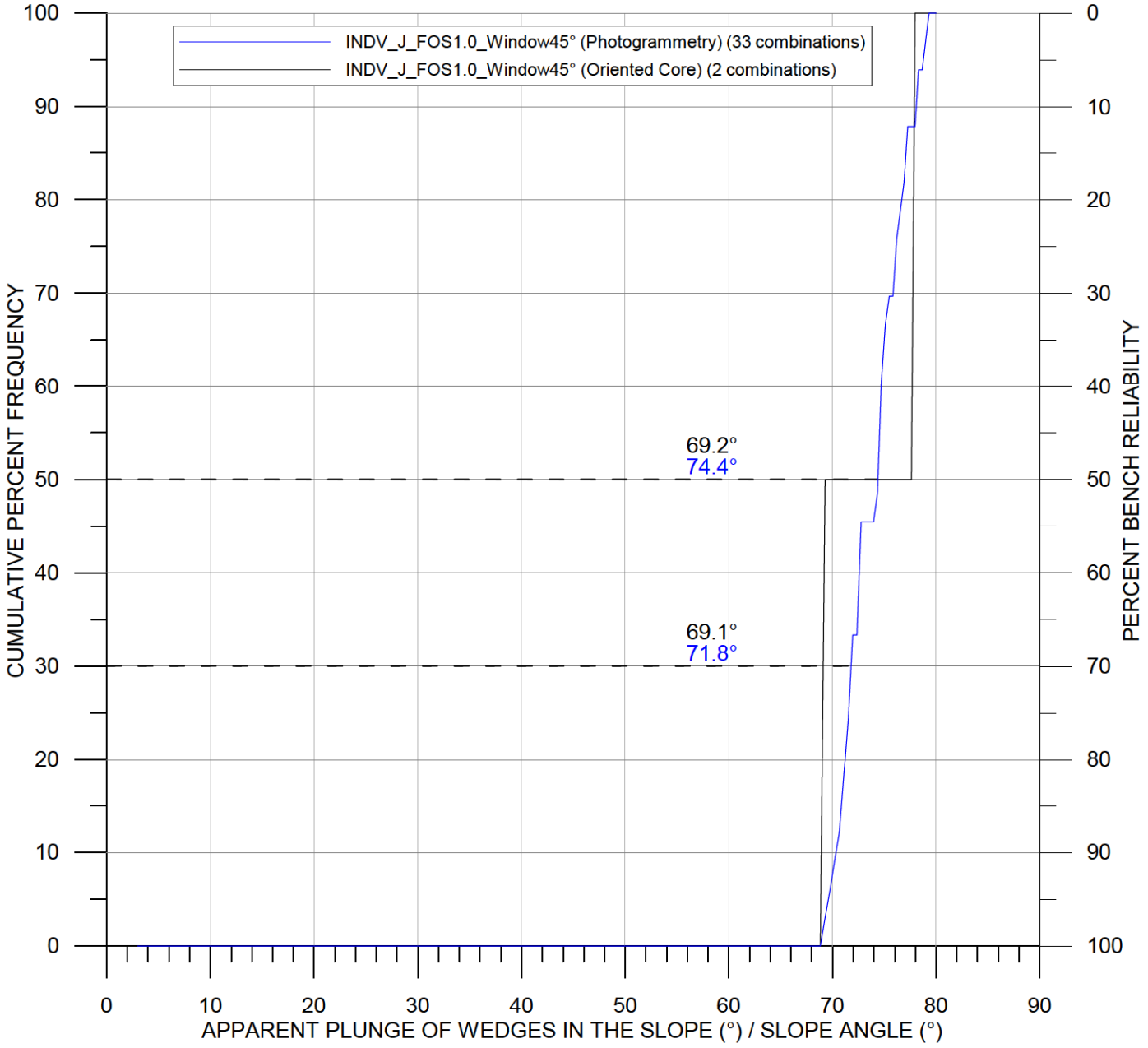
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - CENTRAL 335°

BY:	DATE:
JL	JAN 16
APPROVED:	FIG:
GG	F30

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\Central-335-cf75.grf

CENTRAL 335°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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CUMULATIVE FREQUENCY PLOT
CENTRAL 335° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

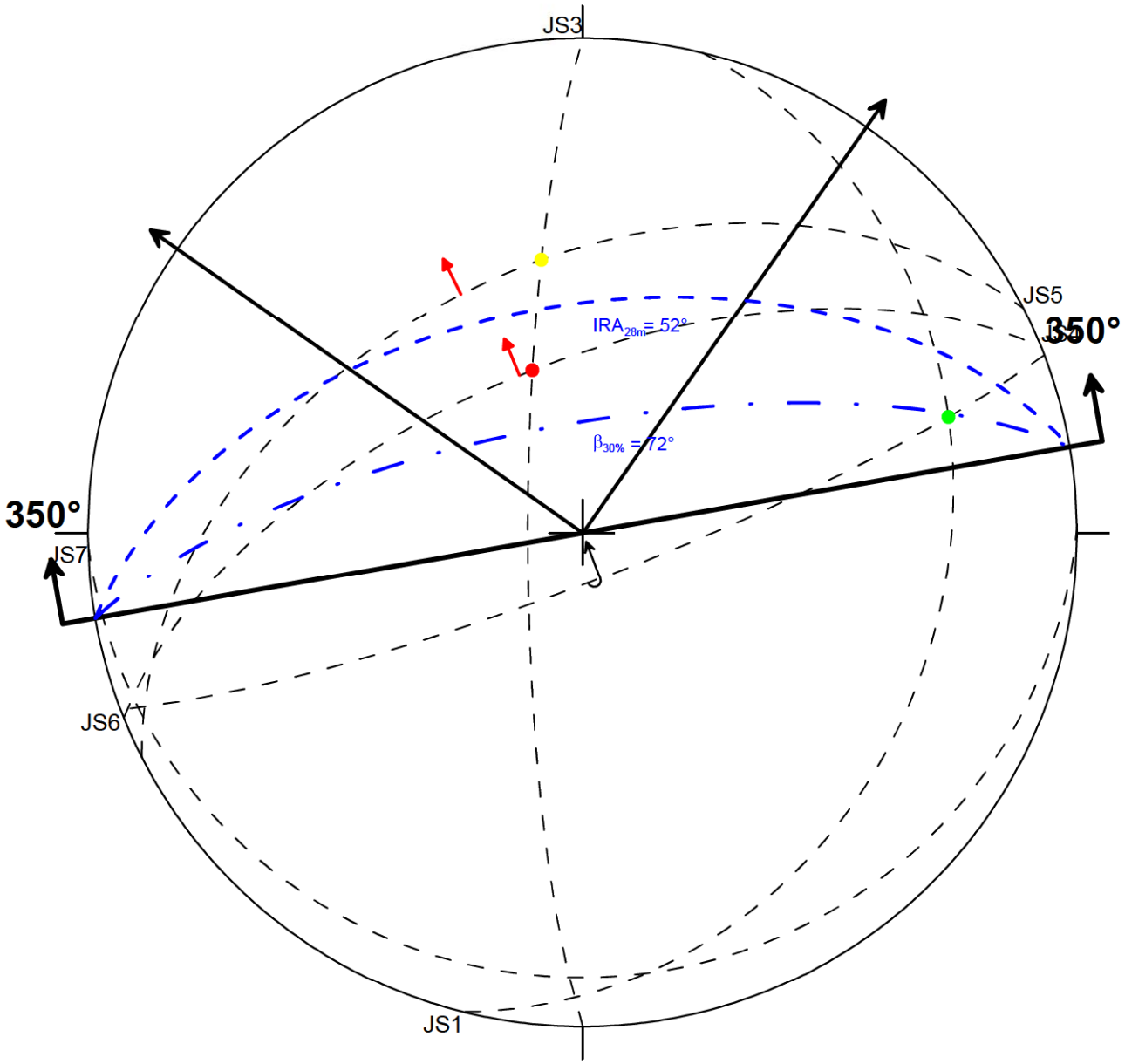
BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F31

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/adamtech/central-350.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00

CENTRAL 350°



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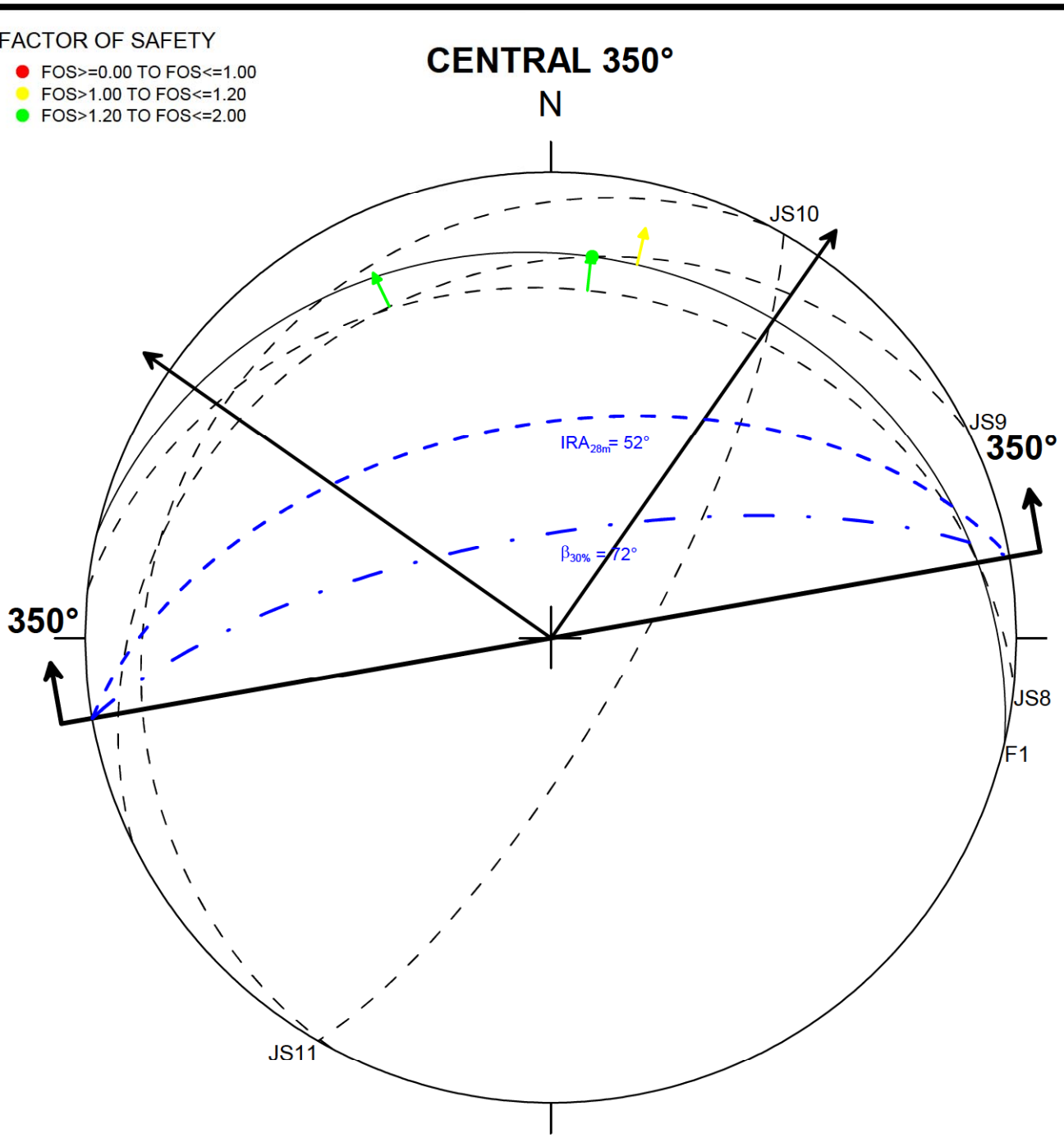
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ADAMTECH PHOTOGRAMMETRY - CENTRAL 350°

BY:	DATE:
JL	JAN 16
APPROVED:	FIG:
GG	F32

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/central-350.grf



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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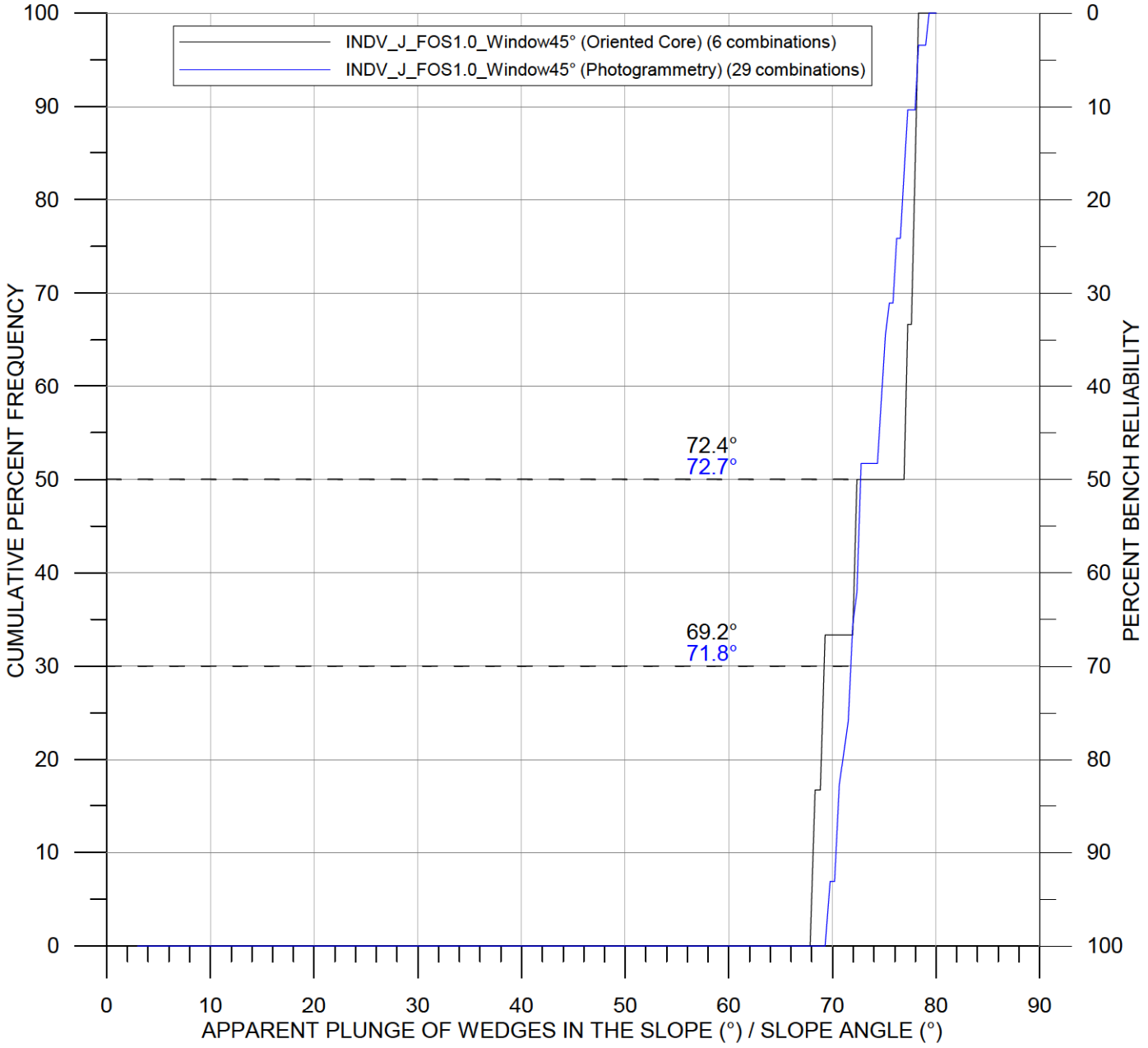
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - CENTRAL 350°

BY:	DATE:
JL	JAN 16
APPROVED:	FIG:
GG	F33

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\Central-350-cf75.grf

CENTRAL 350°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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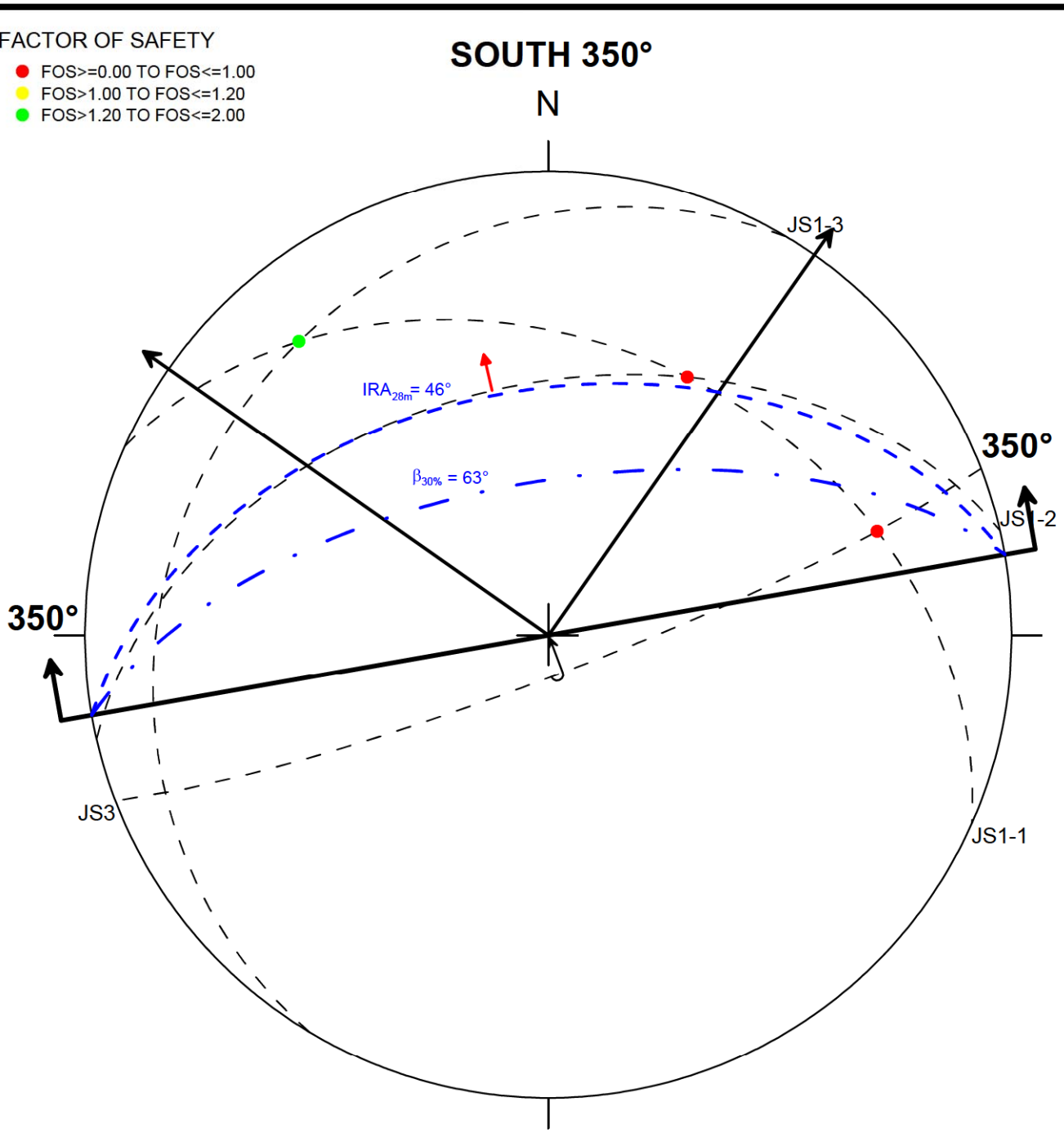
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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CUMULATIVE FREQUENCY PLOT
CENTRAL 350° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F34

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southcombined-350.grf



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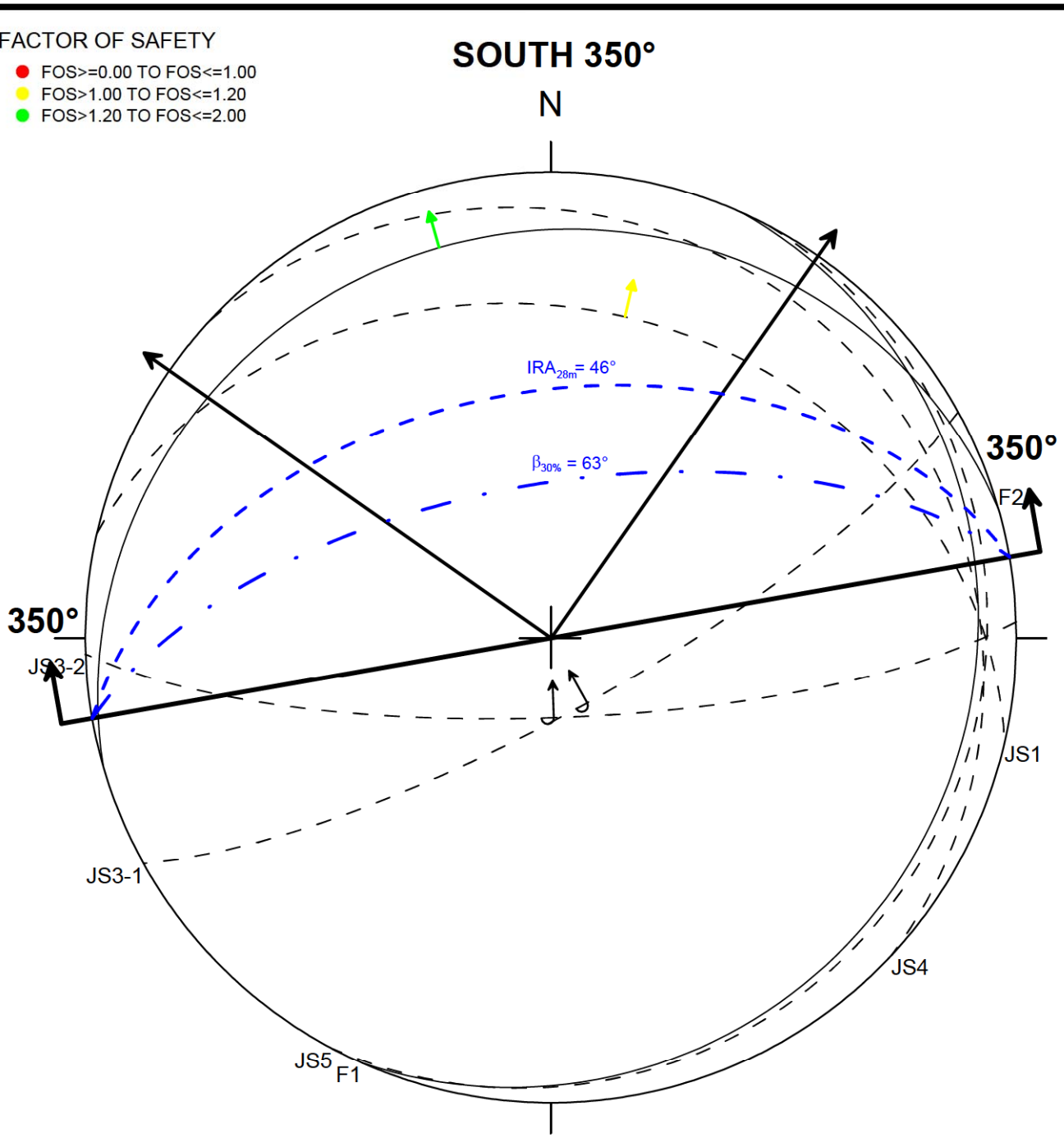
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTH 350°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F35

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southcombined-350.grf



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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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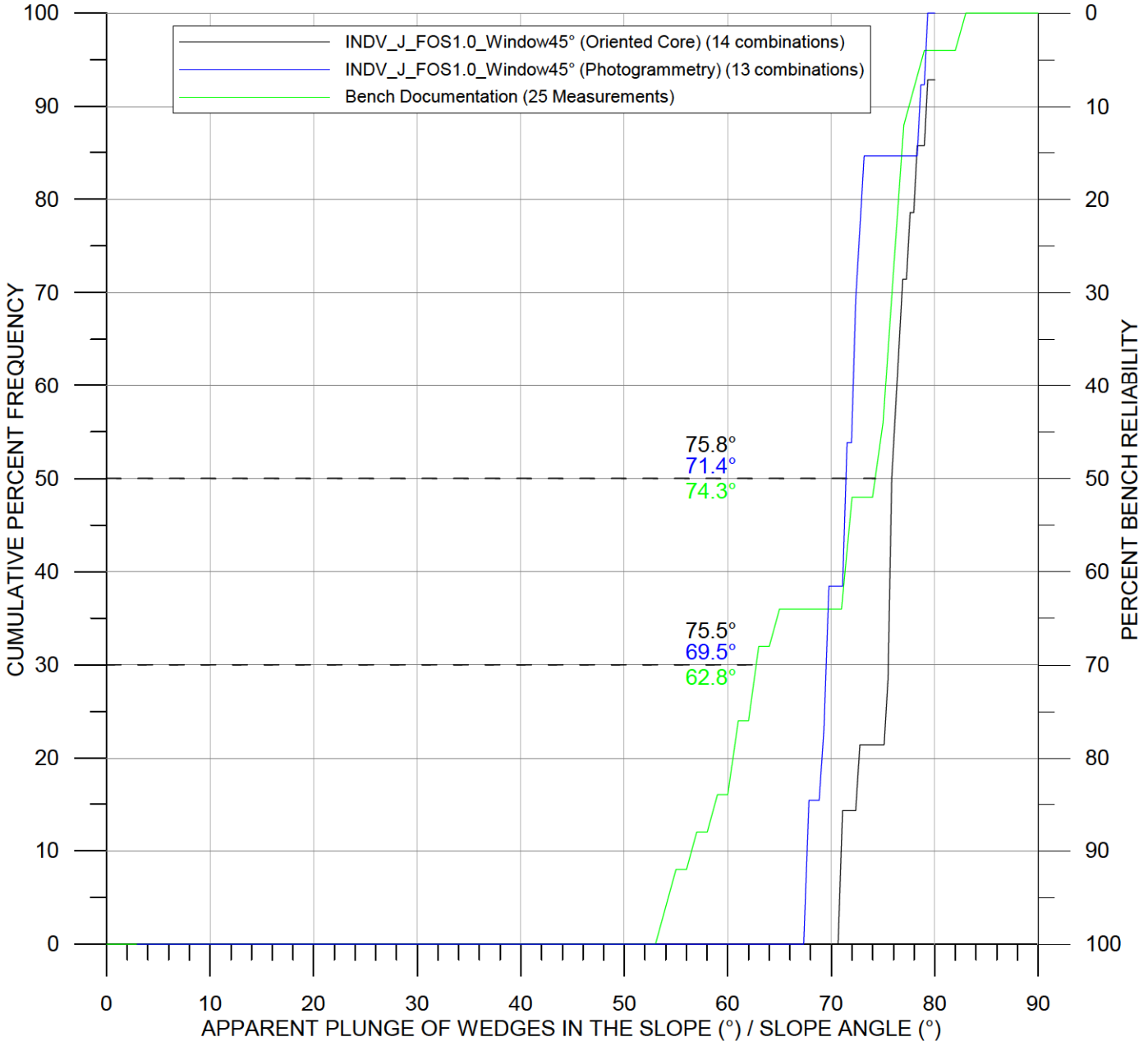
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTH 350°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F36

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\SouthCombined-350-cf75.grf

SOUTH 350°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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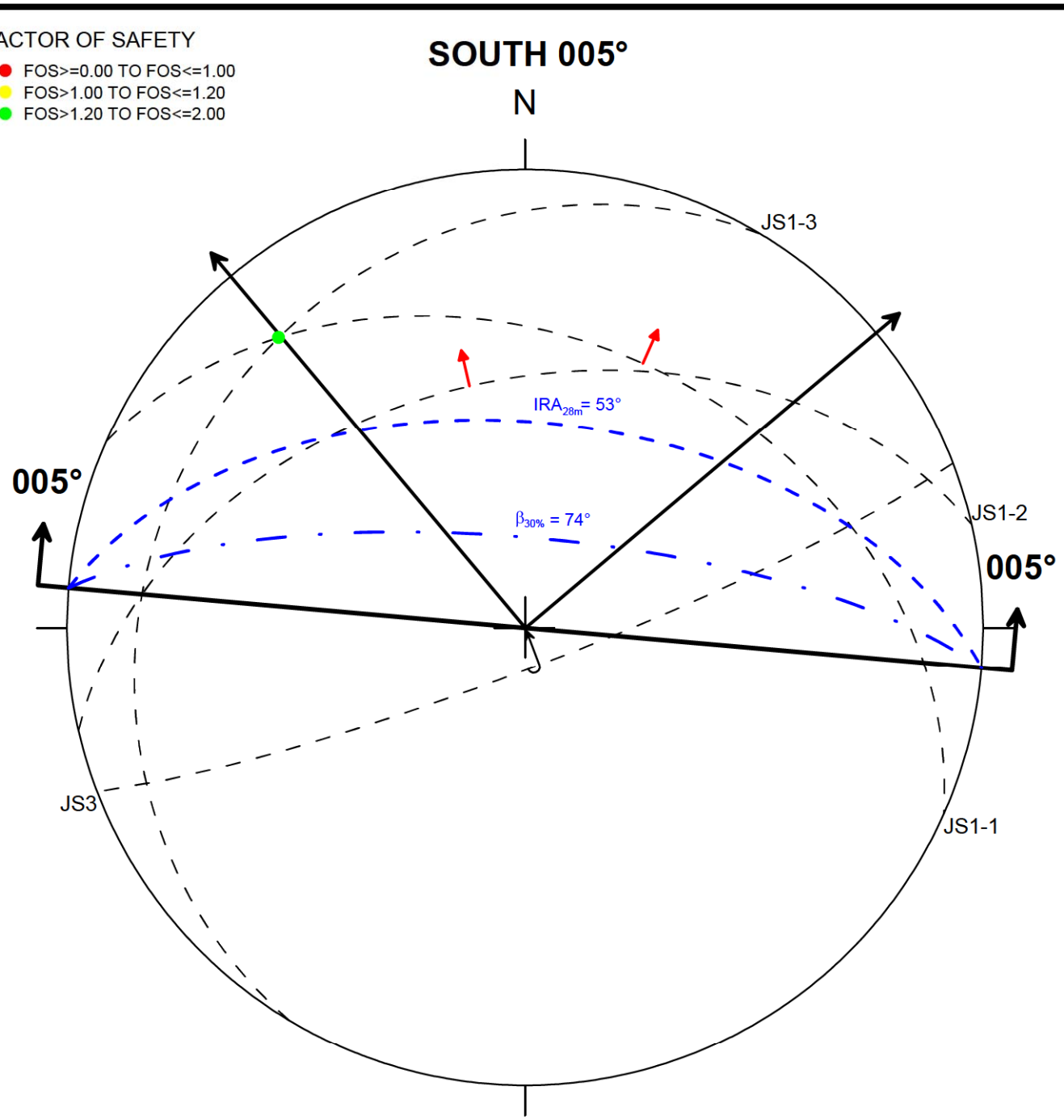
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

CUMULATIVE FREQUENCY PLOT
SOUTH 350° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F37

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southcombined-005.grf



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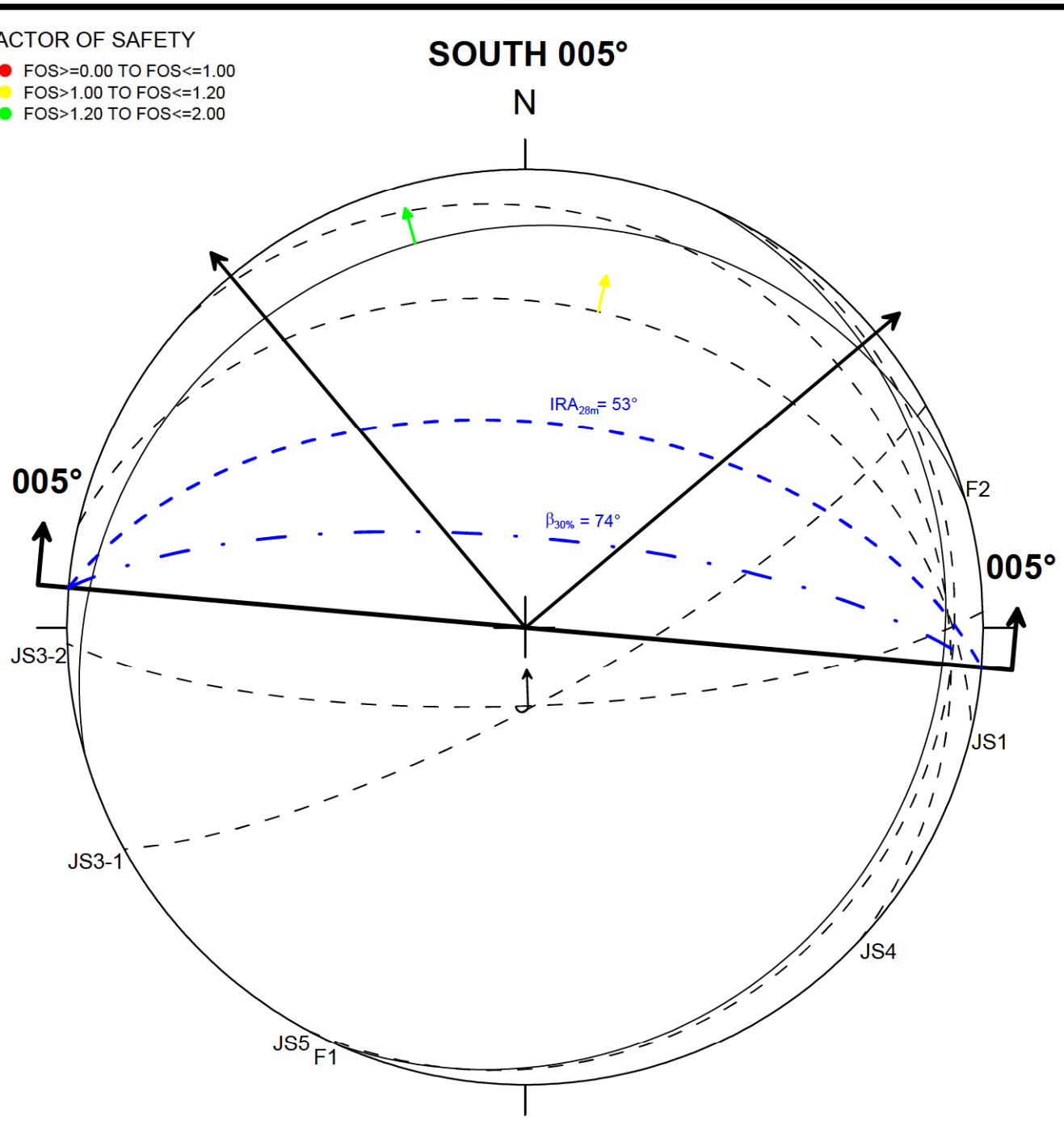
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTH 005°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F38

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southcombined-005.grf



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MONT-WRIGHT - PIT IRÈNE
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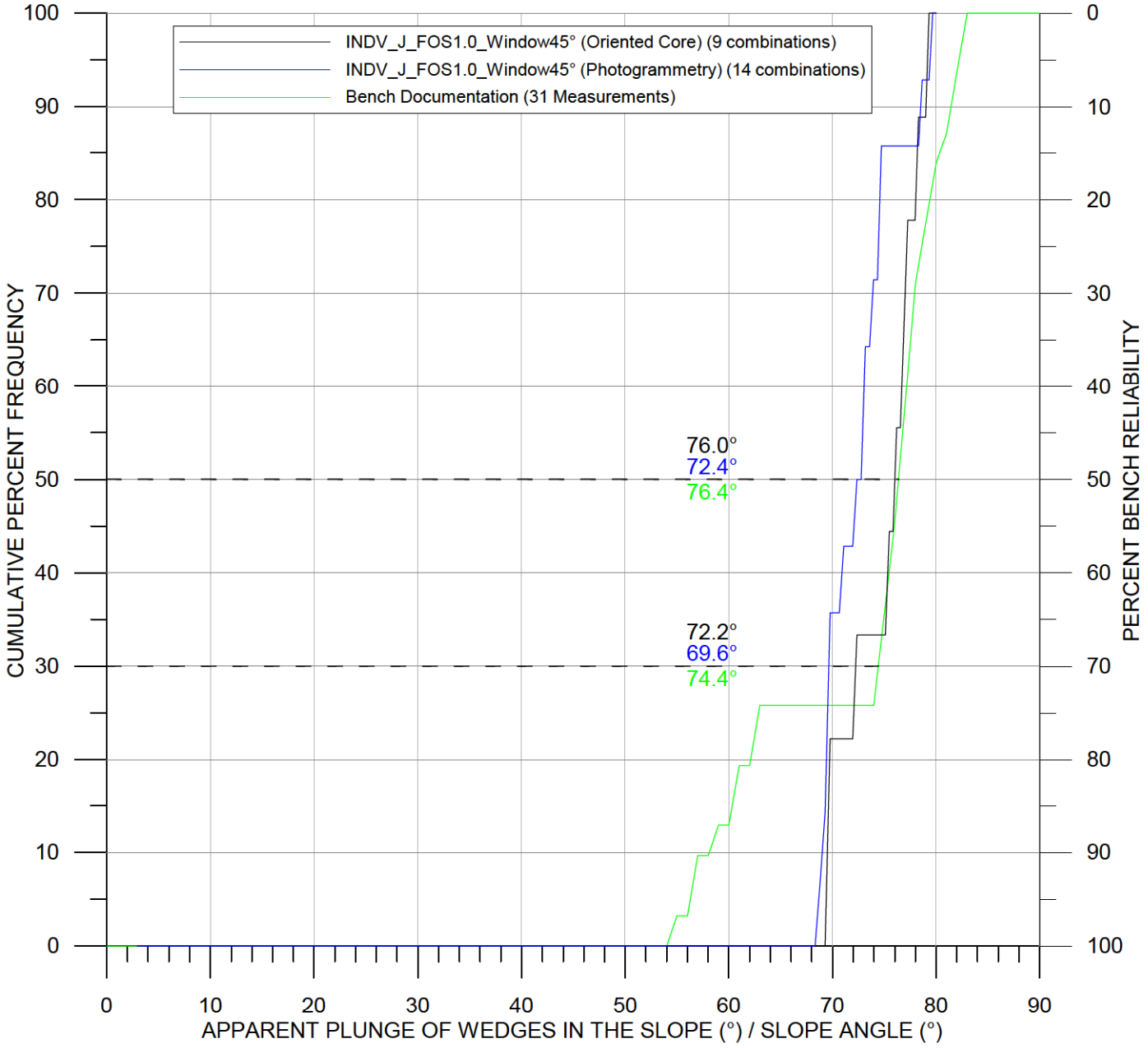
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTH 005°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F39

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\SouthCombined-005-cf75.grf

SOUTH 005°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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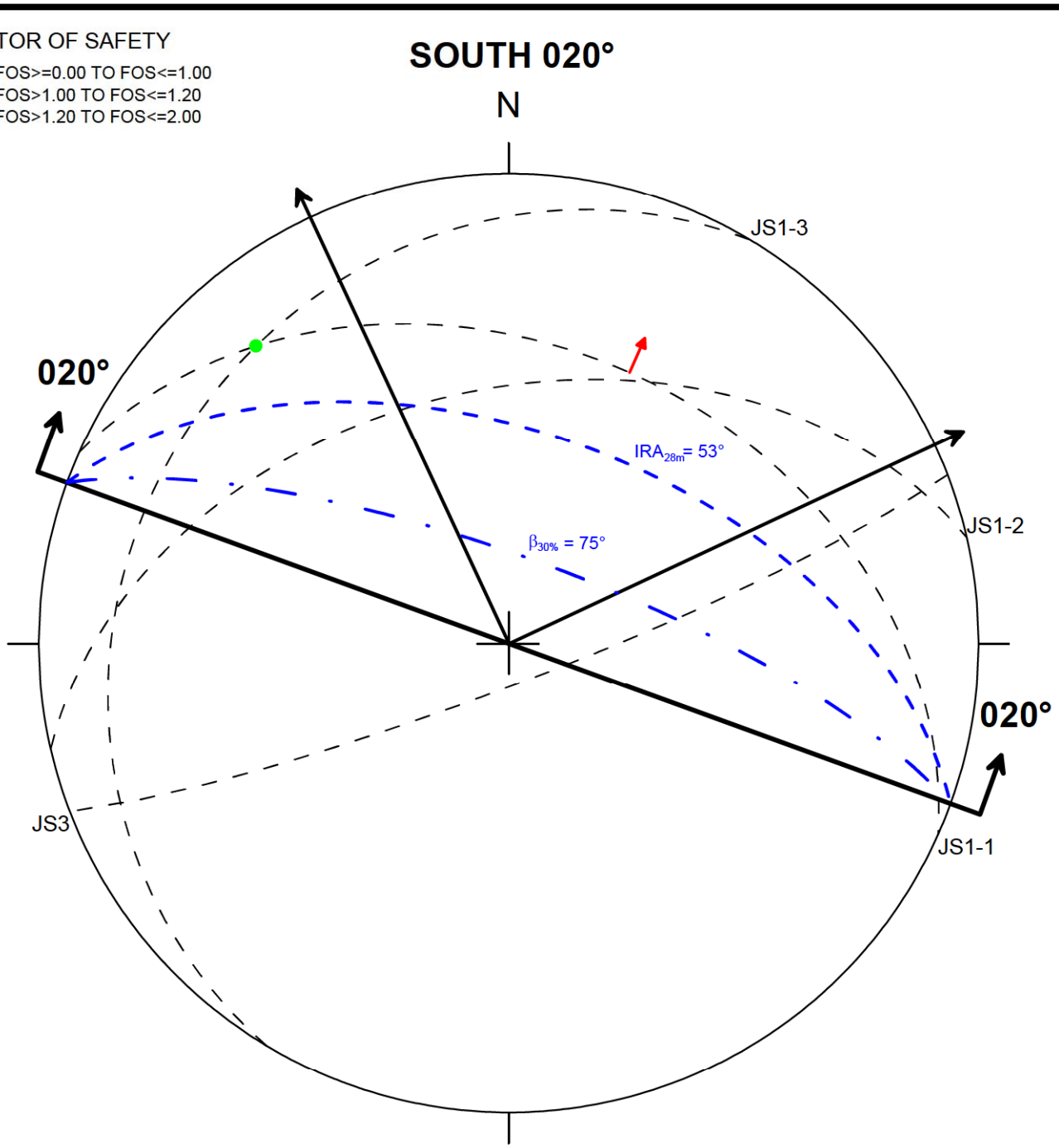
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
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CUMULATIVE FREQUENCY PLOT
SOUTH 005° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F40

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southcombined-020.grf



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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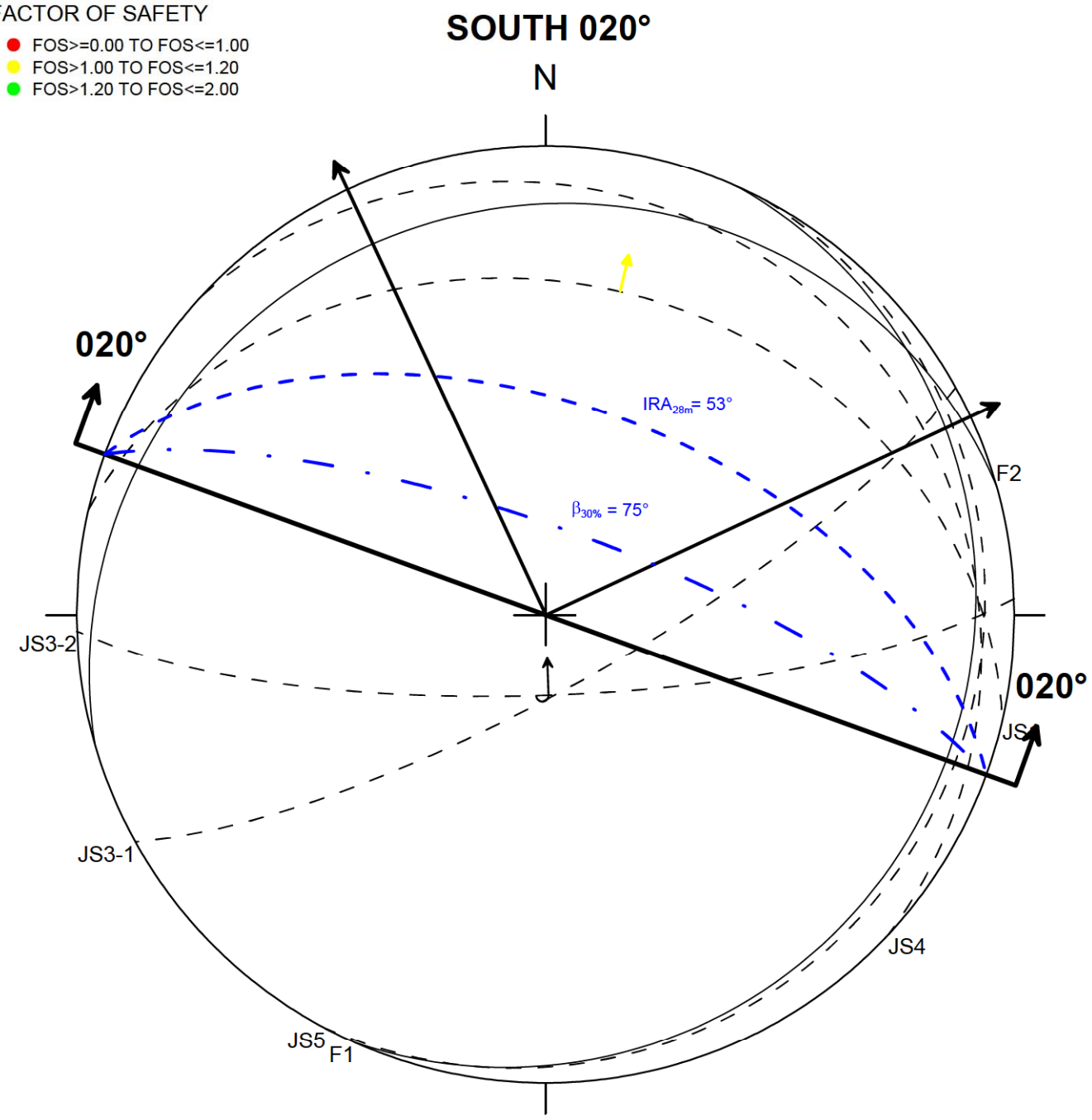
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTH 020°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F41

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southcombined-020.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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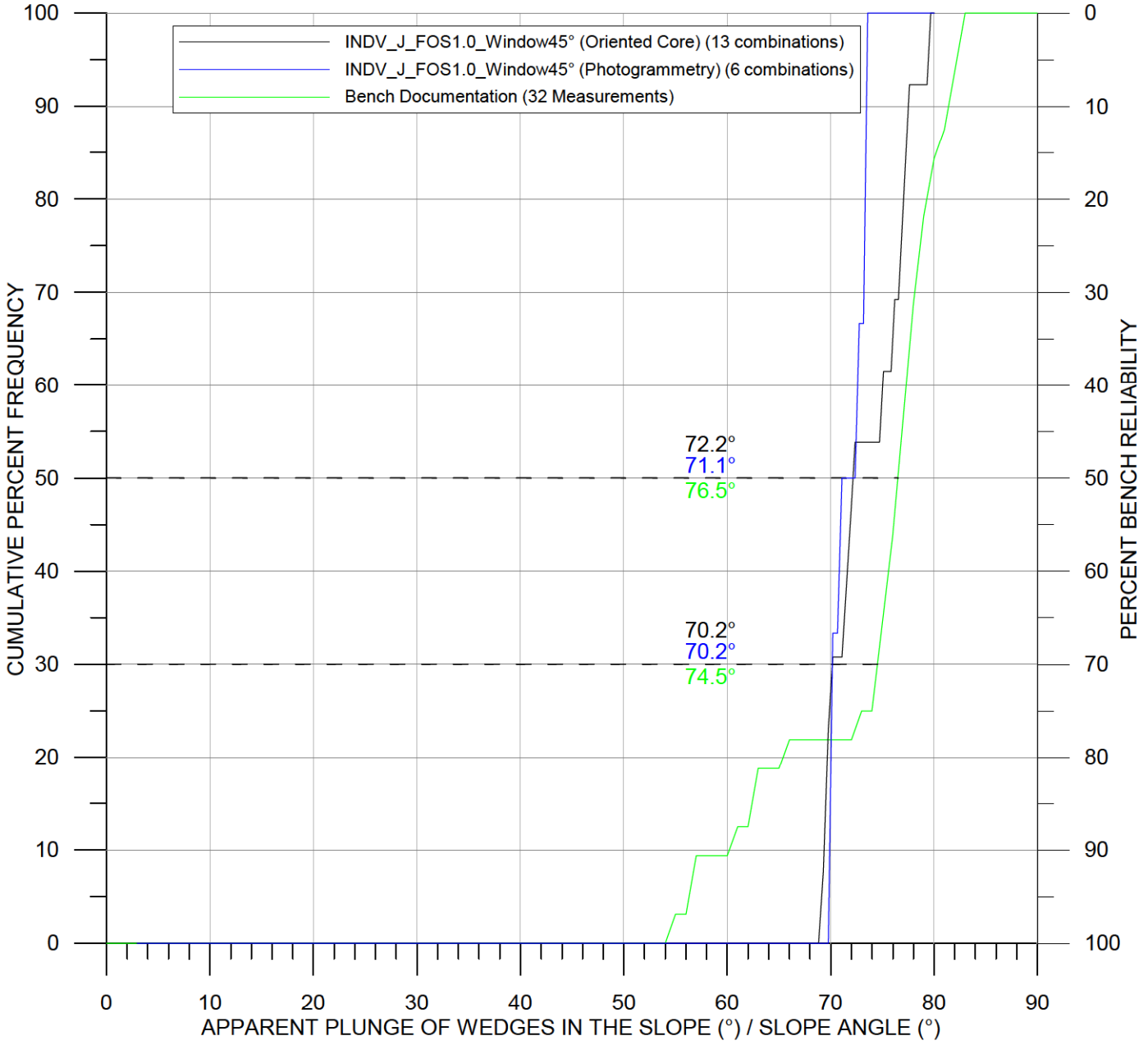
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTH 020°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F42

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\SouthCombined-020-cf75.grf

SOUTH 020°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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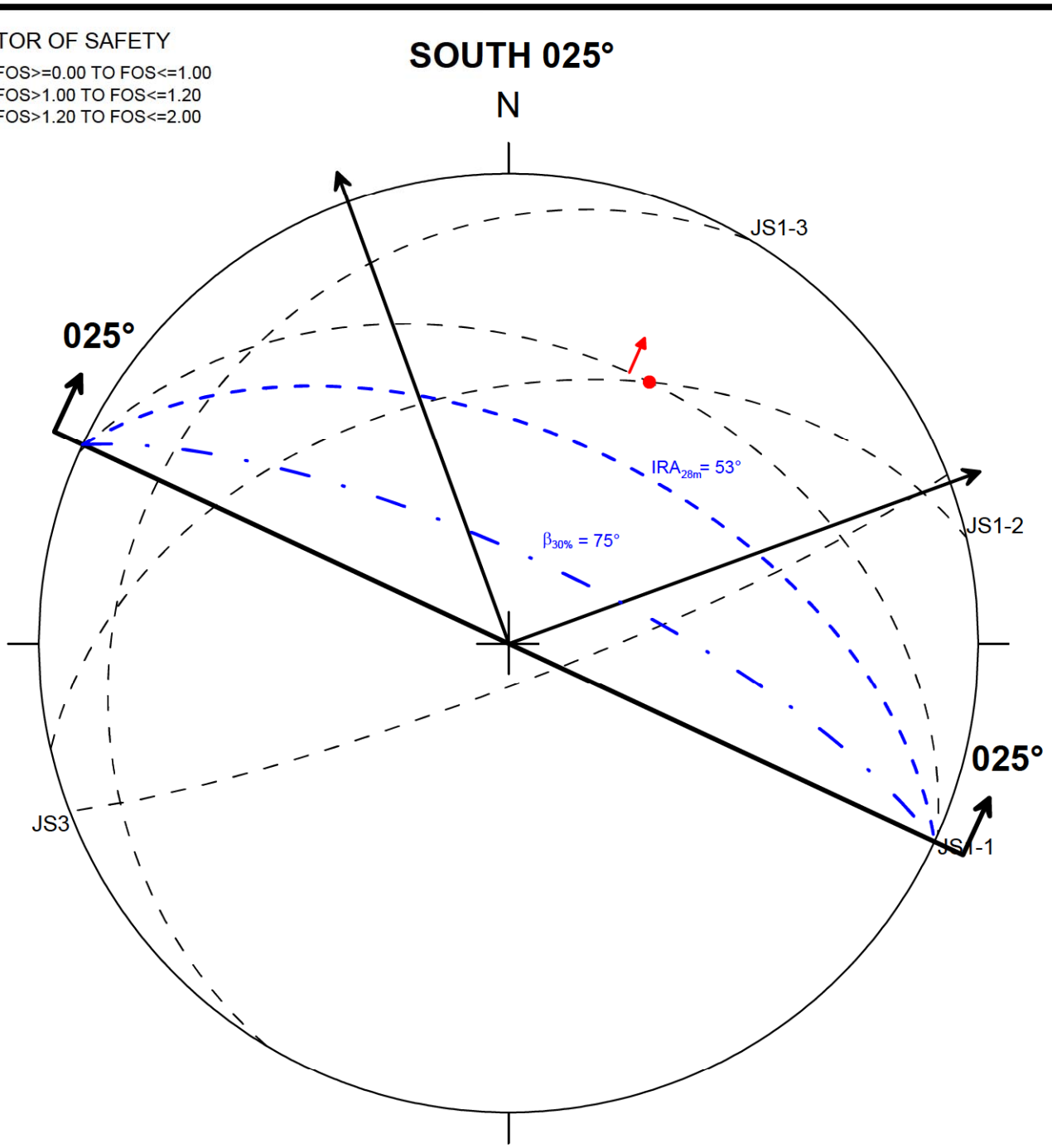
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
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CUMULATIVE FREQUENCY PLOT
SOUTH 020° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F43

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southcombined-025.grf



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

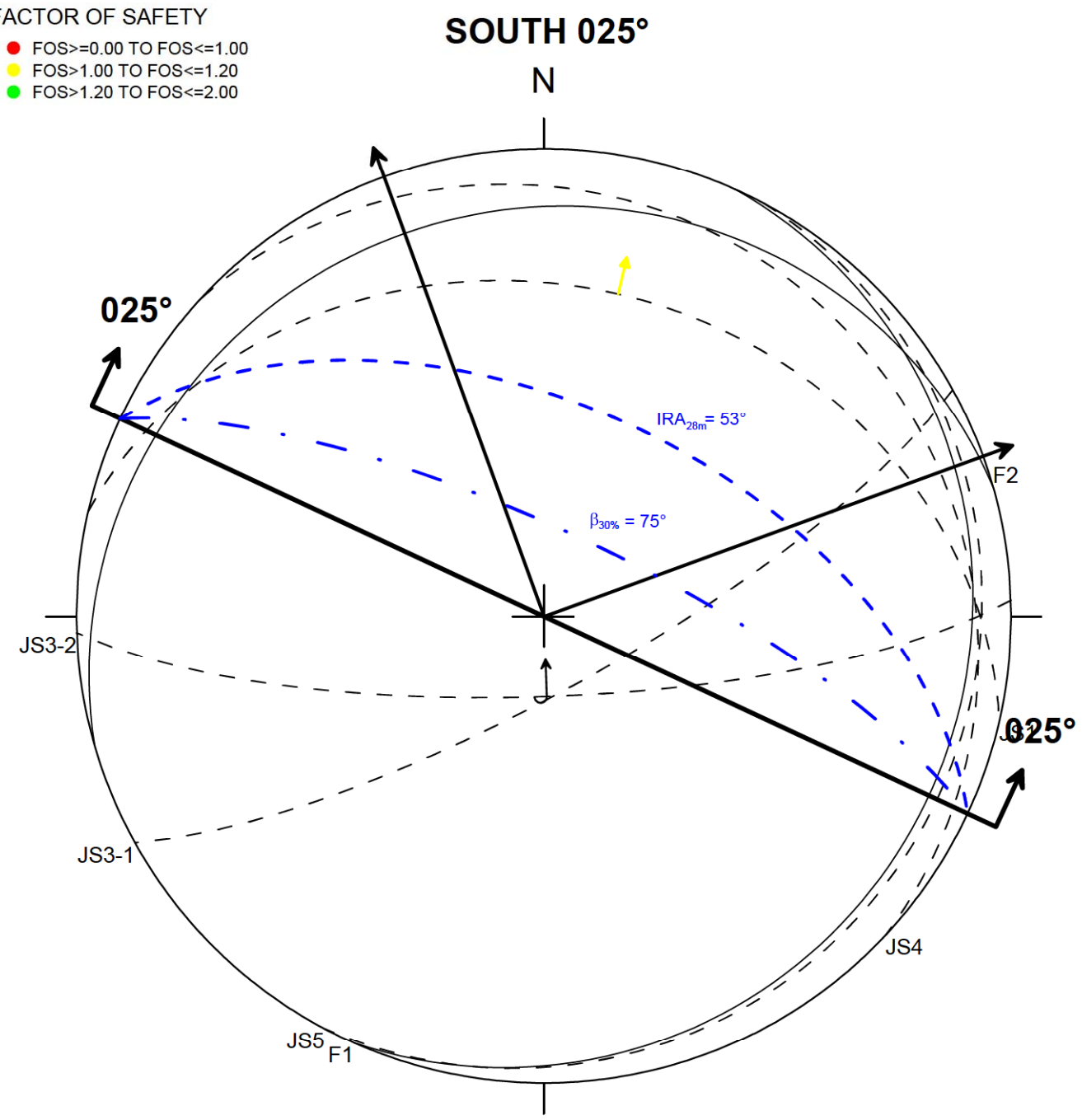
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTH 025°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F44

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southcombined-025.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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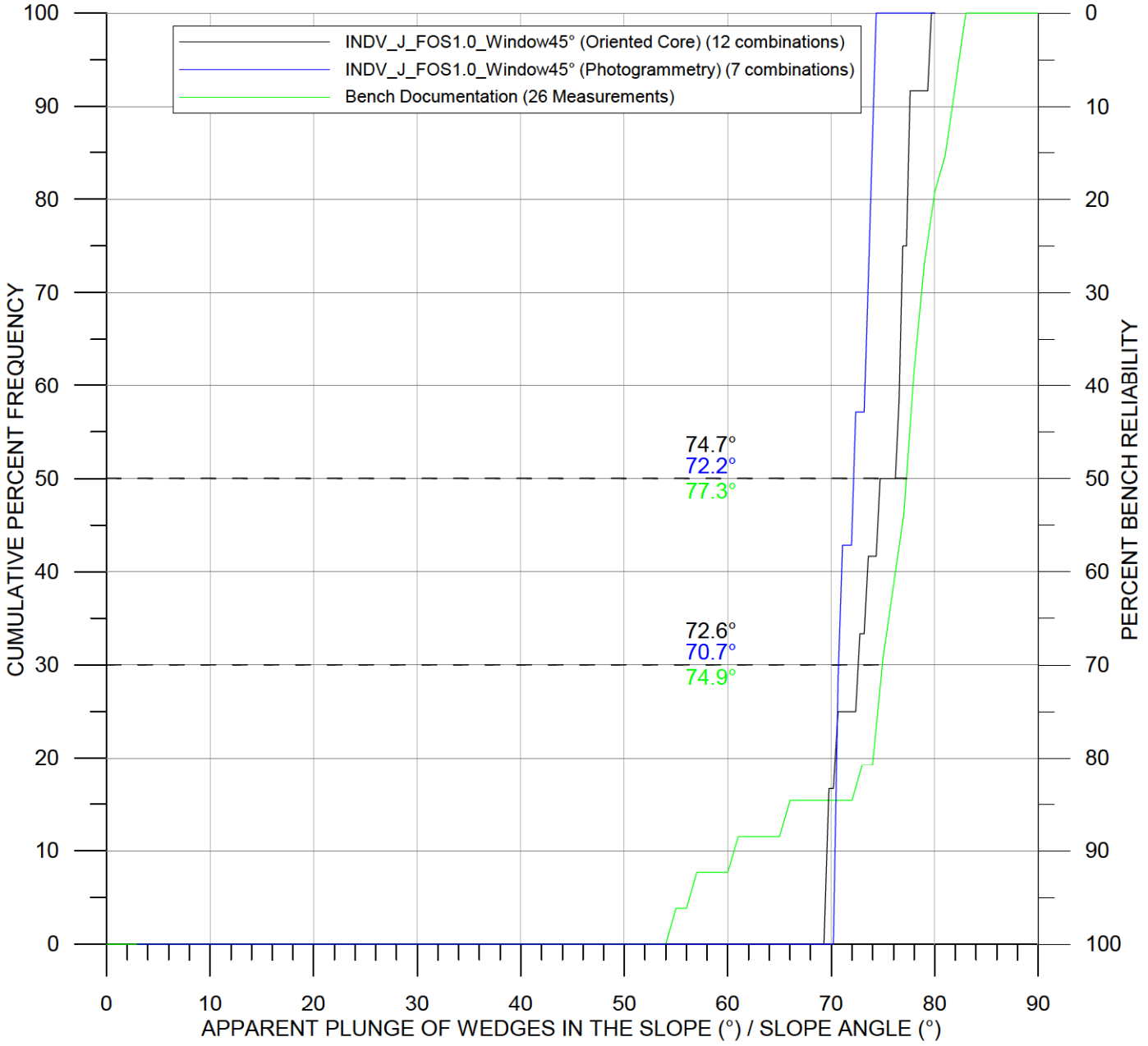
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTH 025°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F45

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\SouthCombined-025-cf75.grf

SOUTH 025°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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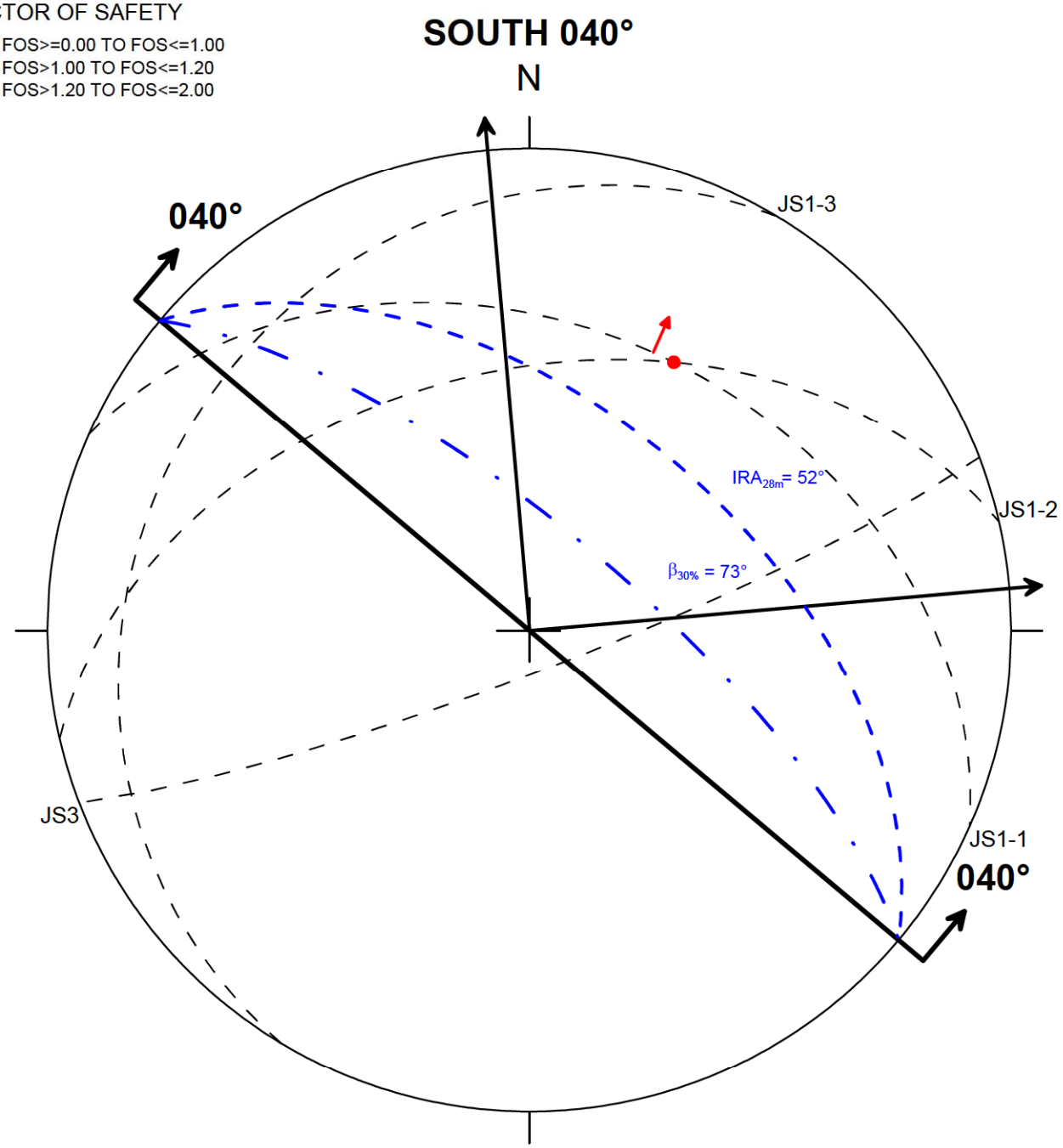
CUMULATIVE FREQUENCY PLOT
SOUTH 025° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F46

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southcombined-040.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00



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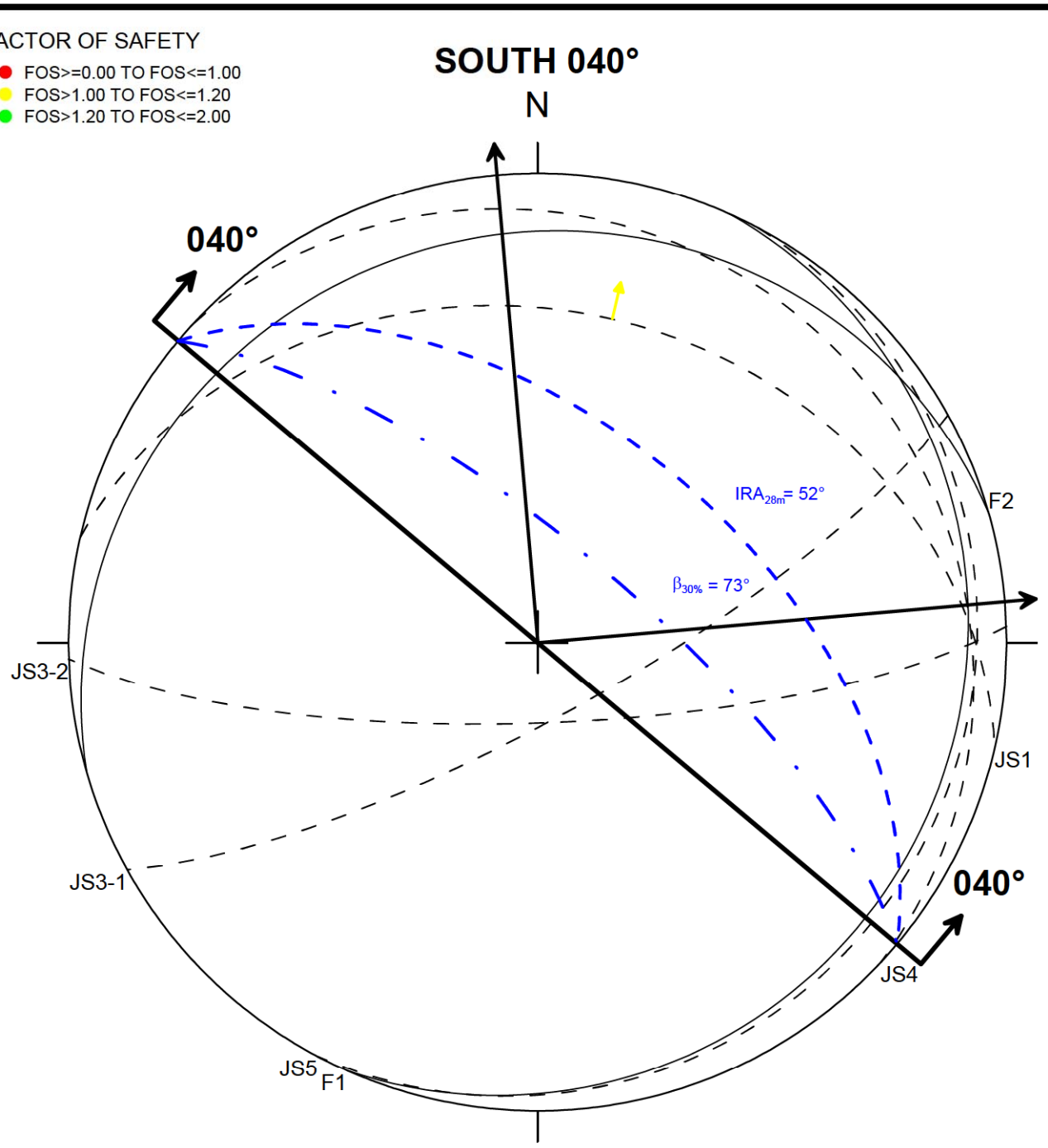
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTH 040°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F47

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southcombined-040.grf



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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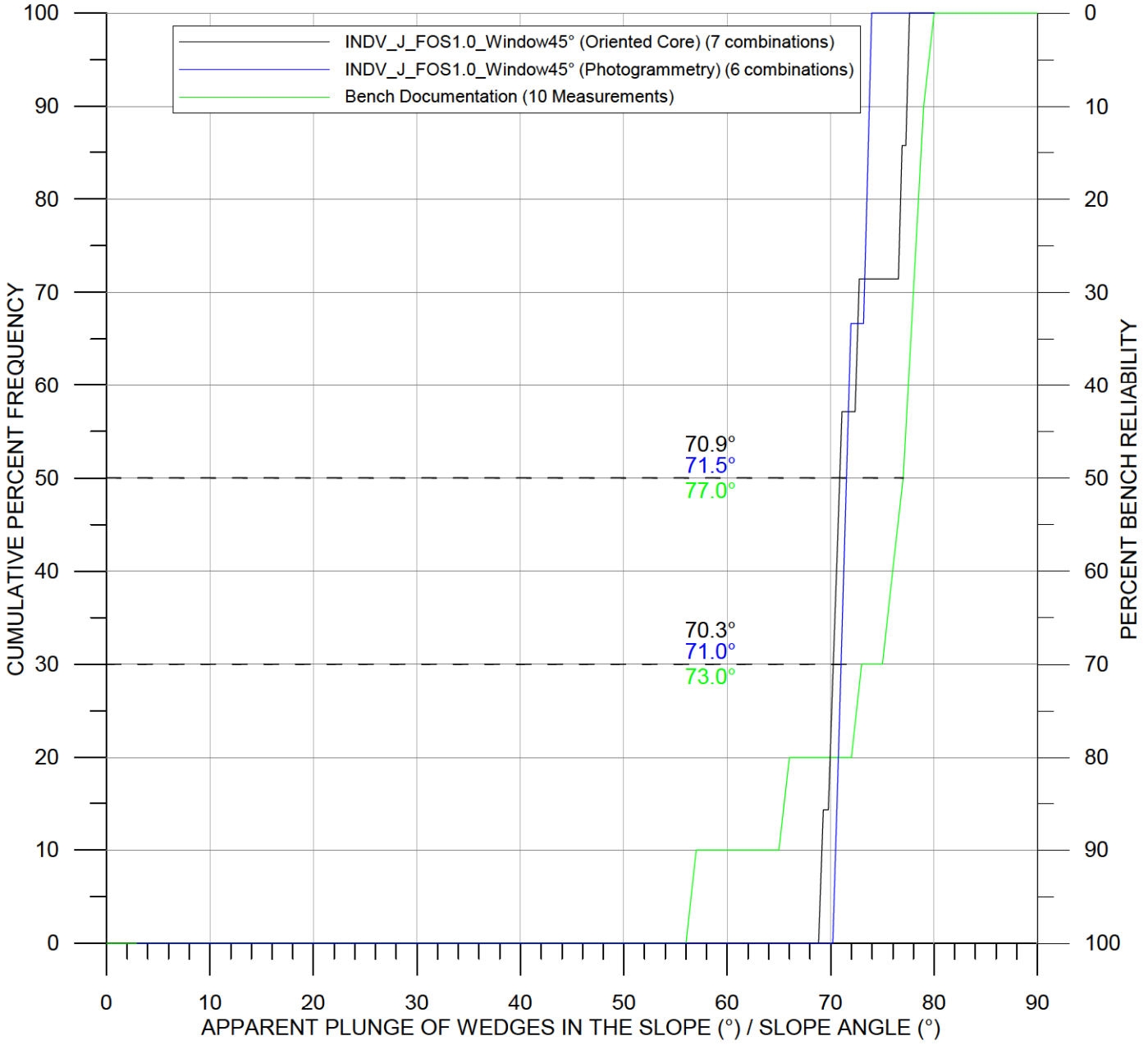
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTH 040°

BY:	DATE:
JL	JAN 16
APPROVED:	FIG:
GG	F48

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\SouthCombined-040-cf75.grf

SOUTH 040°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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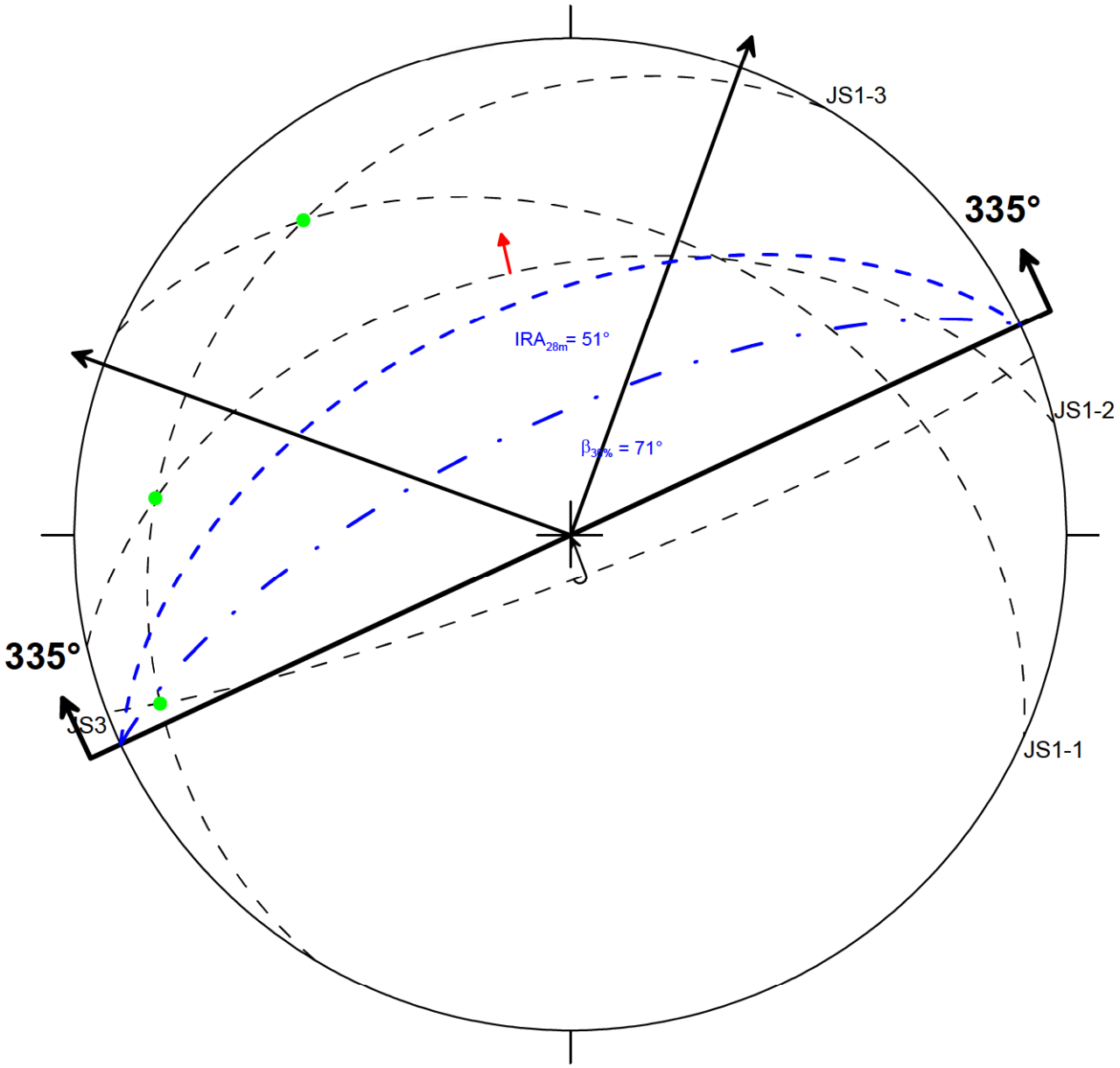
CUMULATIVE FREQUENCY PLOT
SOUTH 040° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F49

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/southcombined-335.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00



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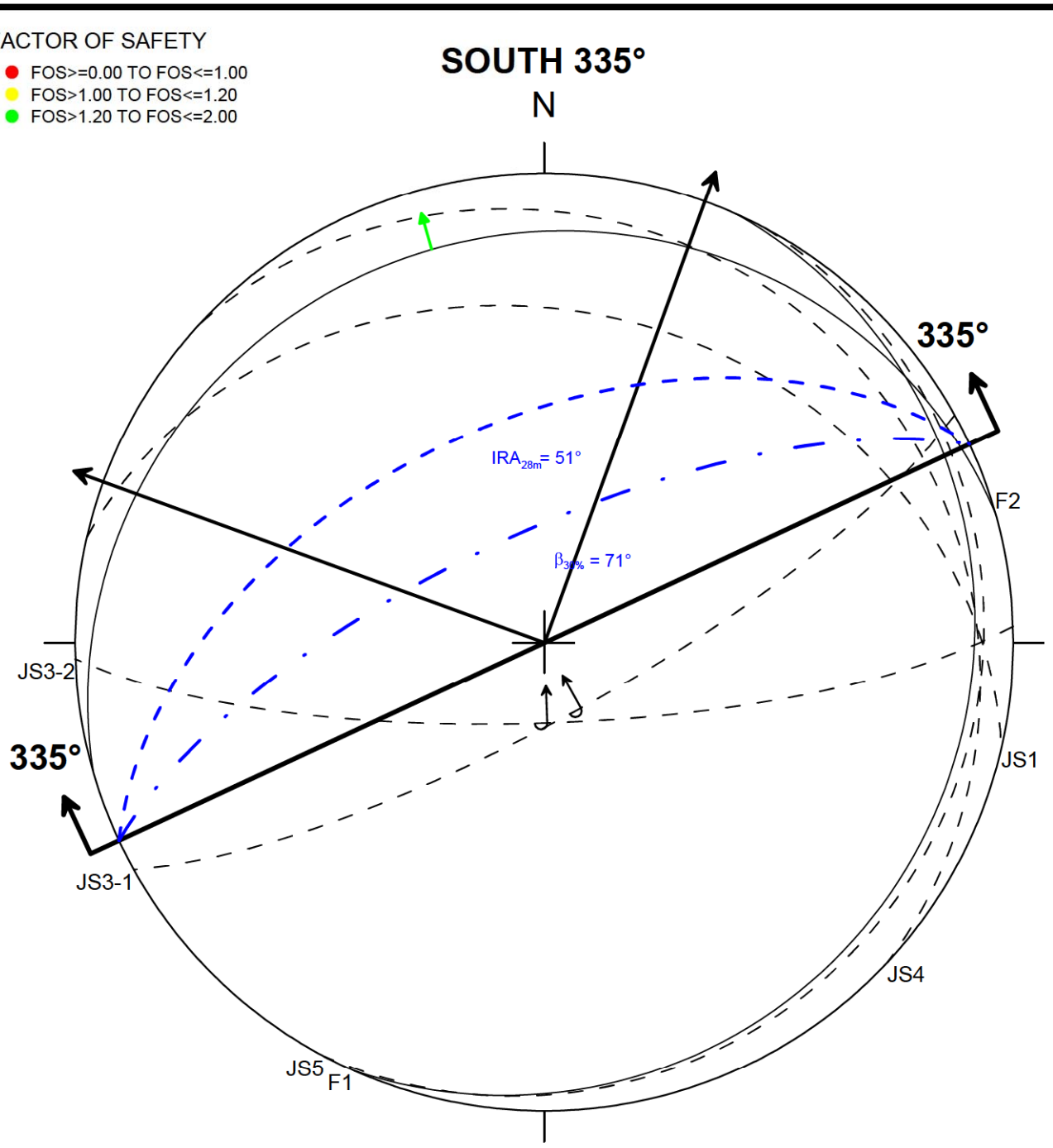
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
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LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - SOUTH 335°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F50

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/oriented_core/southcombined-335.grf



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MONT-WRIGHT - PIT IRÈNE
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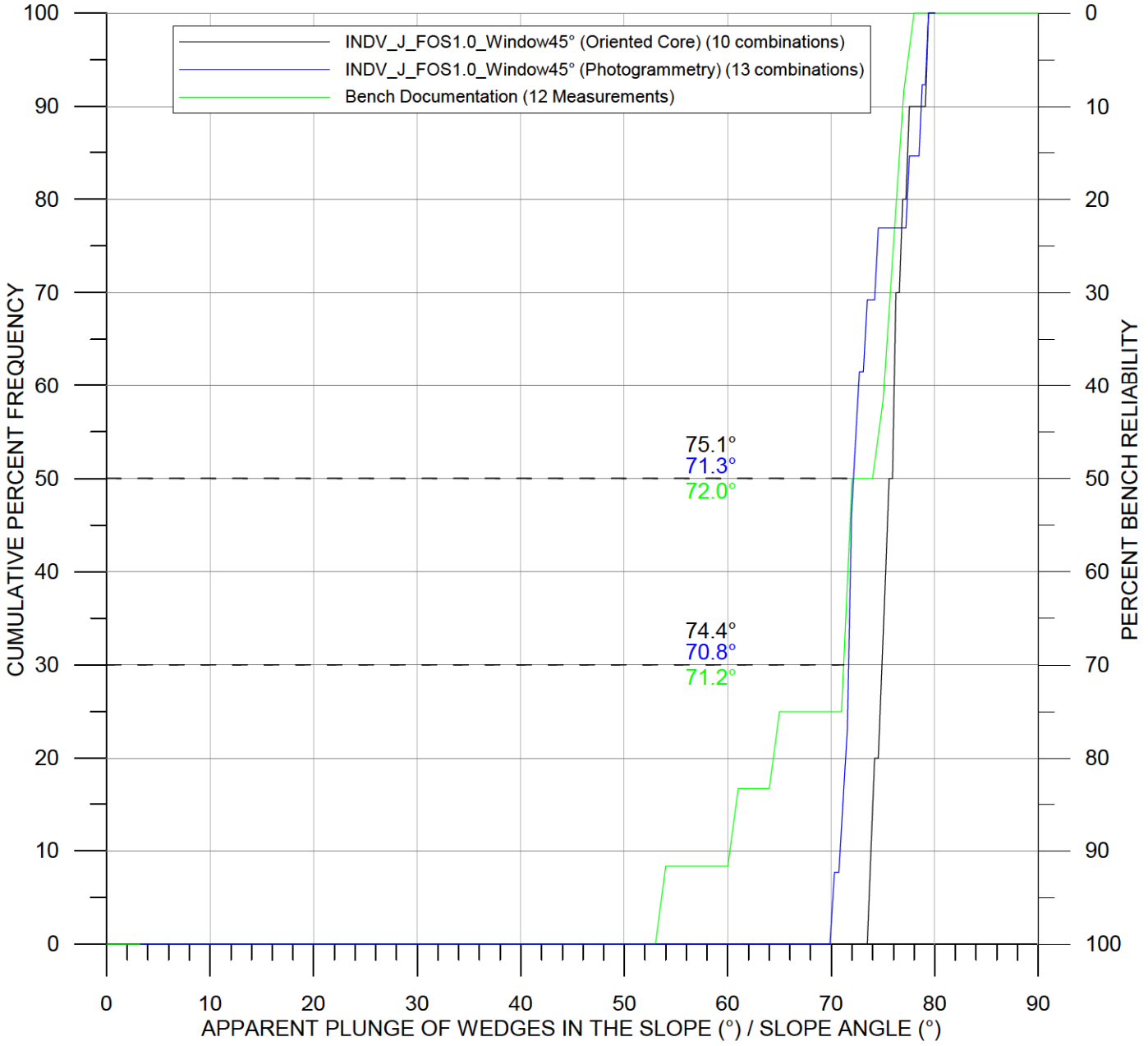
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
ORIENTED CORE - SOUTH 335°

BY:	DATE:
JL	JAN 16
APPROVED:	FIG:
GG	F51

H:\Project\1846\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_allCohesion_75kPa_compound-angle\SouthCombined-335-cf75.grf

SOUTH 335°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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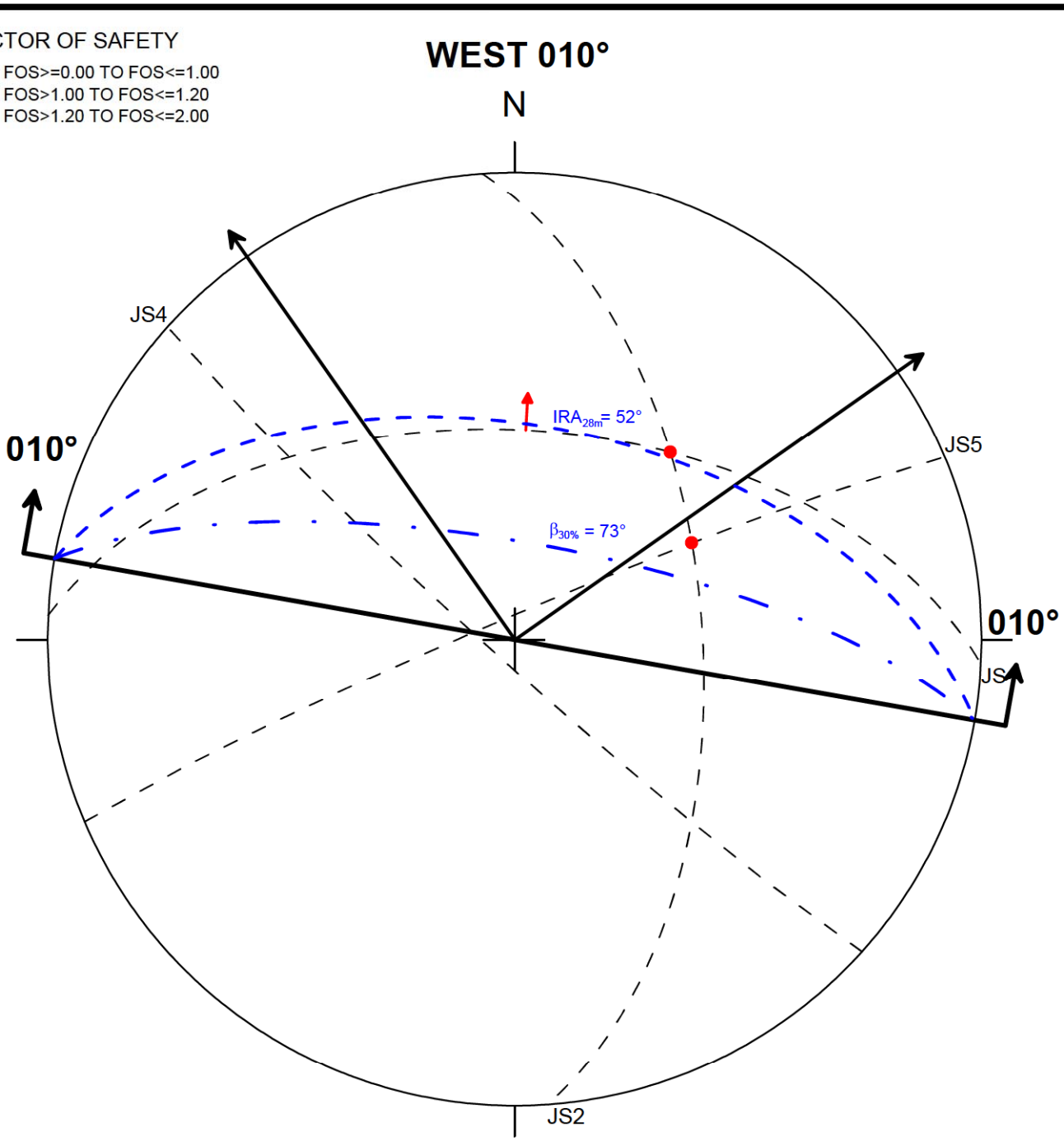
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
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CUMULATIVE FREQUENCY PLOT
SOUTH 335° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F52

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/west-010.grf



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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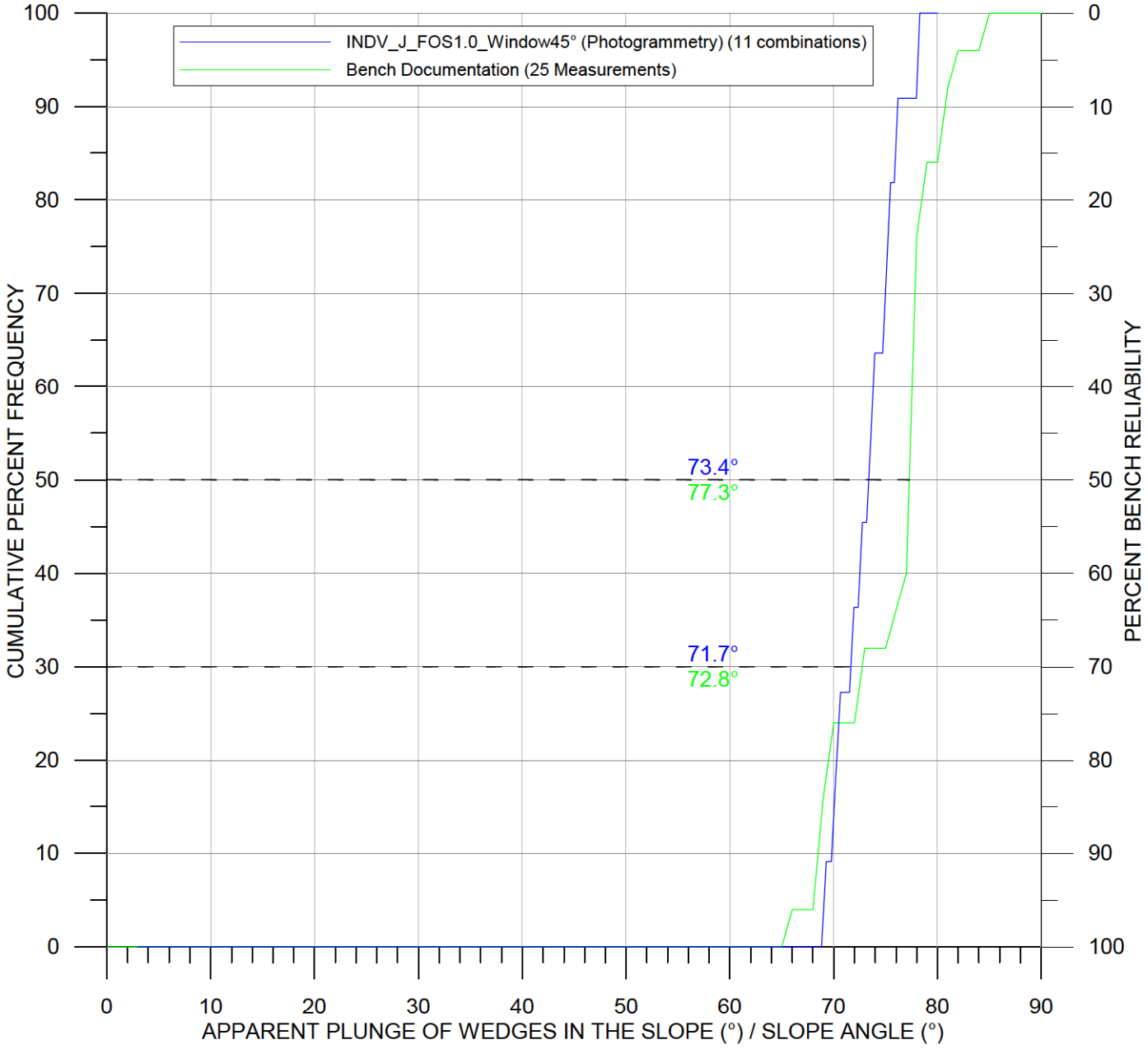
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - WEST 010°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F53

H:\Project\18460\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_all\Cohesion_75kPa_compound-angle\West-010-cf75.grf

WEST 010°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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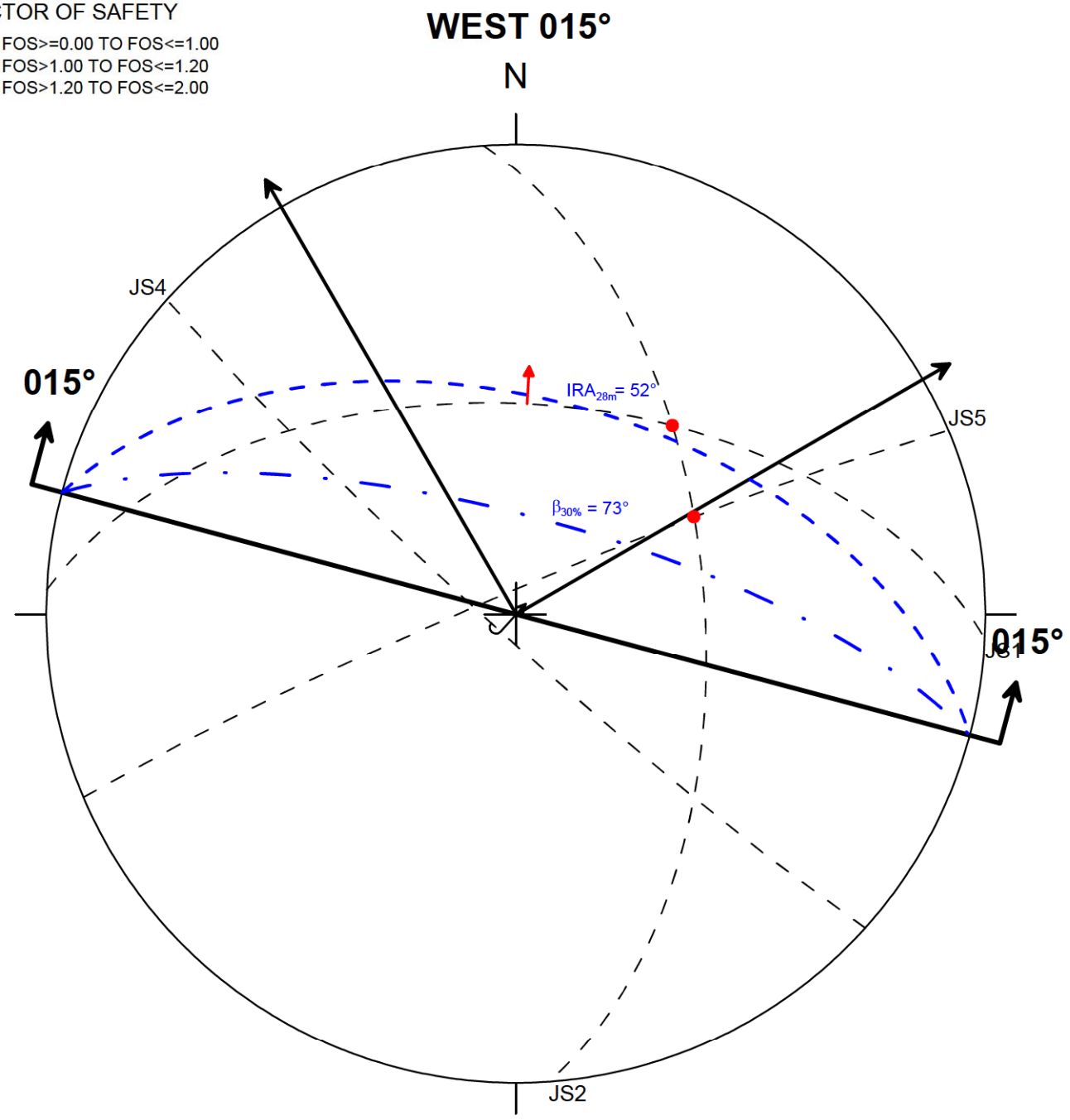
CUMULATIVE FREQUENCY PLOT
WEST 010° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F54

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/west-015.grf

FACTOR OF SAFETY

- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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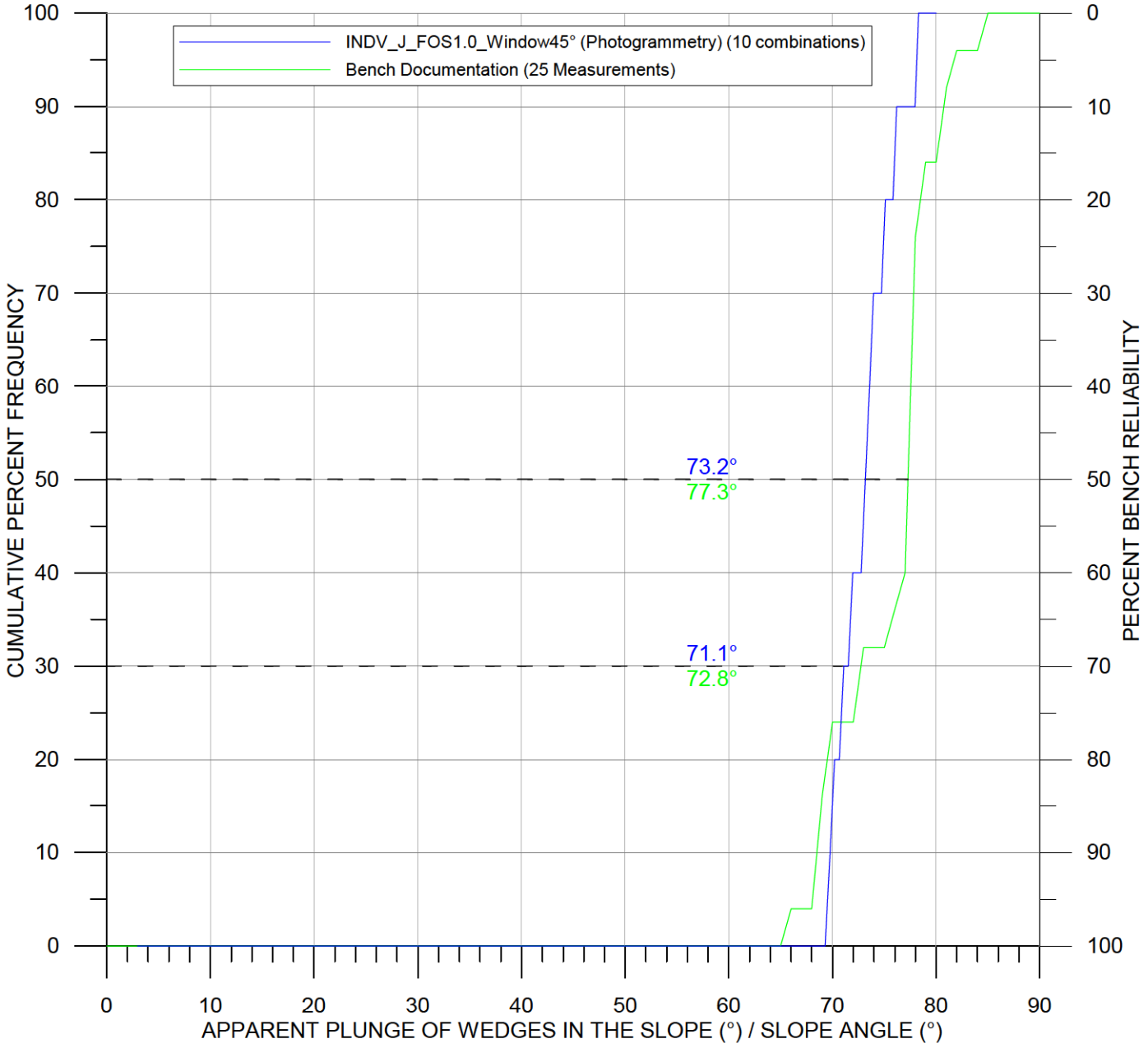
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - WEST 015°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F55

H:\Project\18460\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_all\Cohesion_75kPa_compound-angle\West-015-cf75.grf

WEST 015°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

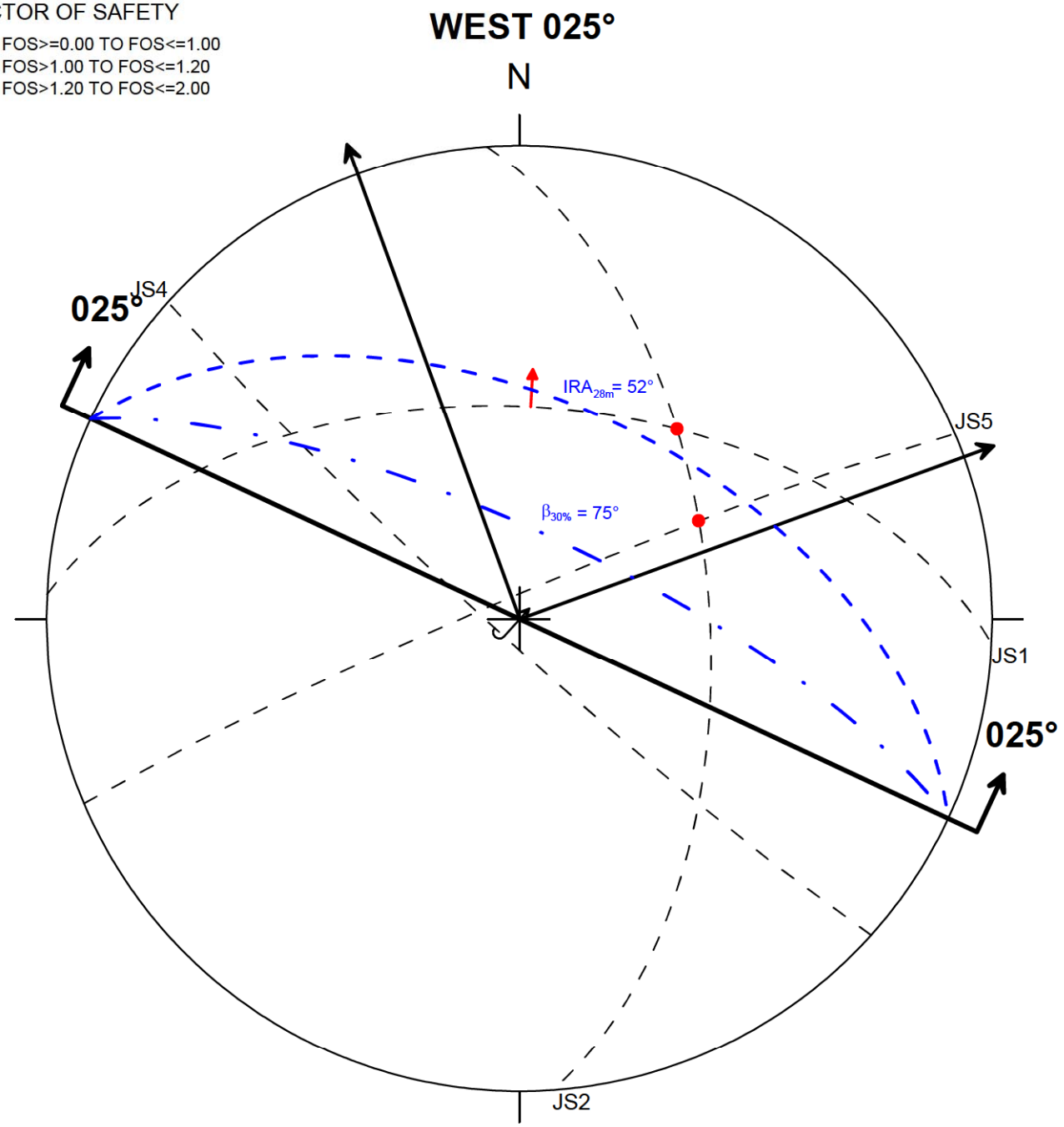
PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

CUMULATIVE FREQUENCY PLOT
WEST 015° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F56

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/west-025.grf

FACTOR OF SAFETY
- FOS>=0.00 TO FOS<=1.00
- FOS>1.00 TO FOS<=1.20
- FOS>1.20 TO FOS<=2.00



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ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

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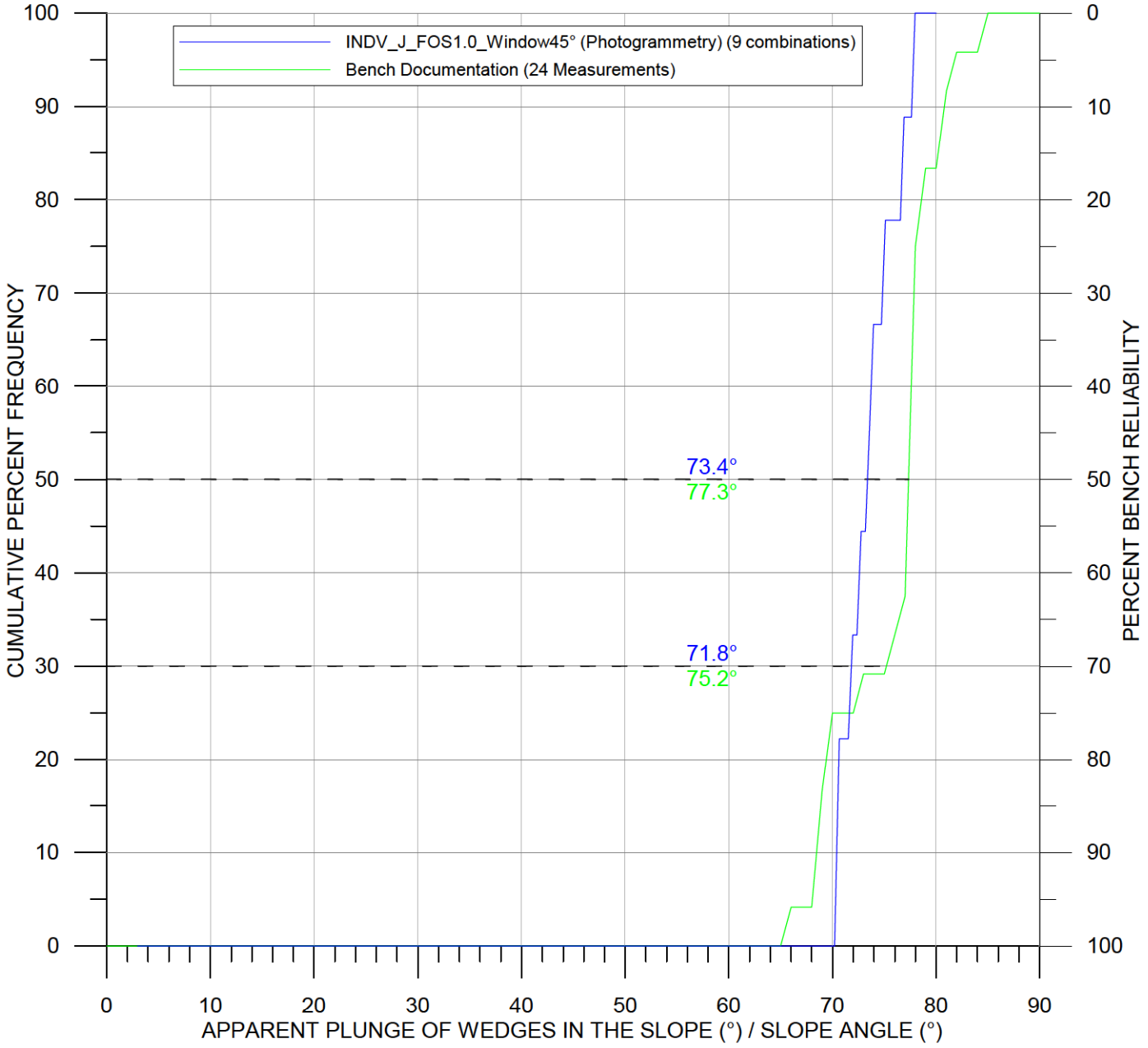
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - WEST 025°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F57

H:\Project\18460\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_all\Cohesion_75kPa_compound-angle\West-025-cf75.grf

WEST 025°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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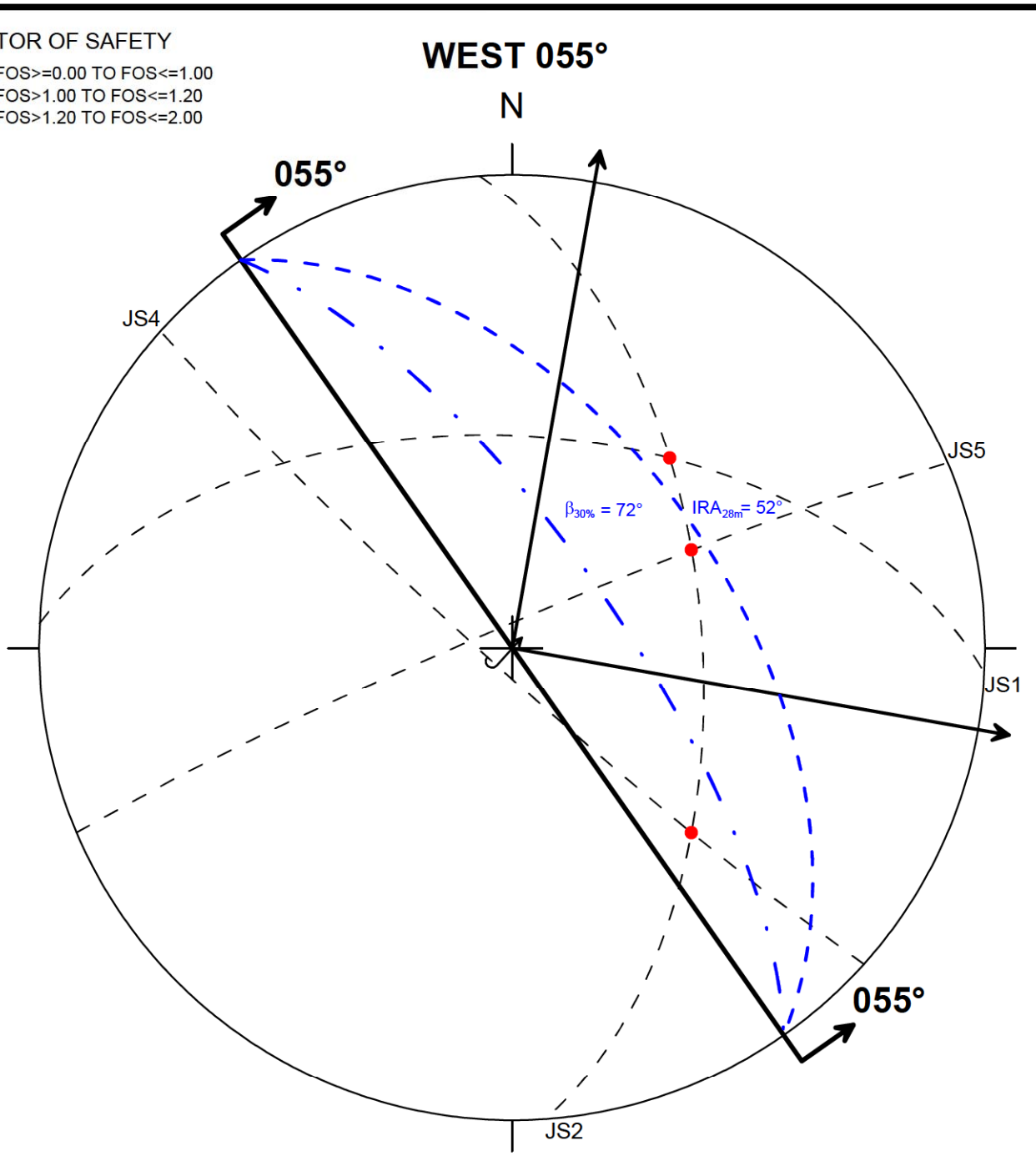
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

CUMULATIVE FREQUENCY PLOT
WEST 025° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F58

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/west-055.grf



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2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

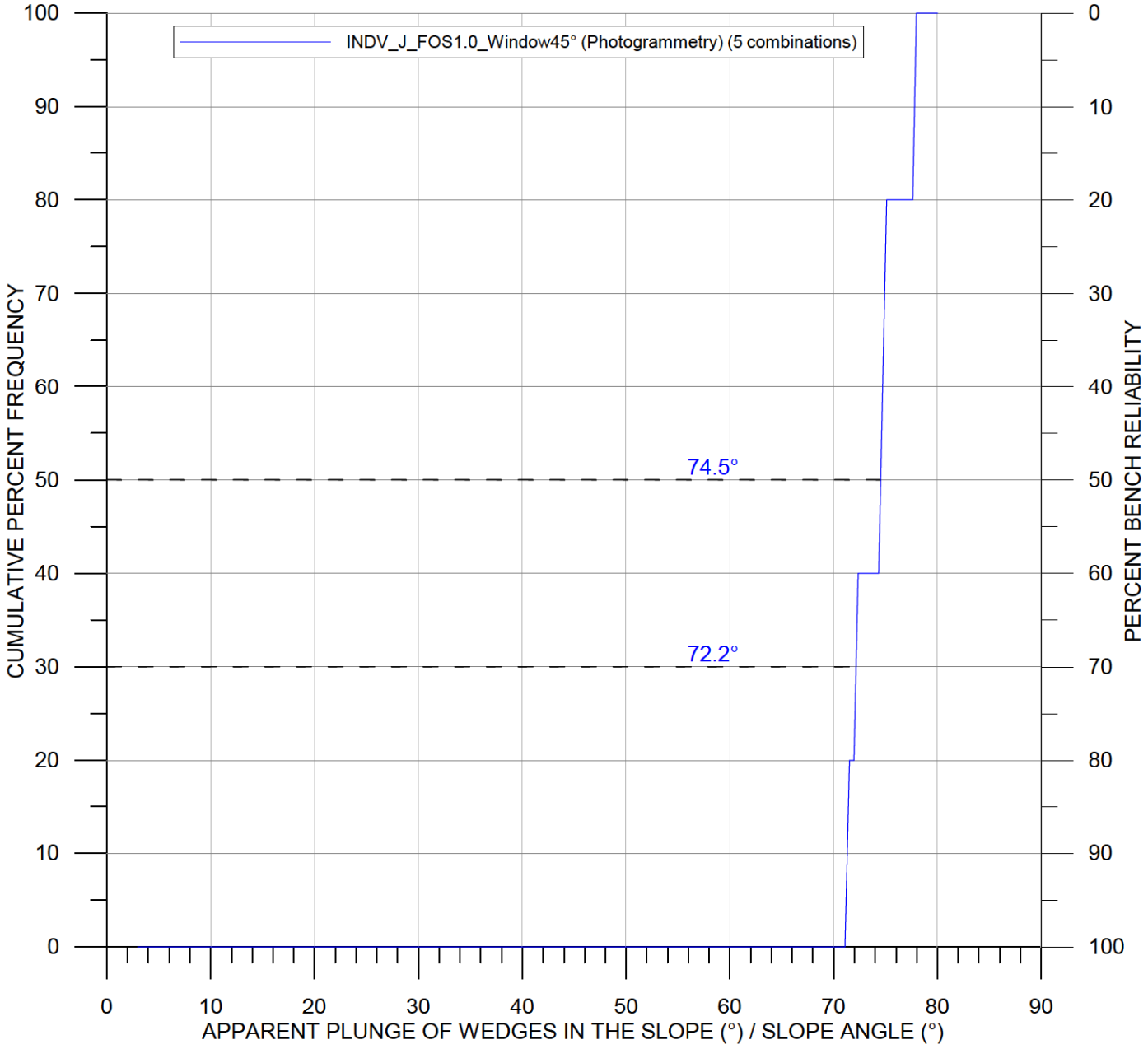
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - WEST 055°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F59

H:\Project\18460\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_all\Cohesion_75kPa_compound-angle\West-055-cf75.grf

WEST 055°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



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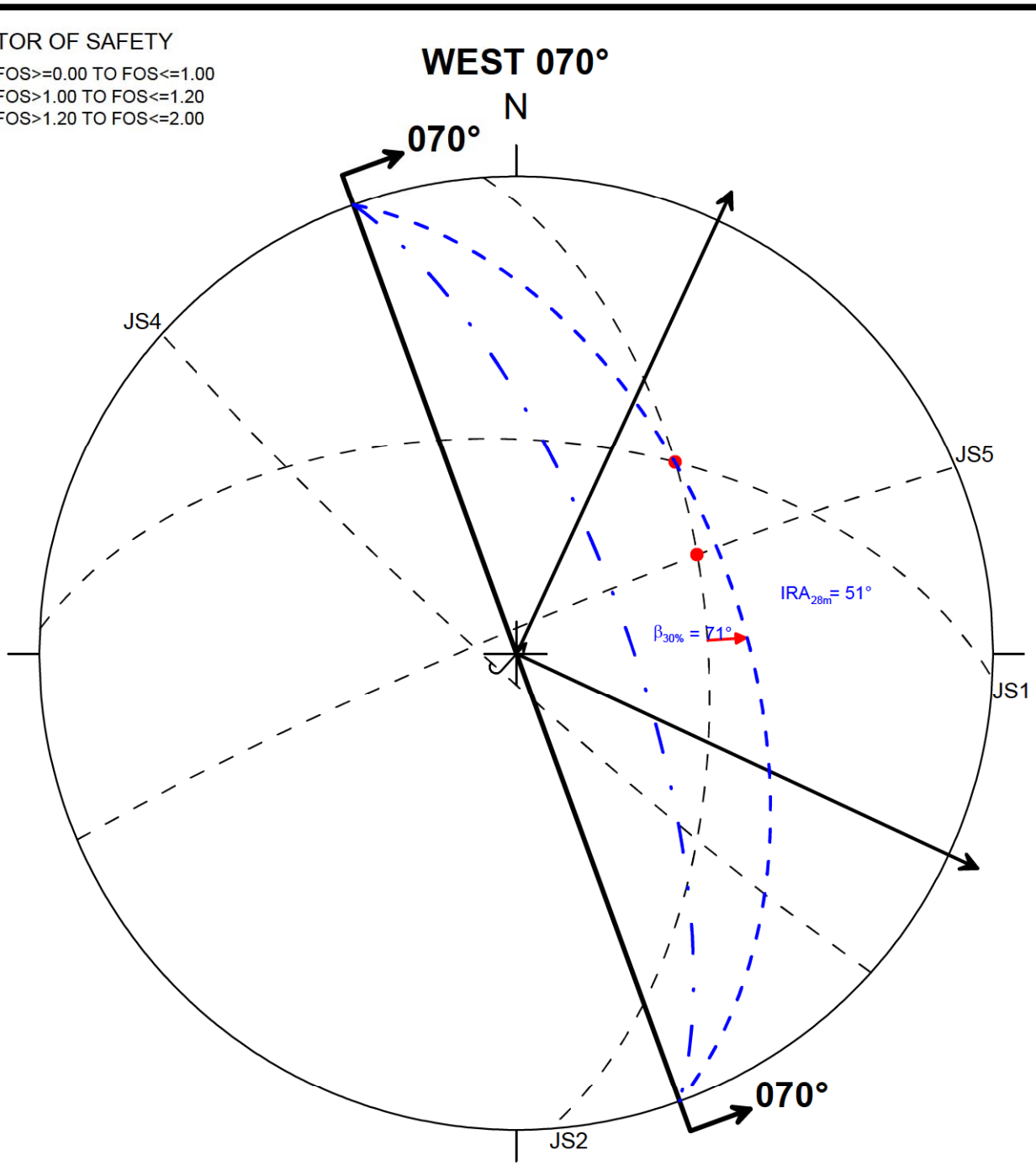
ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

CUMULATIVE FREQUENCY PLOT
WEST 055° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F60

file: h:/project/1846/2015-06 slope design updates/kinematics/peak/combined_siro+adam/west-070.grf



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2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

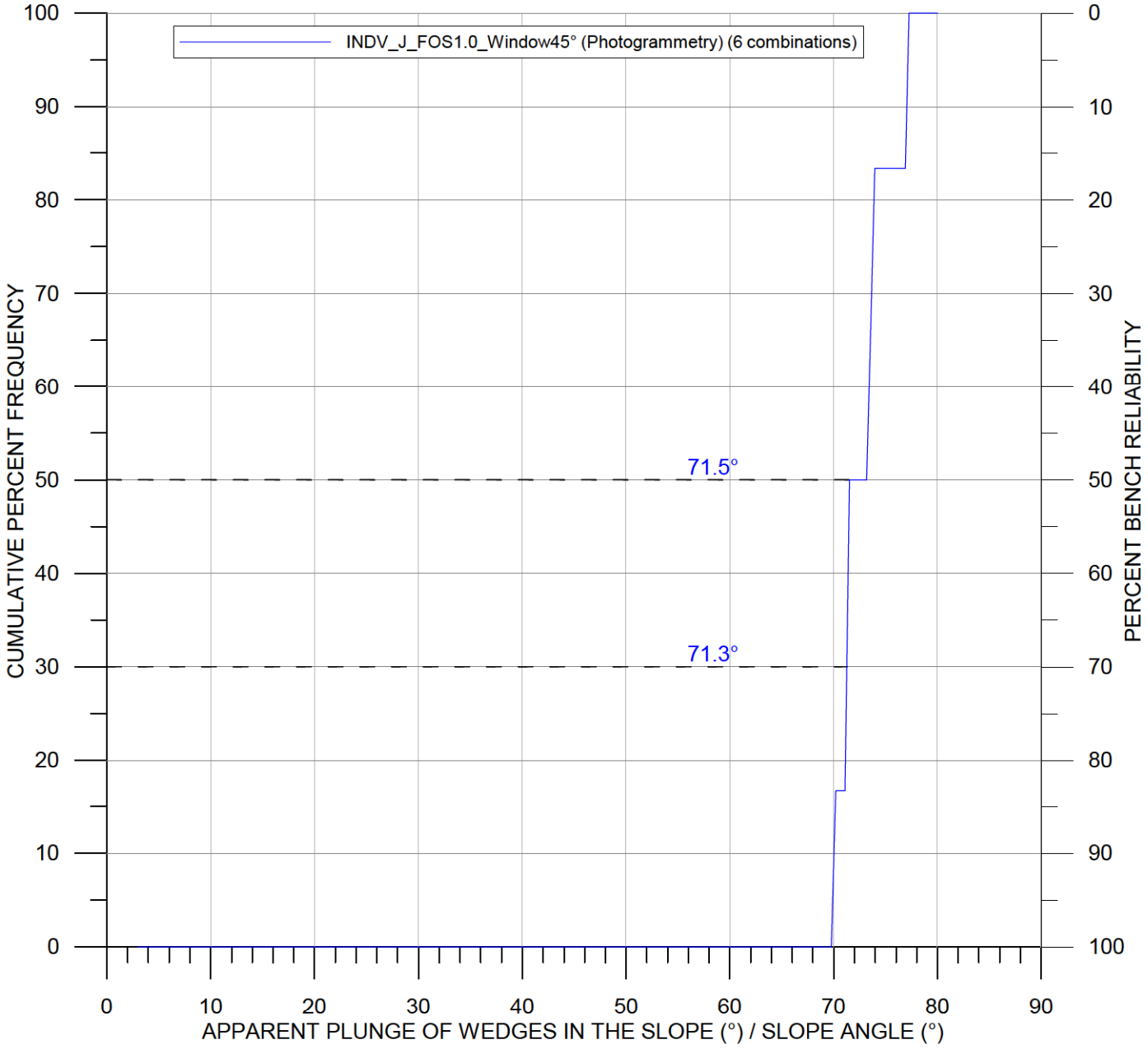
LOWER HEMISPHERE EQUAL AREA PROJECTIONS
KINEMATICALLY POSSIBLE FAILURE MODES
COMBINED PHOTOGRAMMETRY - WEST 070°

BY:	DATE:
JL	FEB 16
APPROVED:	FIG:
GG	F61

H:\Project\18460\2015-06 slope design updates\Kinematics\CFAs\28m_BH_phi_38_all\Cohesion_75kPa_compound-angle\West-070-cf75.grf

WEST 070°

WEDGESORT2: Planes re-sorted based on assumed release feature.
Plane replication excluded.



PREPARED SOLELY FOR THE USE OF OUR CLIENT AND NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ASSOCIATES ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

ARCELORMITTAL MINES CANADA
MONT-WRIGHT - PIT IRÈNE
2015 GEOTECHNICAL ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

CUMULATIVE FREQUENCY PLOT
WEST 070° - COMPOUND BREAKBACK ANGLE
C=75KPA PHI=38° BH=28M

BY:	DATE:
CJH	FEB 16
APPROVED:	FIG:
GG	F62

APPENDIX G

SLIDE LIMIT EQUILIBRIUM STABILITY ANALYSIS RESULTS

ANALYSIS OF THE PROPOSED PIT IRÈNE MINE PLAN

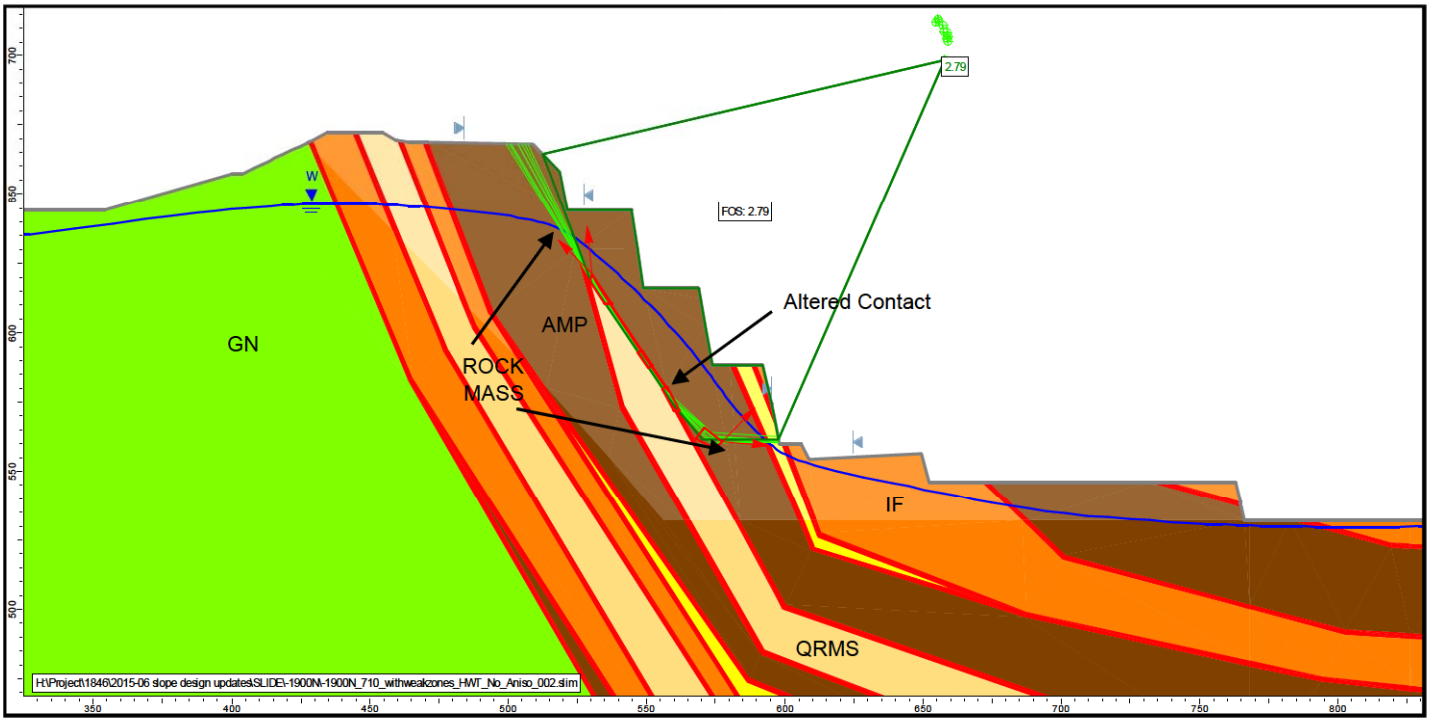


Fig. G1: Section -1900/N - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 2.79 between the 560 and 668m levels.

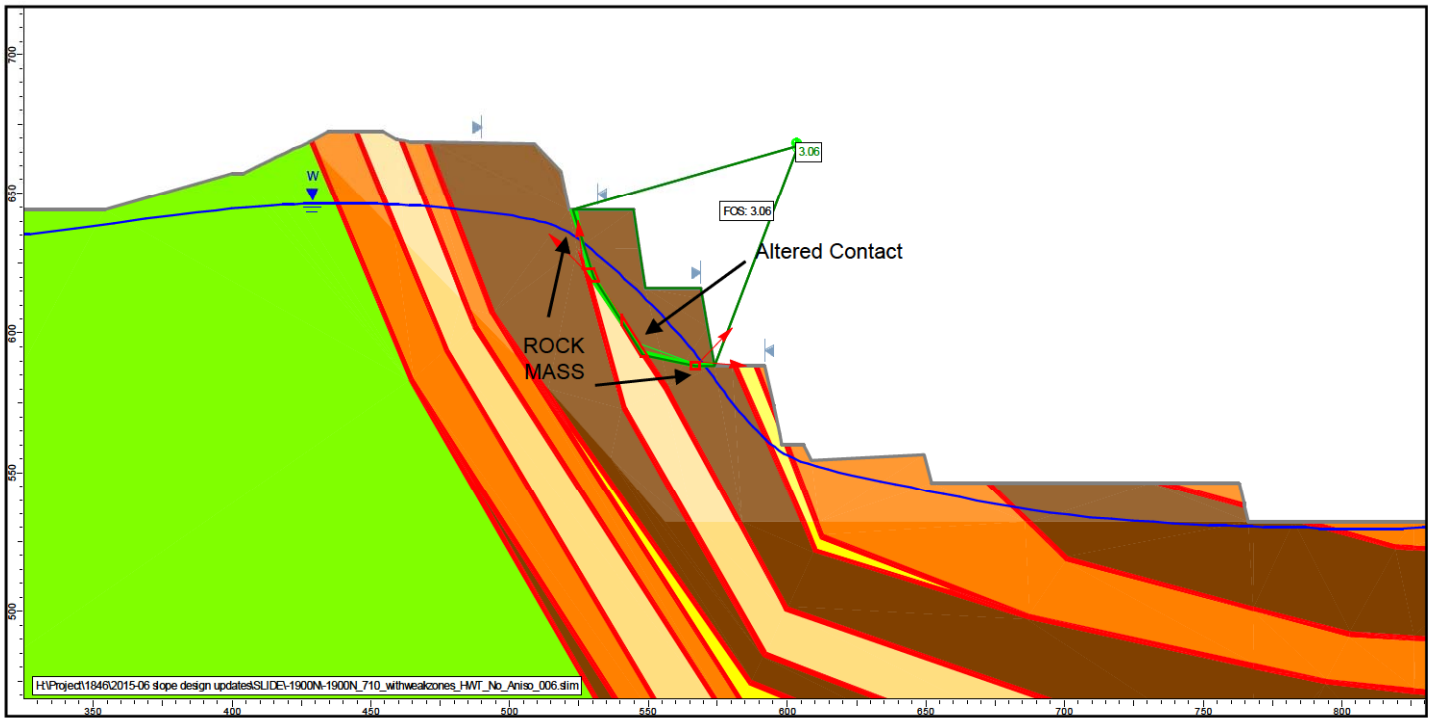


Fig. G2: Section -1900/N - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 3.06 between the 588 and 644m levels.

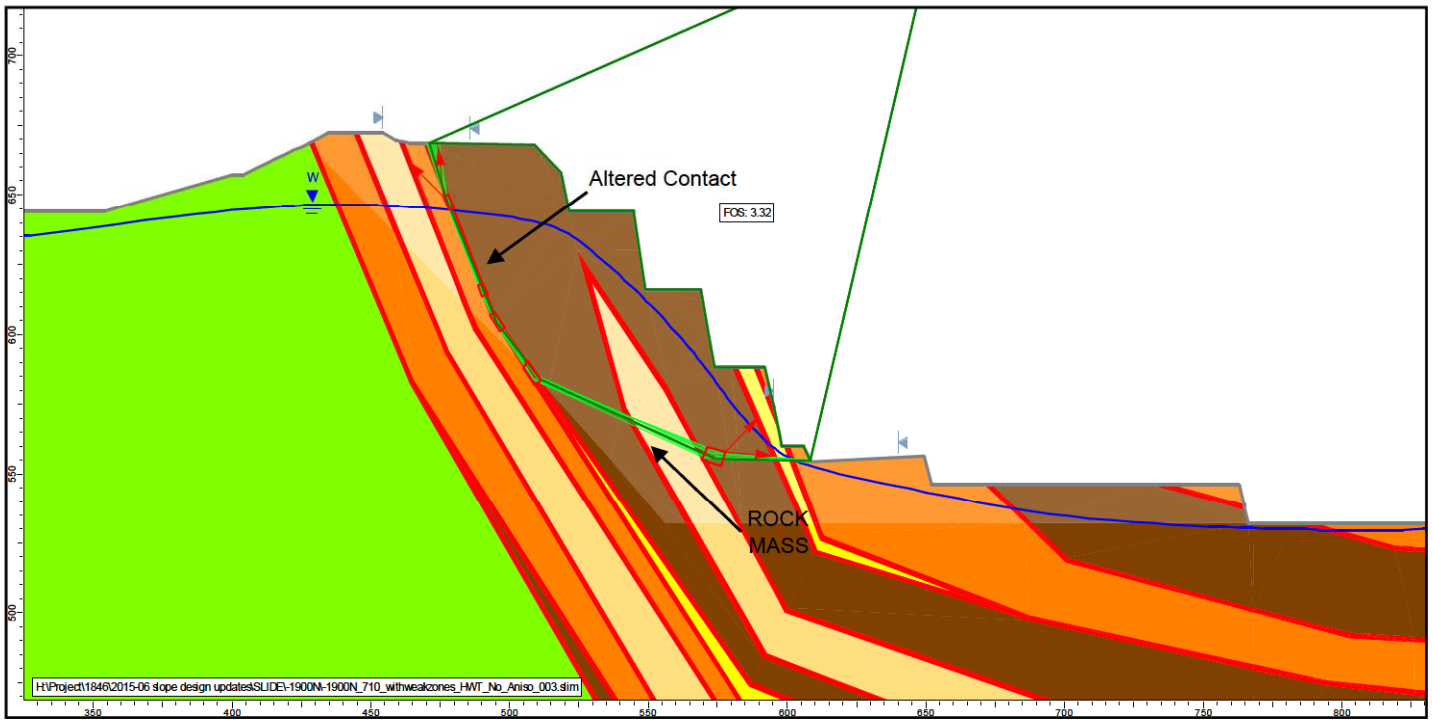


Fig. G3: Section -1900/N - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 3.32 between the 554 and 668m levels.

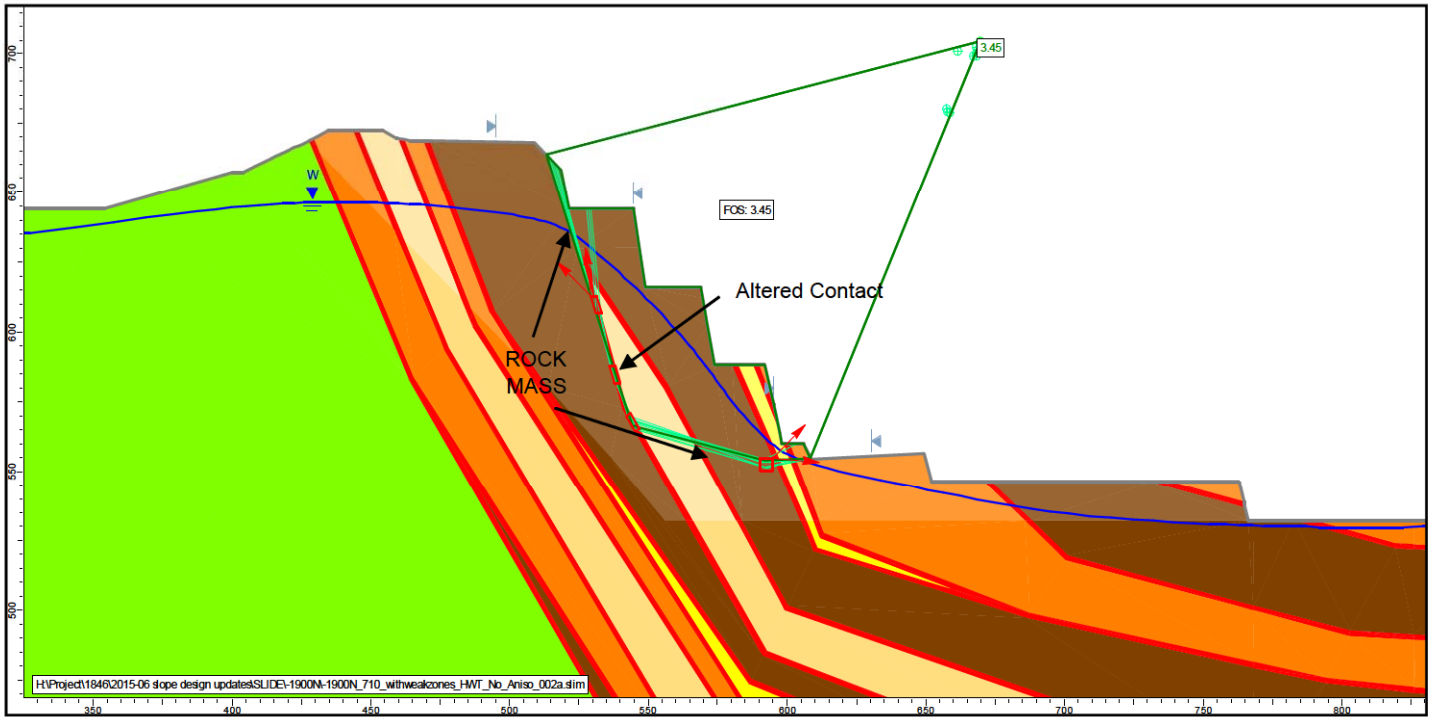


Fig. G4: Section -1900/N - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 3.45 between the 554 and 668m levels.

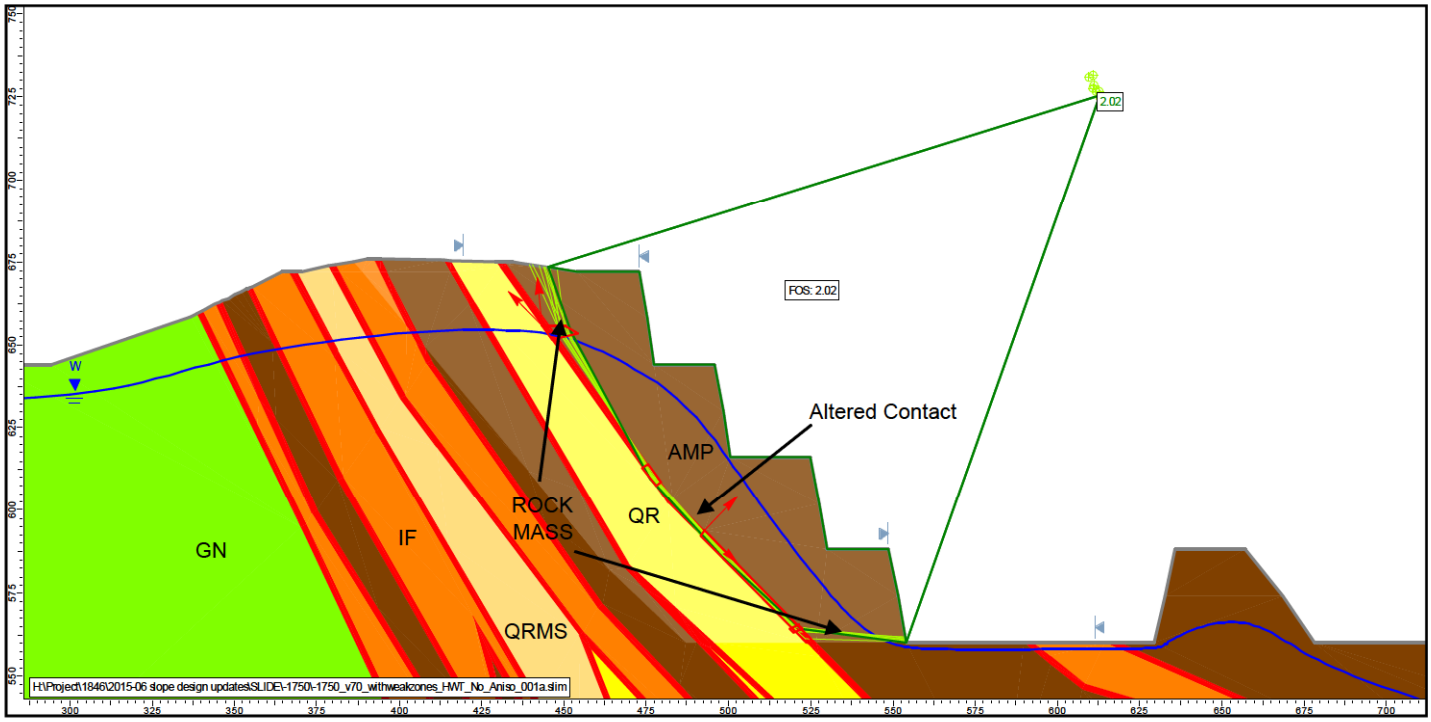


Fig. G5: Section -1750/N - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 2.02 between the 560 and 672m levels.

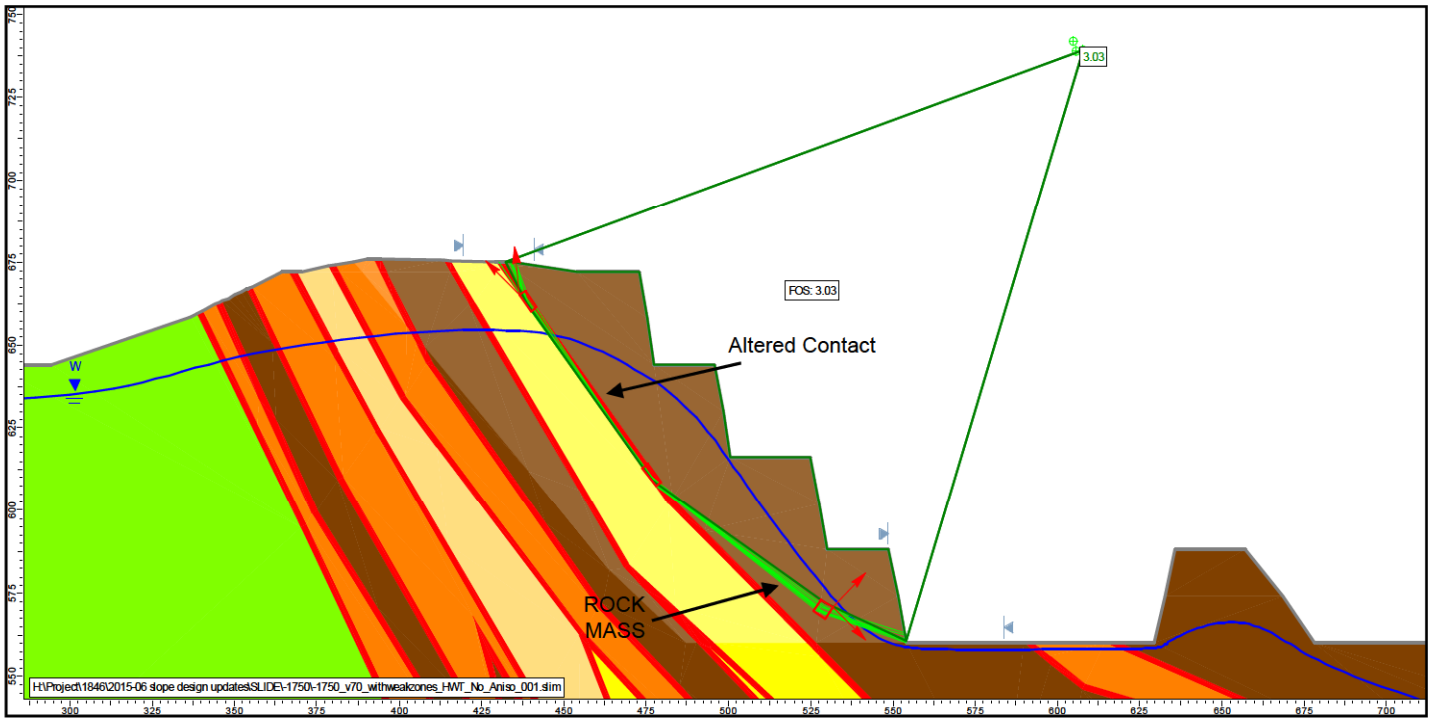


Fig. G6: Section -1750/N - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 3.03 between the 560 and 672m levels.

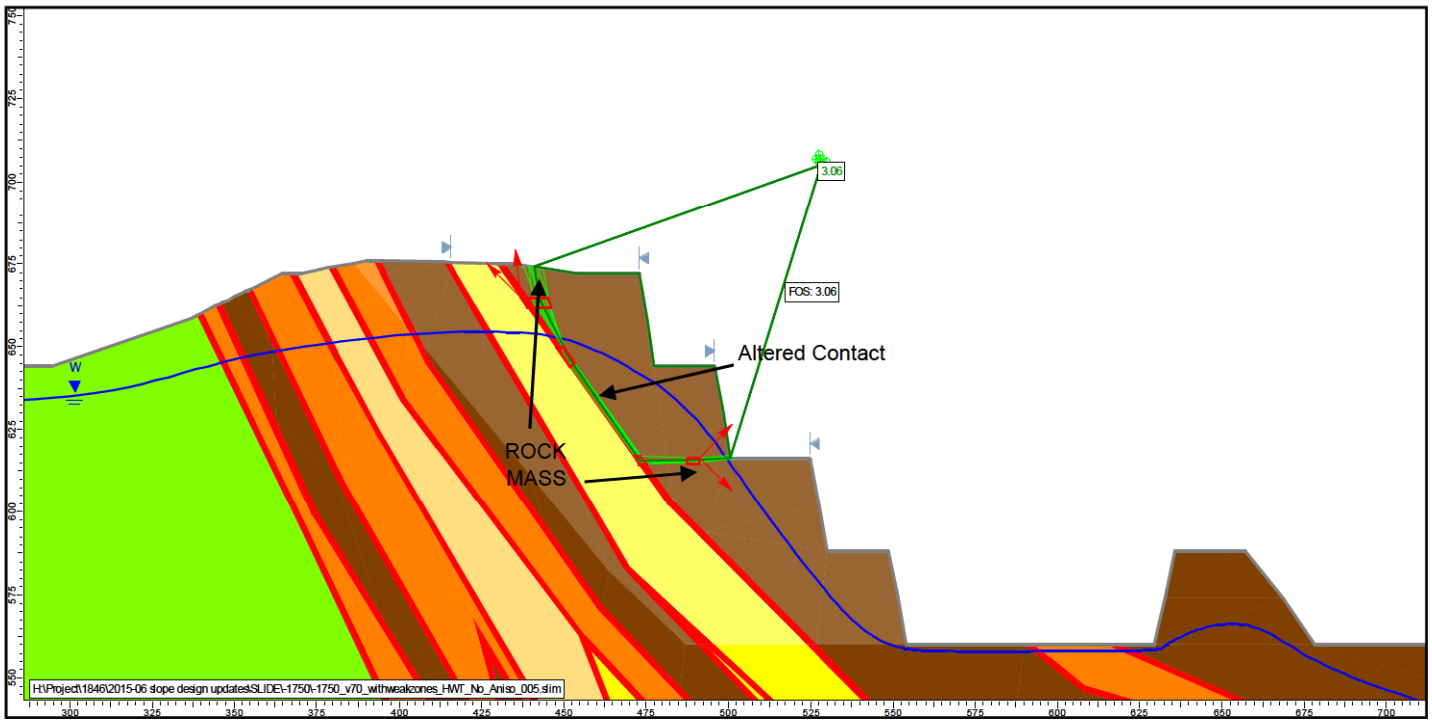


Fig. G7: Section -1750/N - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 3.06 between the 616 and 672m levels.

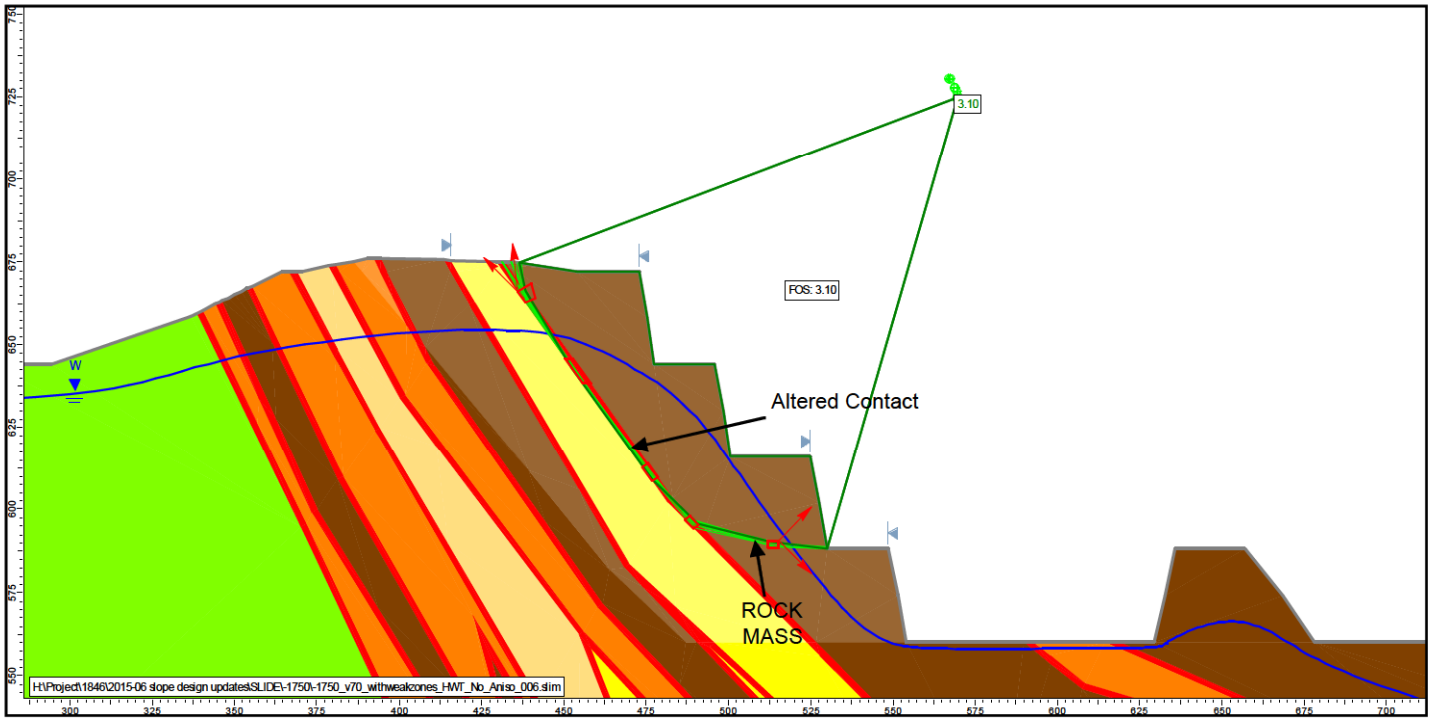


Fig. G8: Section -1750/N - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 3.10 between the 588 and 672m levels.

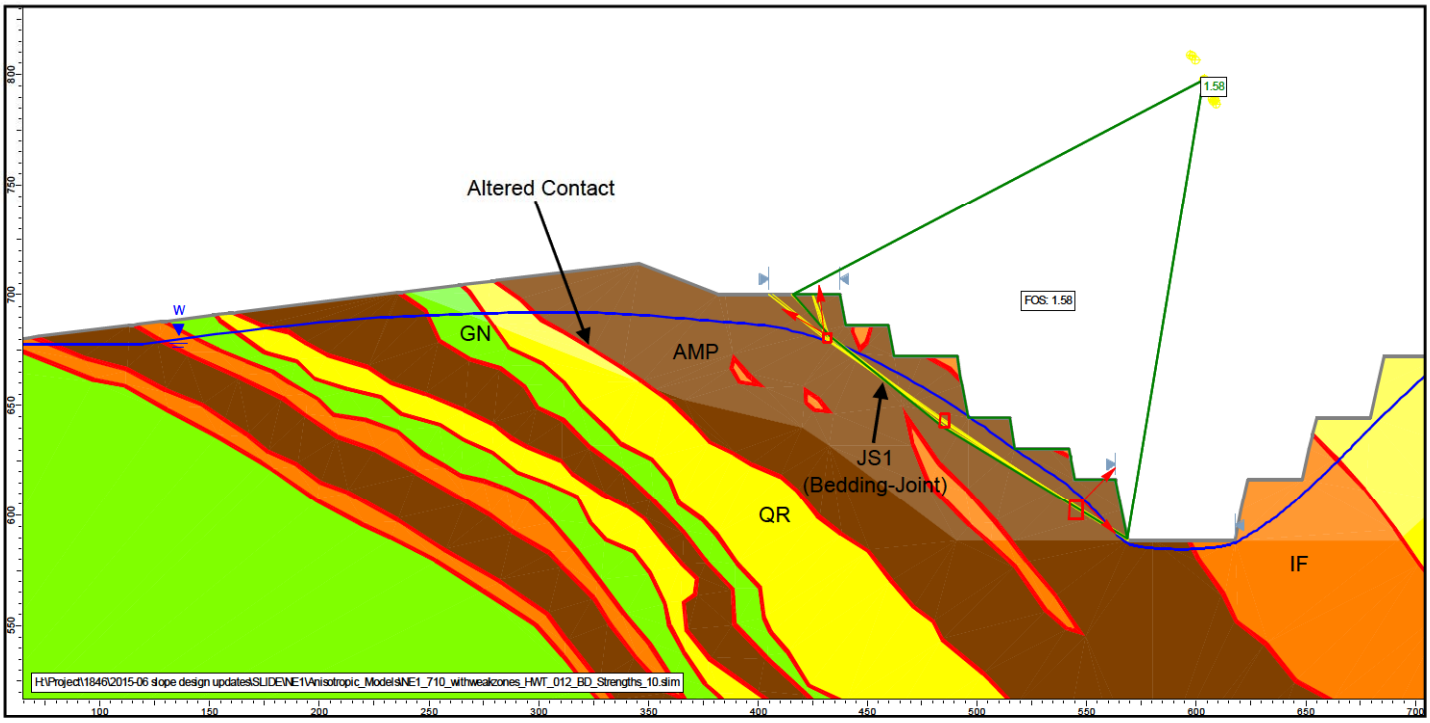


Fig. G9: Section NE1 – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints . Minimum FoS = 1.58 between the 588 and 700m levels.

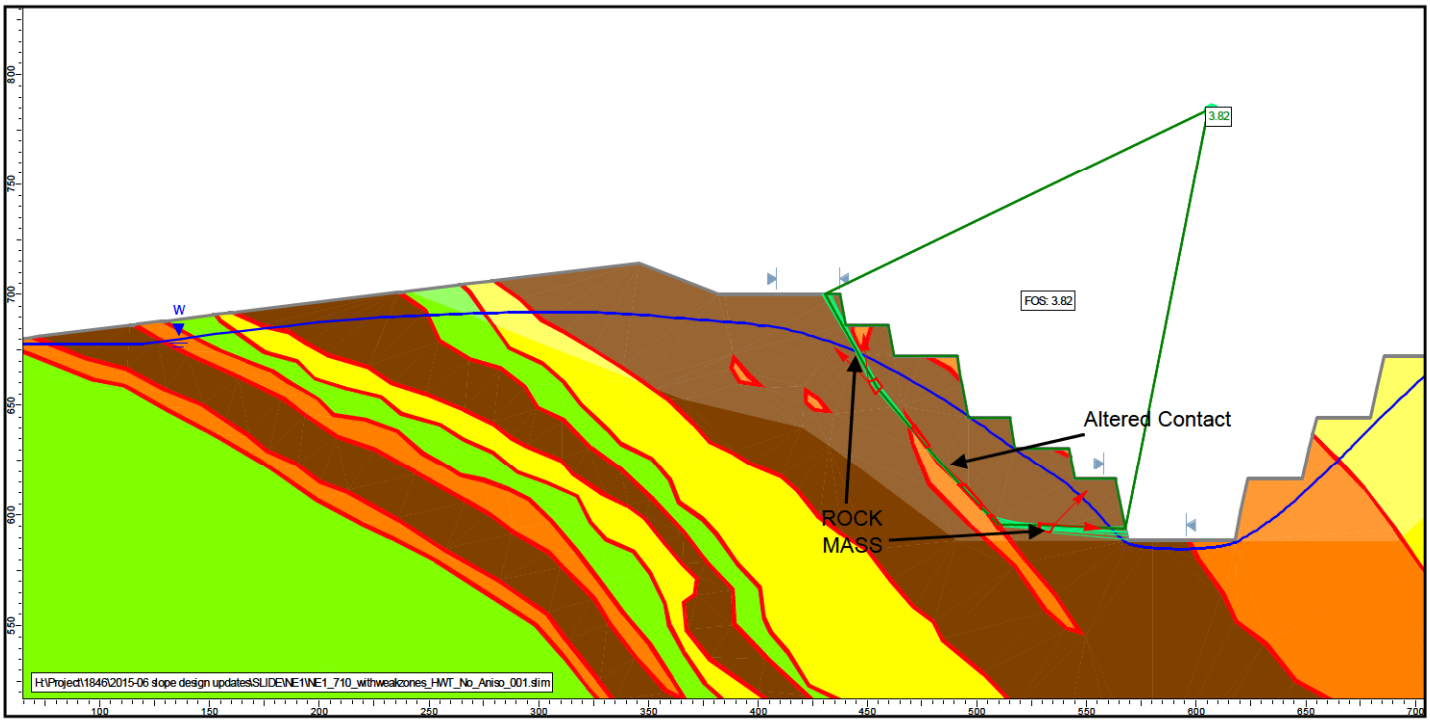


Fig. G10: Section NE1 - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 3.82 between the 588 and 700m levels.

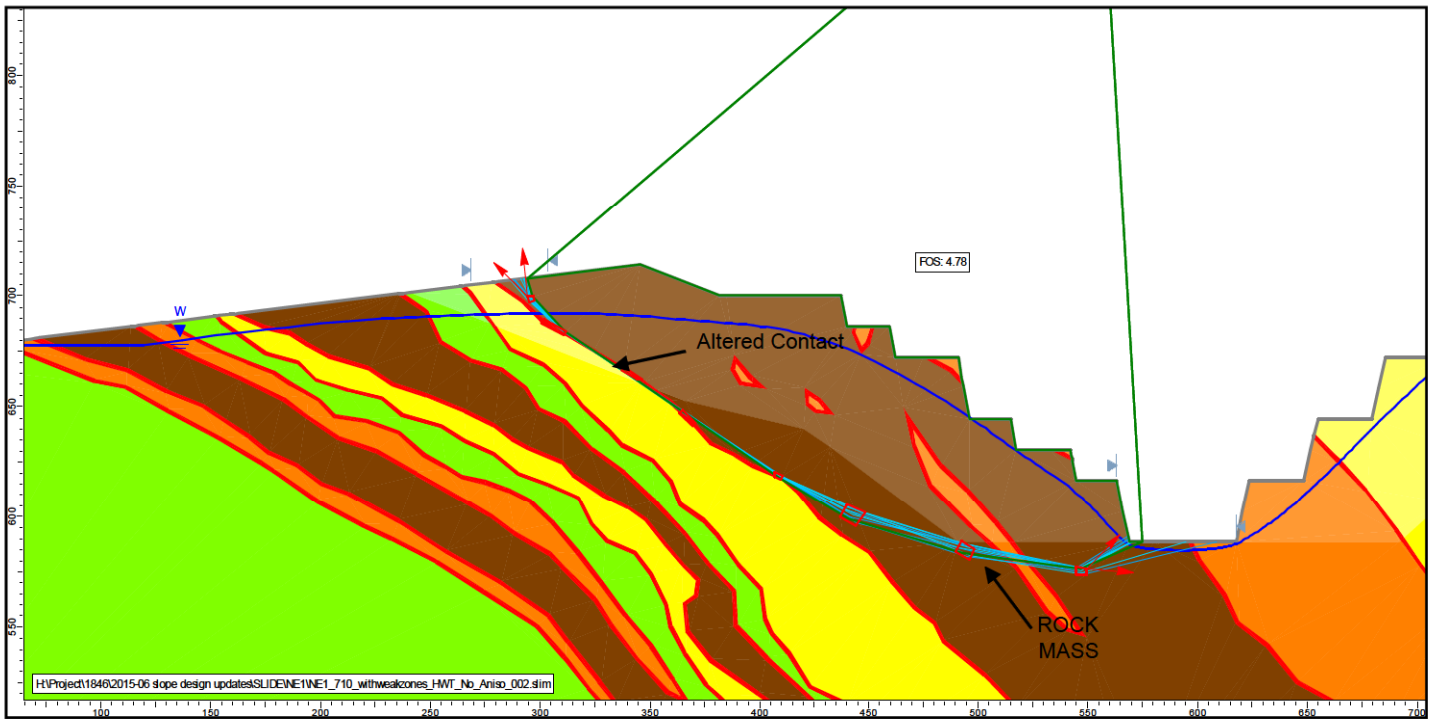


Fig. G11: Section NE1 - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 4.78 between the 588 and 700m levels.

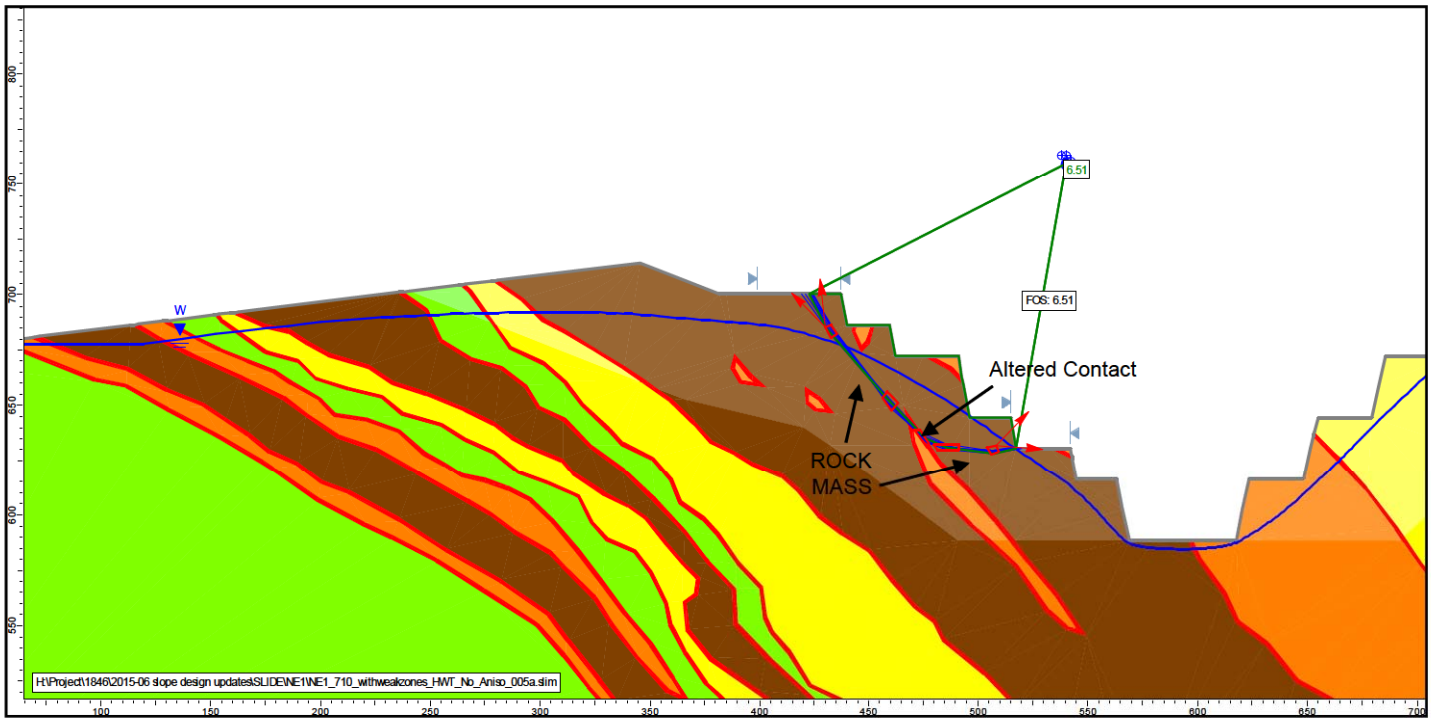


Fig. G12: Section NE1 - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 6.51 between the 630 and 700m levels.

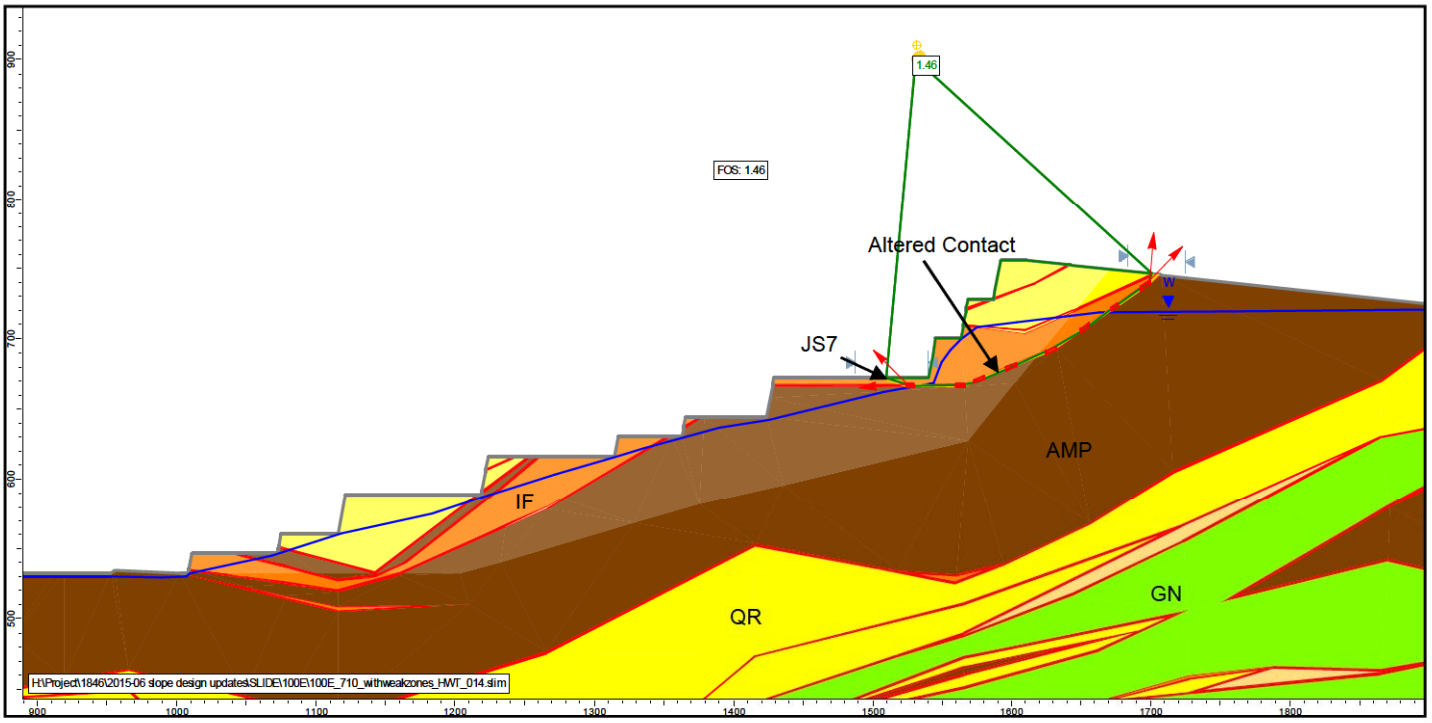


Fig. G13: Section 100E – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and 20% for joints. Minimum FoS = 1.46 between the 672 and 756m levels.

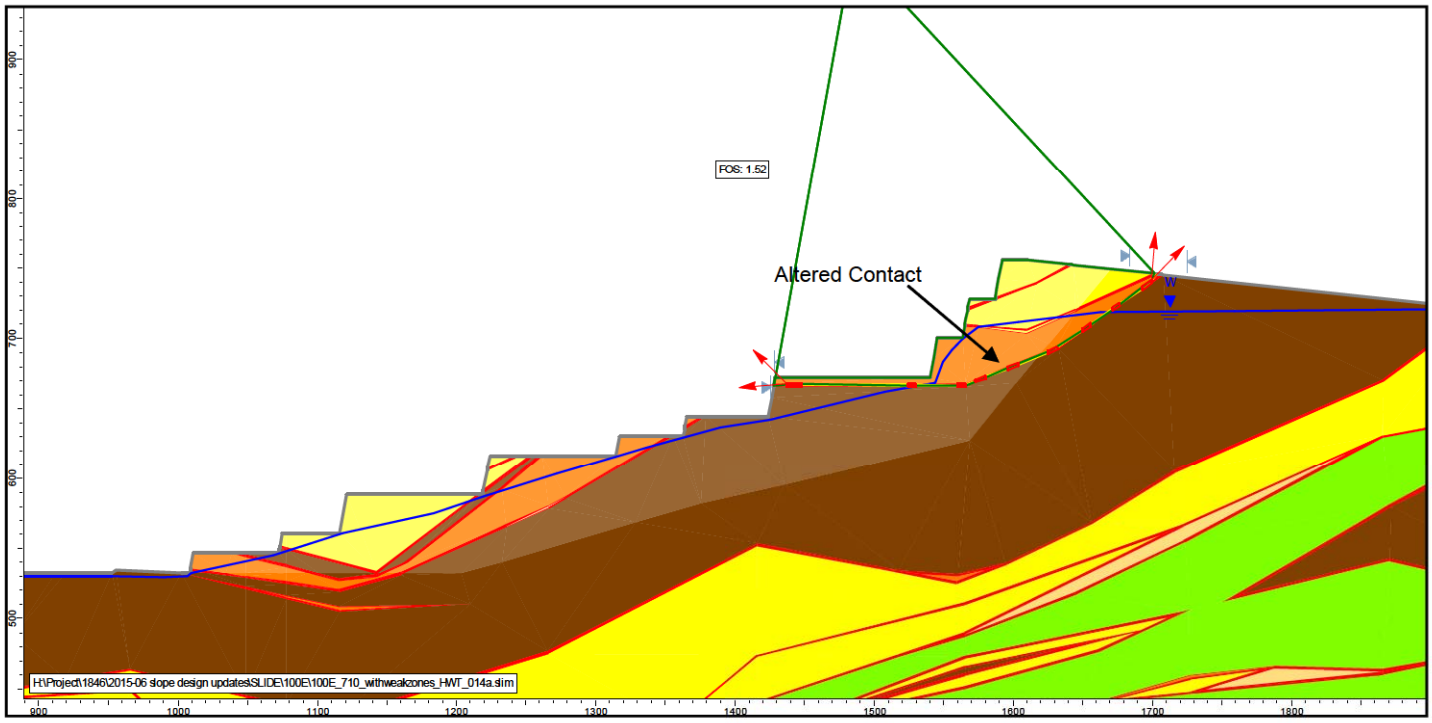


Fig. G14: Section 100E - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 1.52 between the 672 and 756m levels.

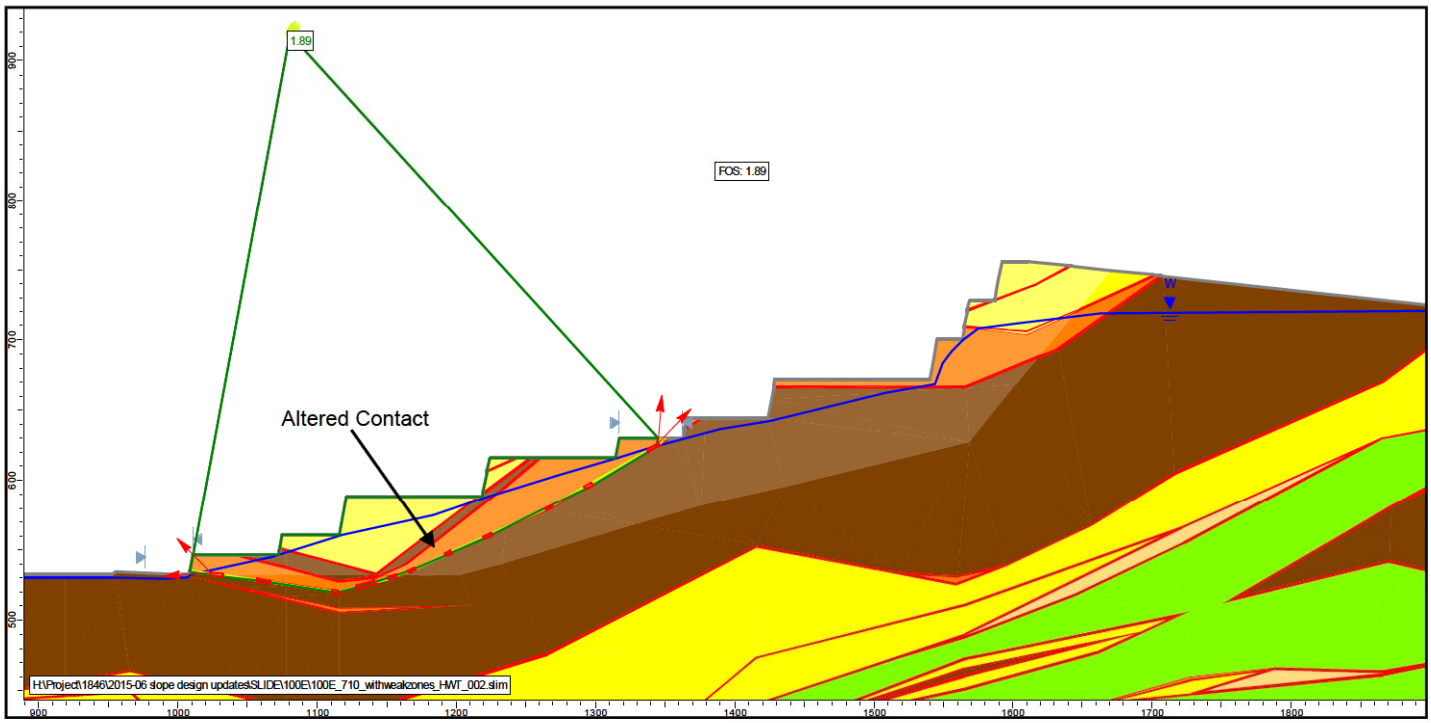


Fig. G15: Section 100E - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 1.89 between the 532 and 630m levels.

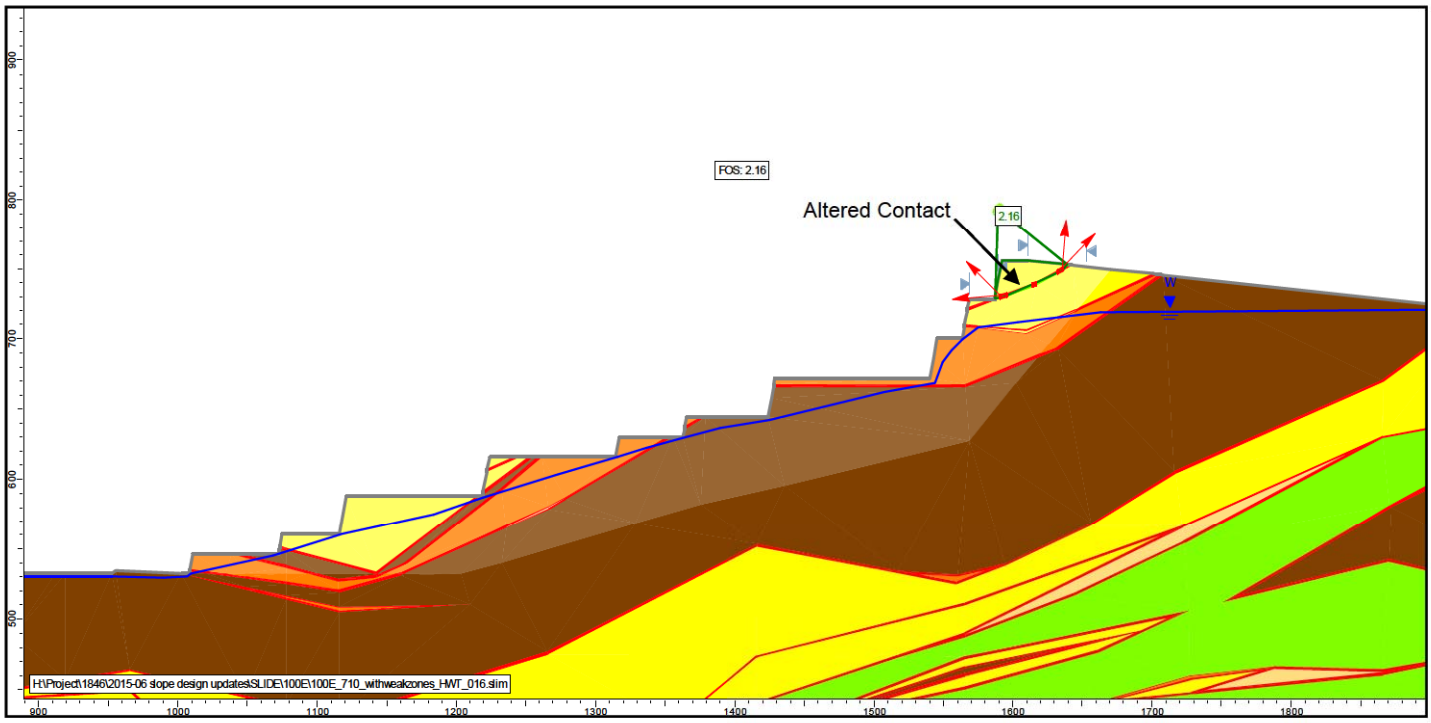


Fig. G16: Section 100E - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 2.16 between the 728 and 756m levels.

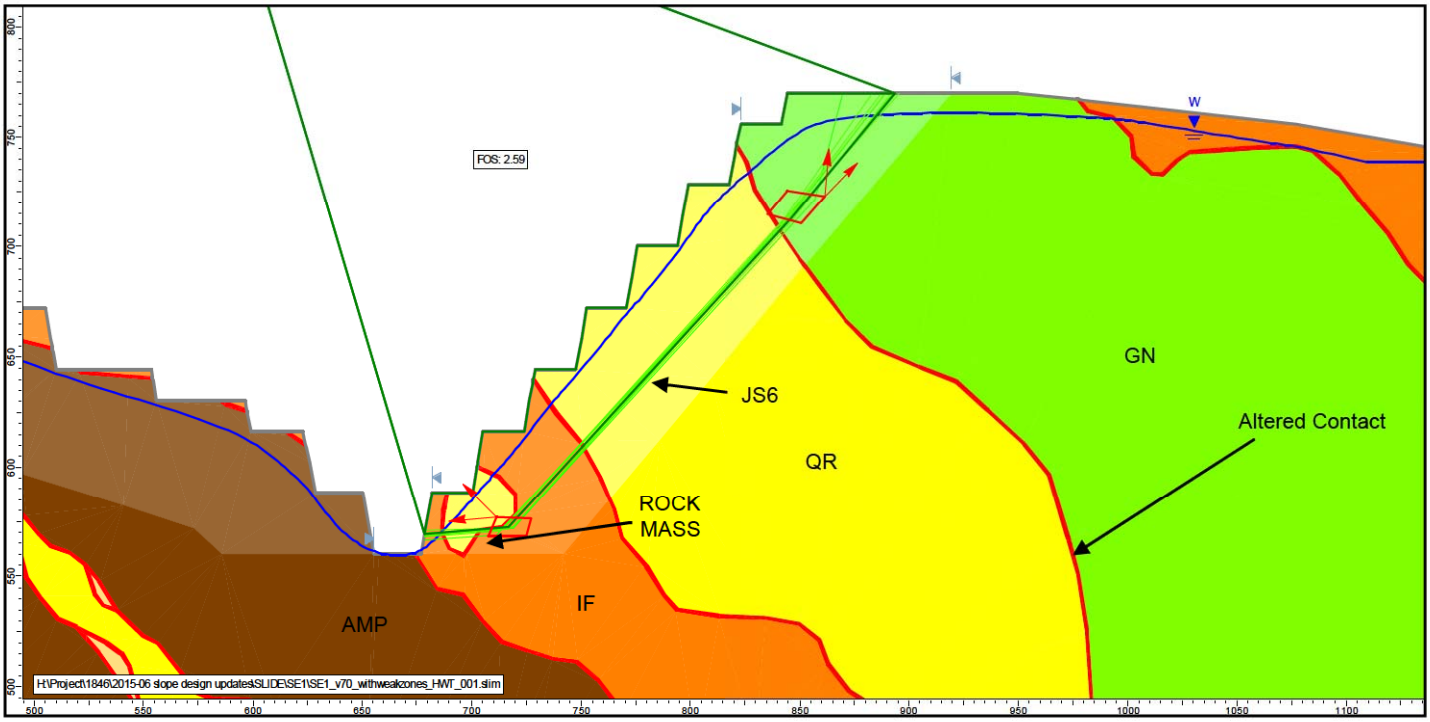


Fig. G17: Section I-SE1 – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 2.59 between the 560 and 770m levels.

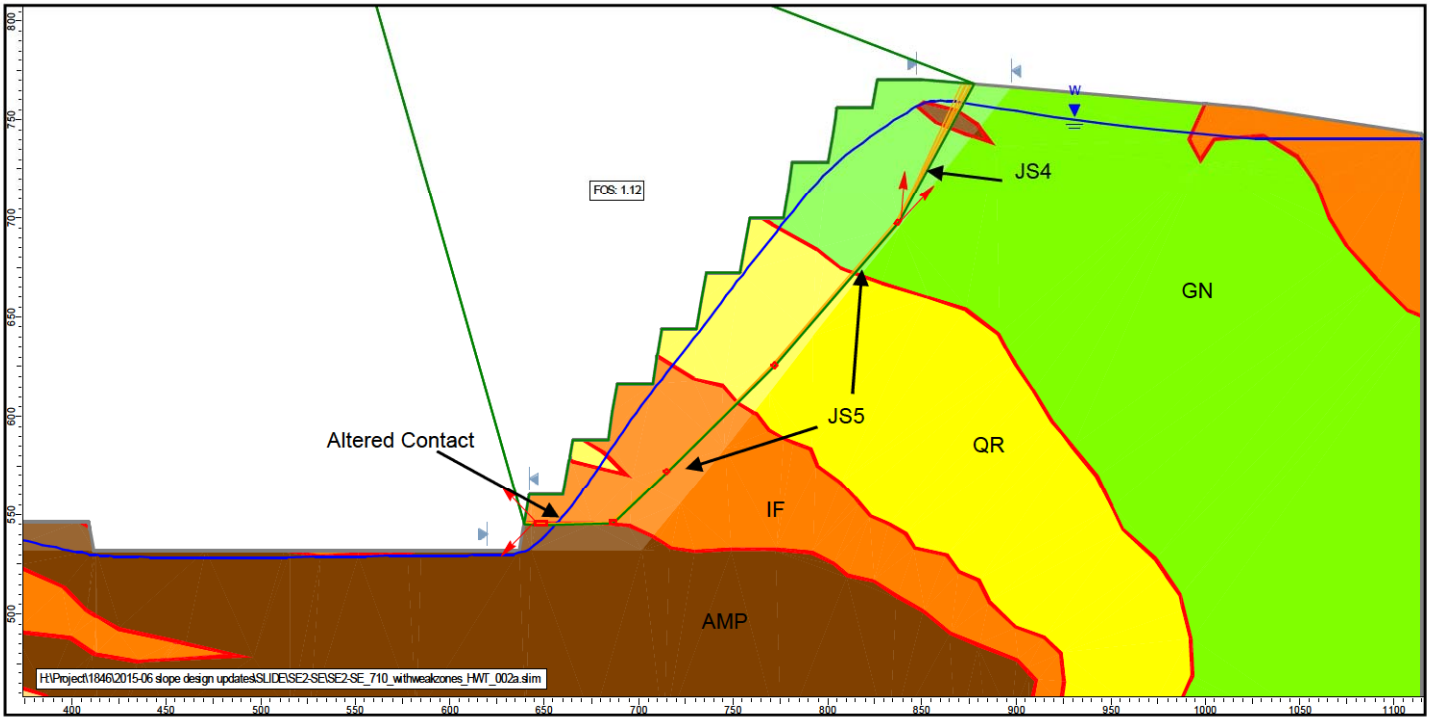


Fig. G18: Section I-SE2/SE – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.12 between the 532 and 770m levels.

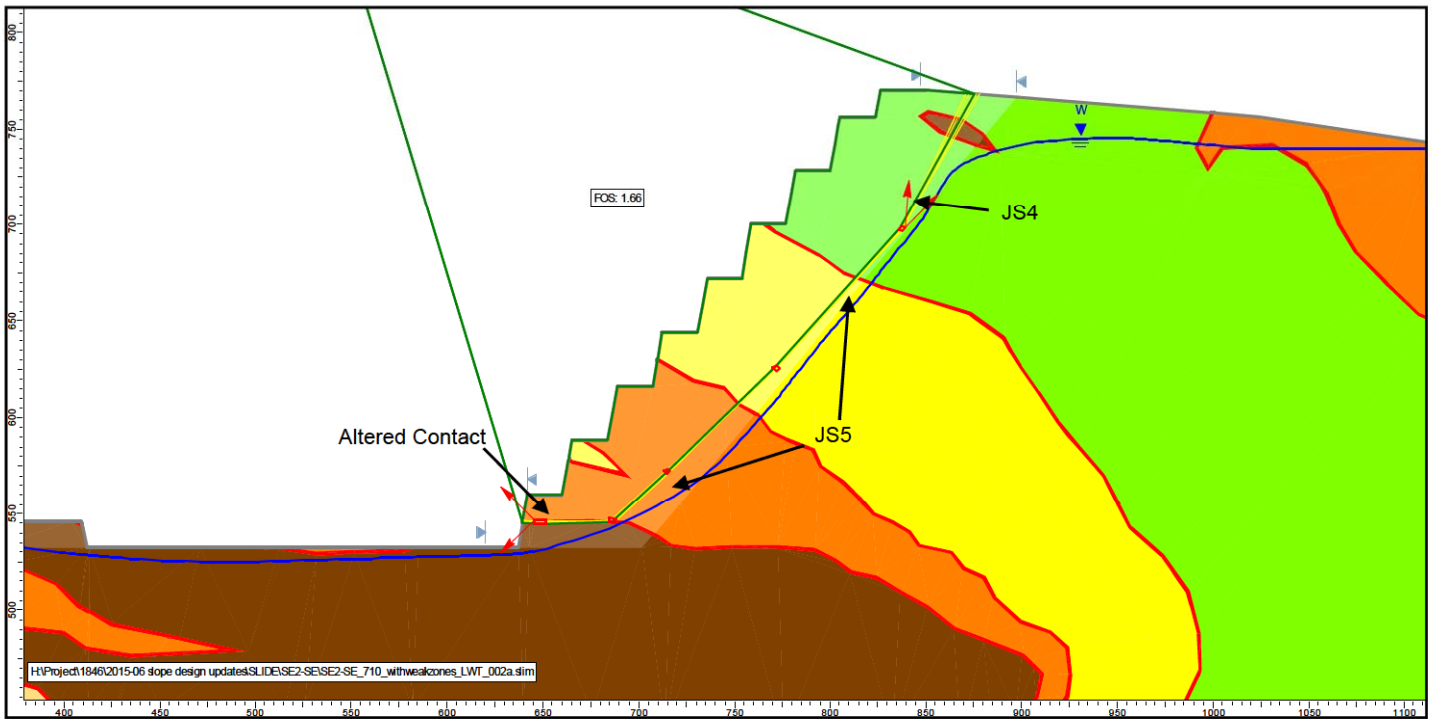


Fig. G19: Section I-SE2/SE – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the augmented depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.66 between the 532 and 770m levels.

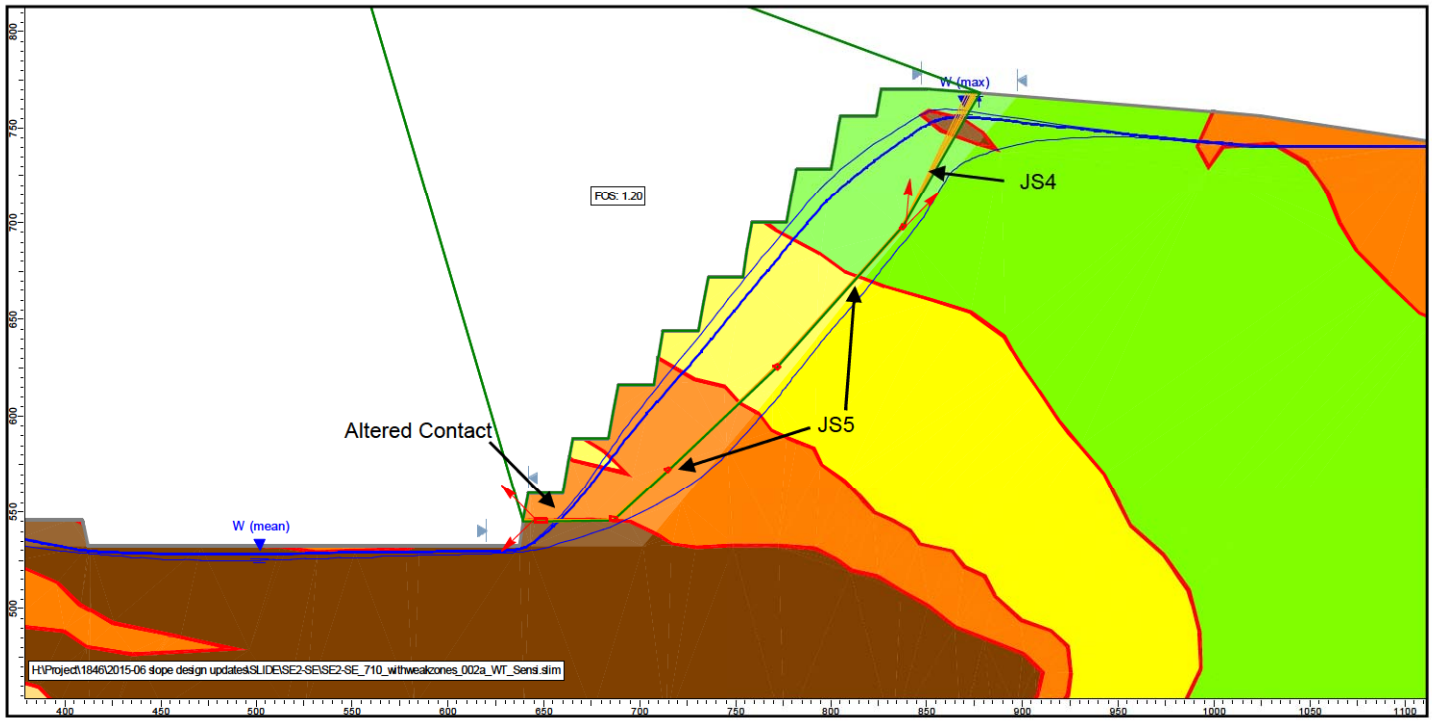


Fig. G20: Section I-SE2/SE – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) assuming 12m of depressurization. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.20 between the 532 and 770m levels.

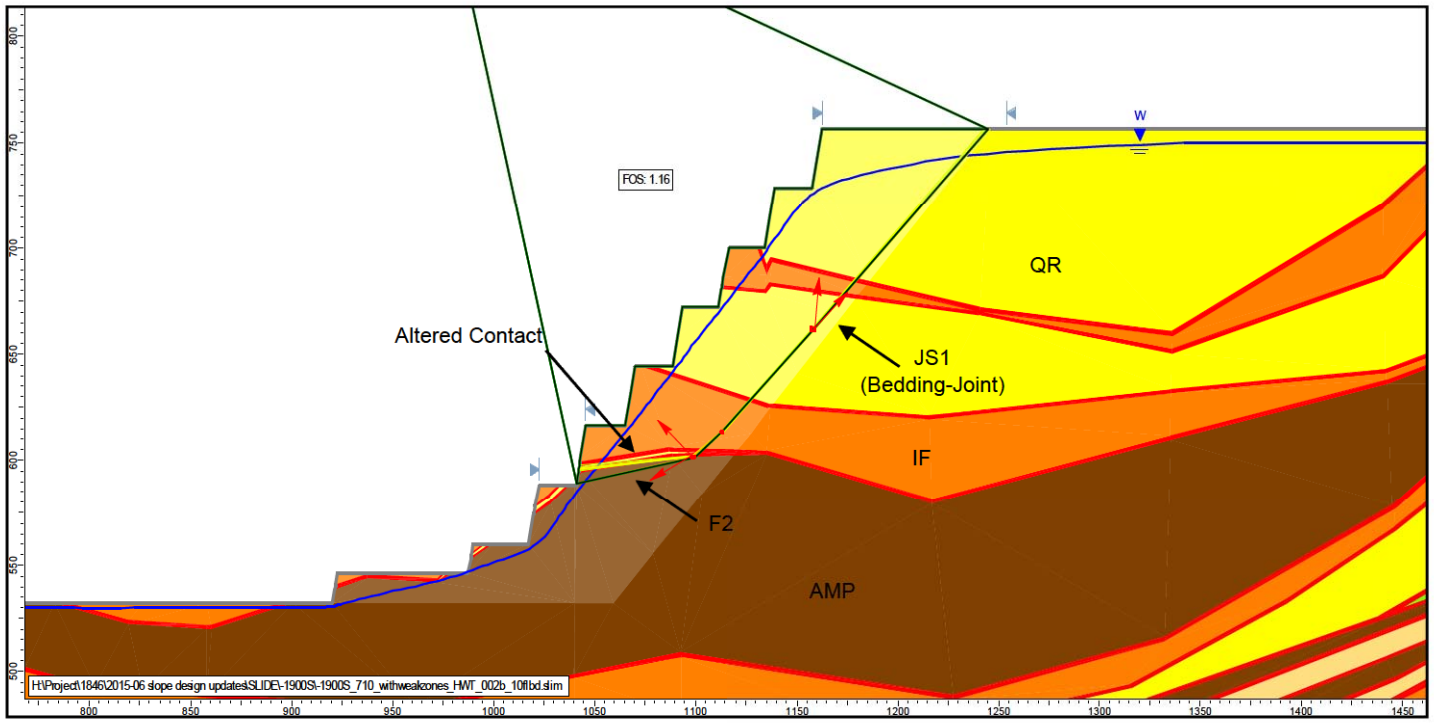


Fig. G21: Section -1900/S – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.16 between the 588 and 756m levels.

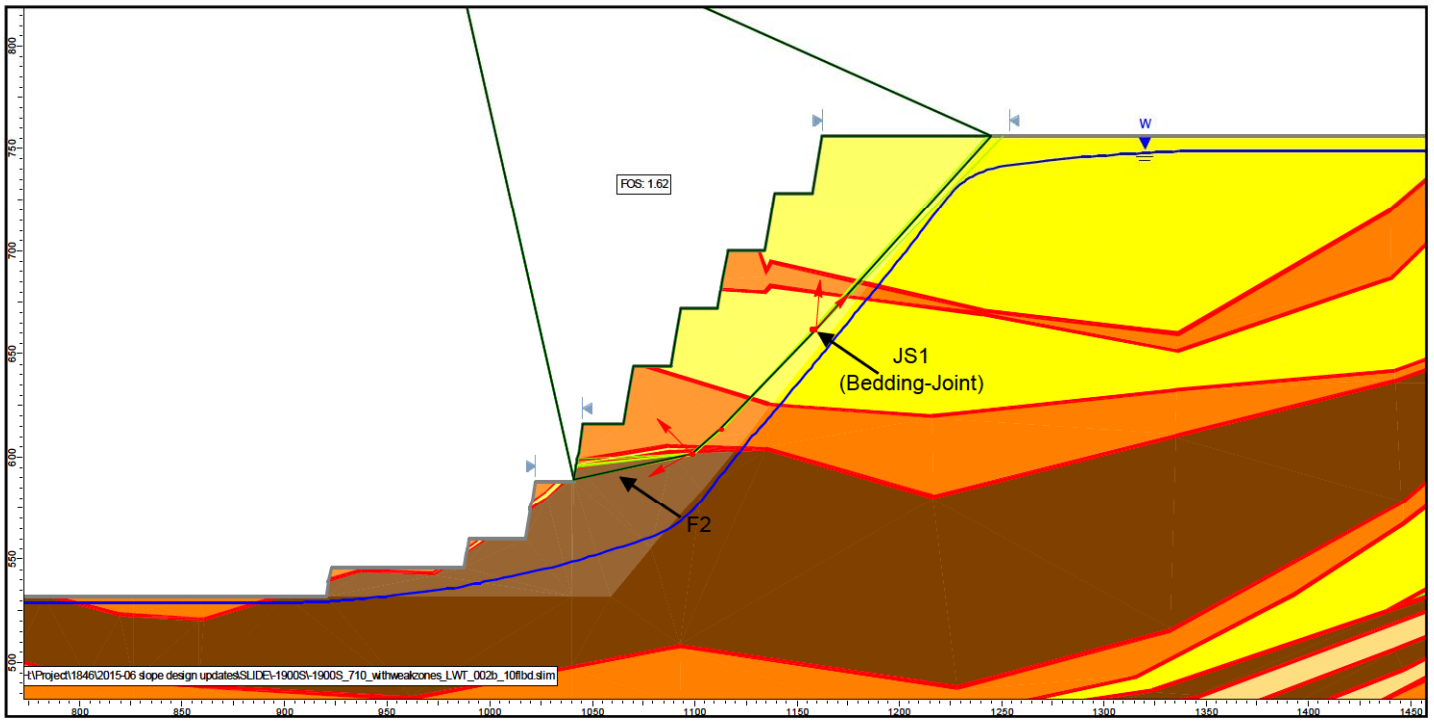


Fig. G22: Section -1900/S – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the augmented depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.62 between the 588 and 756m levels.

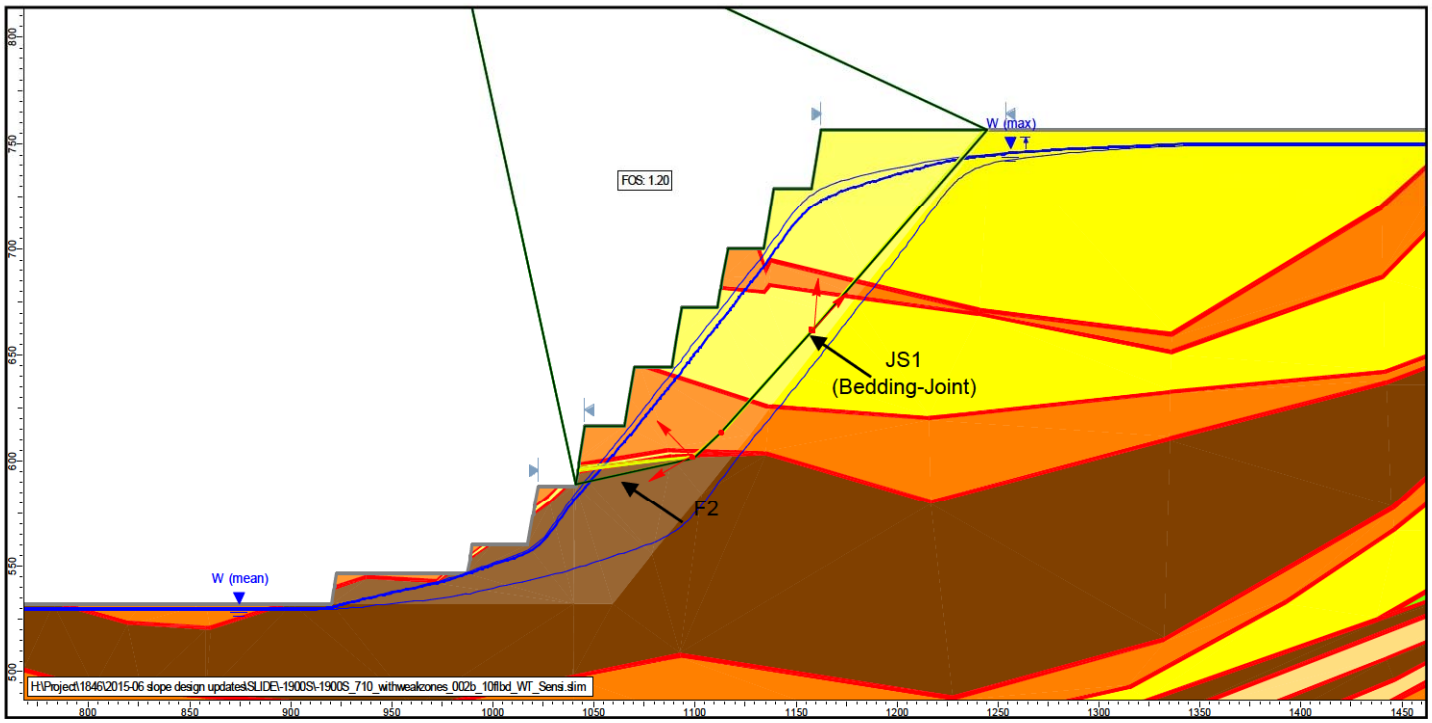


Fig. G23: Section -1900/S – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) assuming 13m of depressurization. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.20 between the 588 and 756m levels.

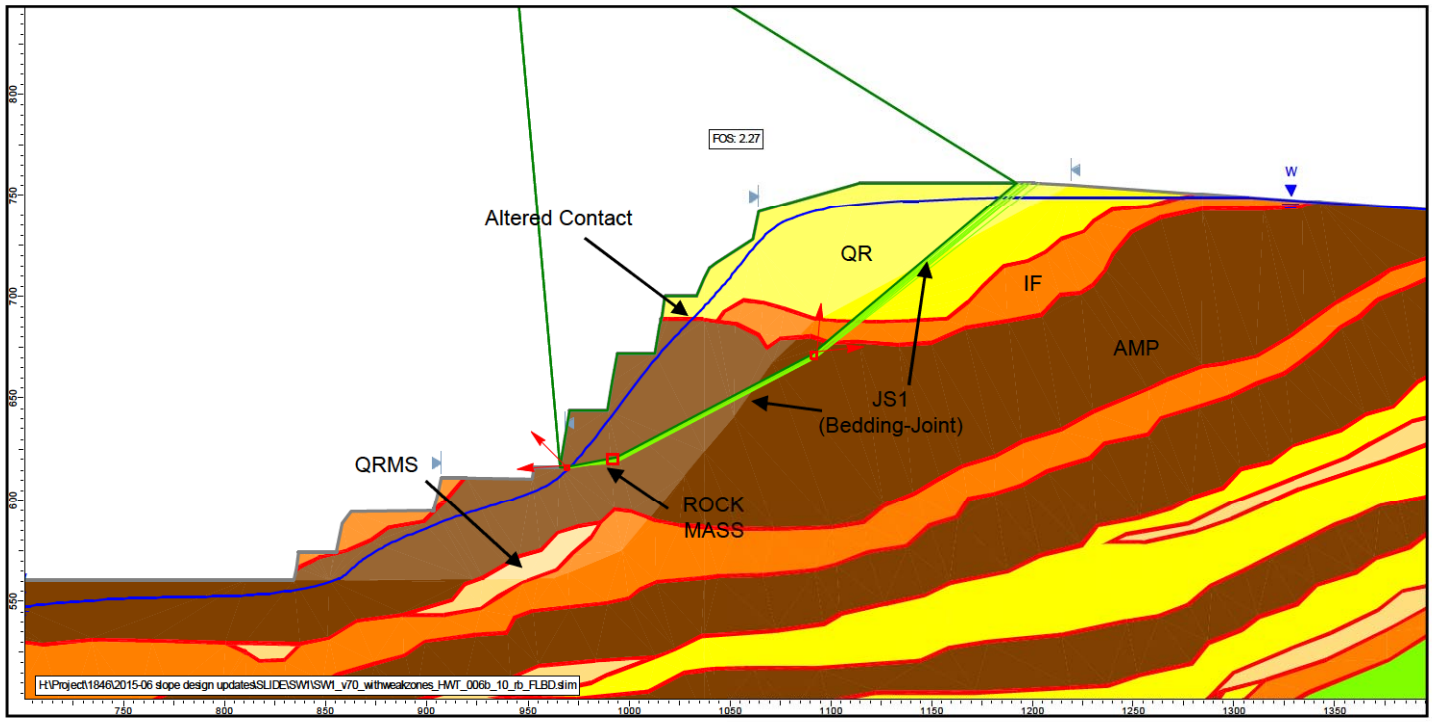


Fig. G24: Section SW1 – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 2.27 between the 616 and 756m levels.

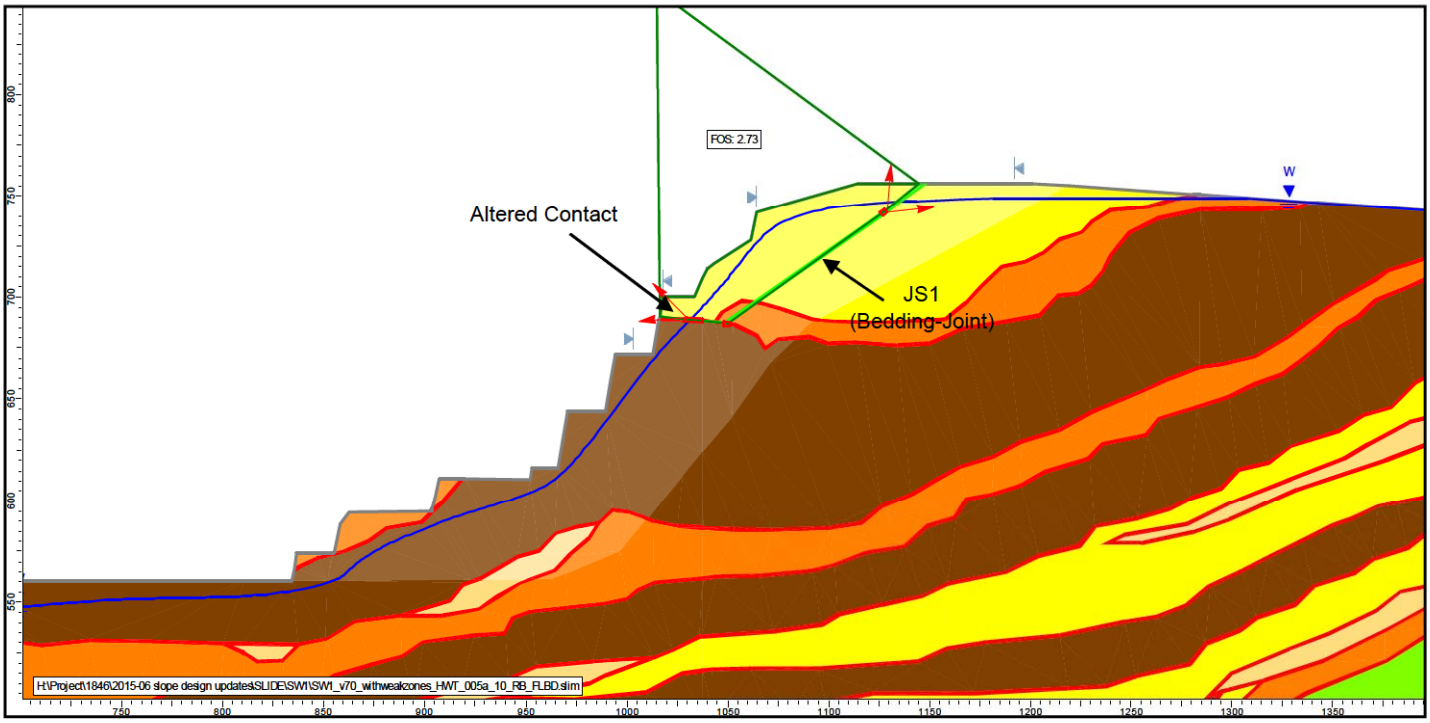


Fig. G25: Section SW1 – Anisotropic Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 2.73 between the 672 and 756m levels.

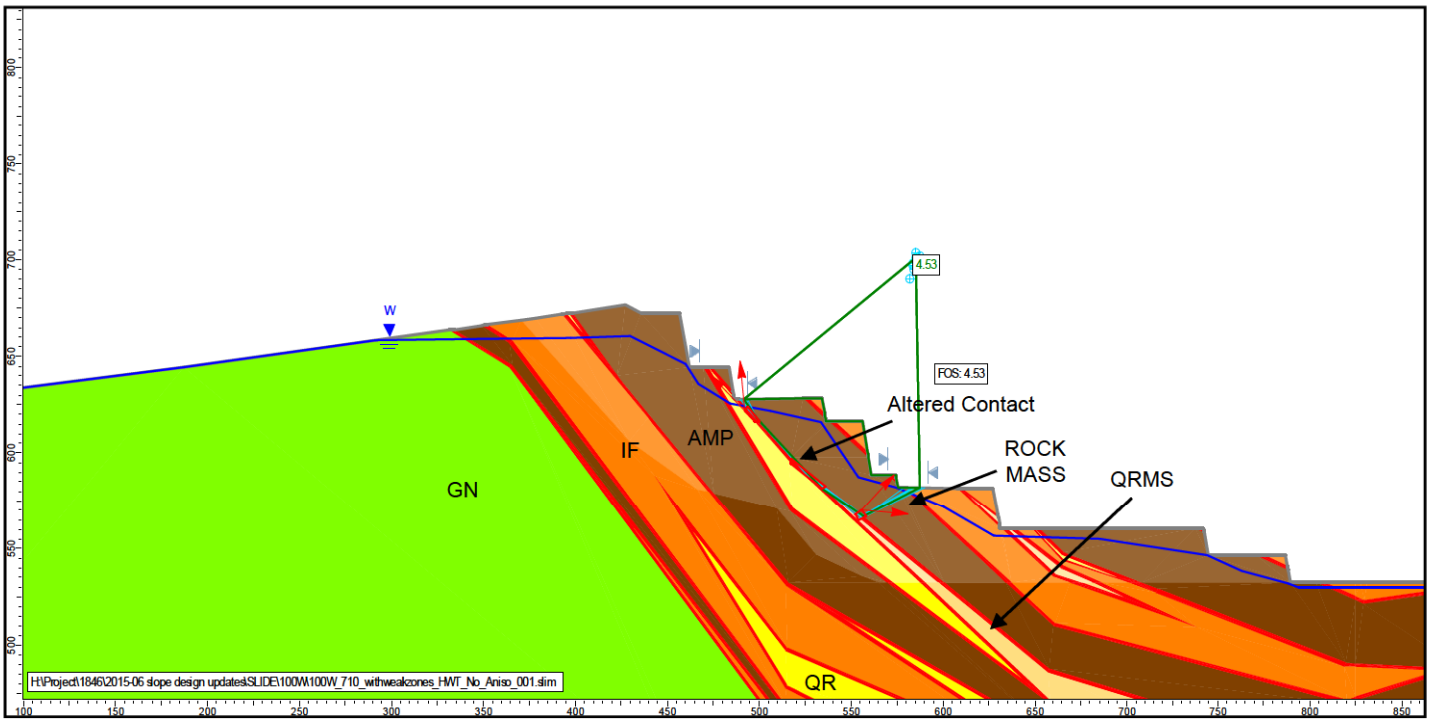


Fig. G26: Section 100W - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 4.53 between the 582 and 628m levels.

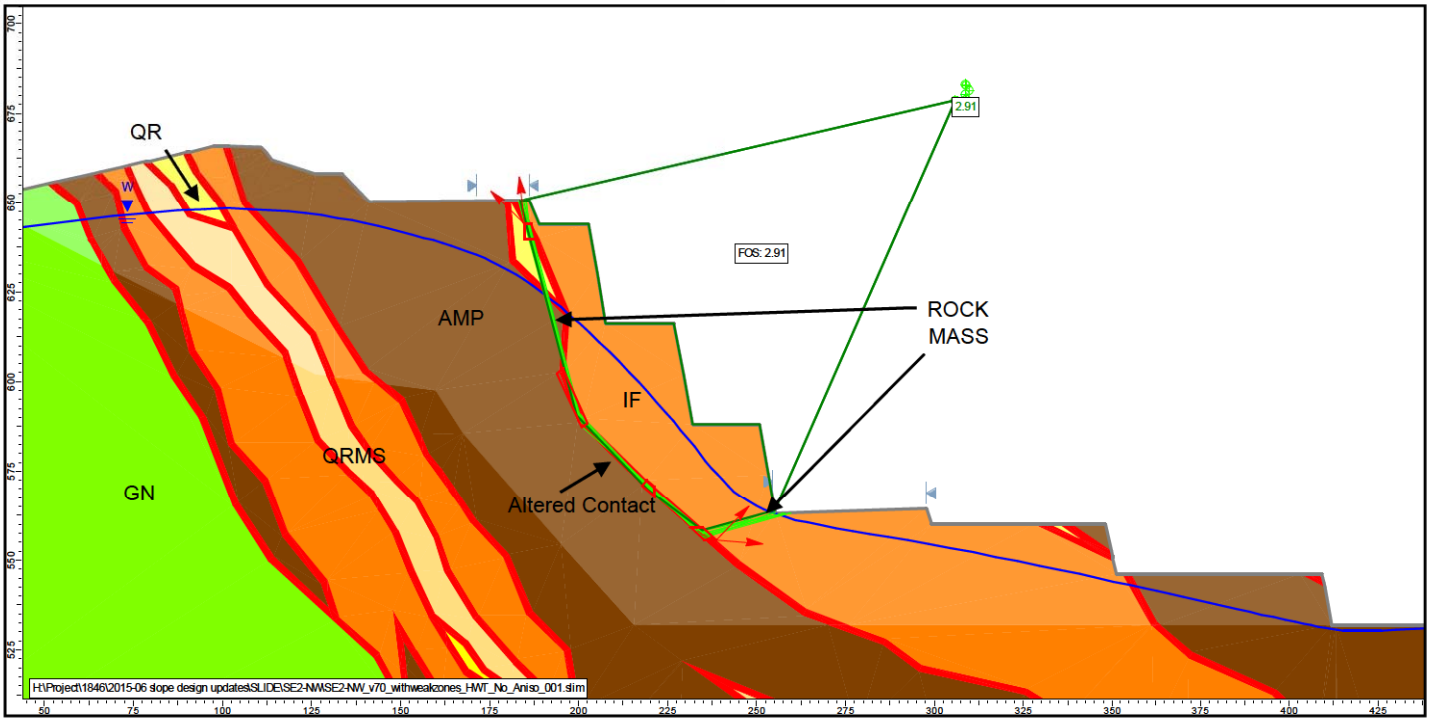


Fig. G27: Section I-SE2/NW - Slide analysis of the Pit Irène Mine Plan (v7.0) for the passive depressurization case. Minimum FoS = 2.91 between the 564 and 650m levels.

ANALYSIS OF OPTIMIZED SLOPES FOR PIT IRÈNE

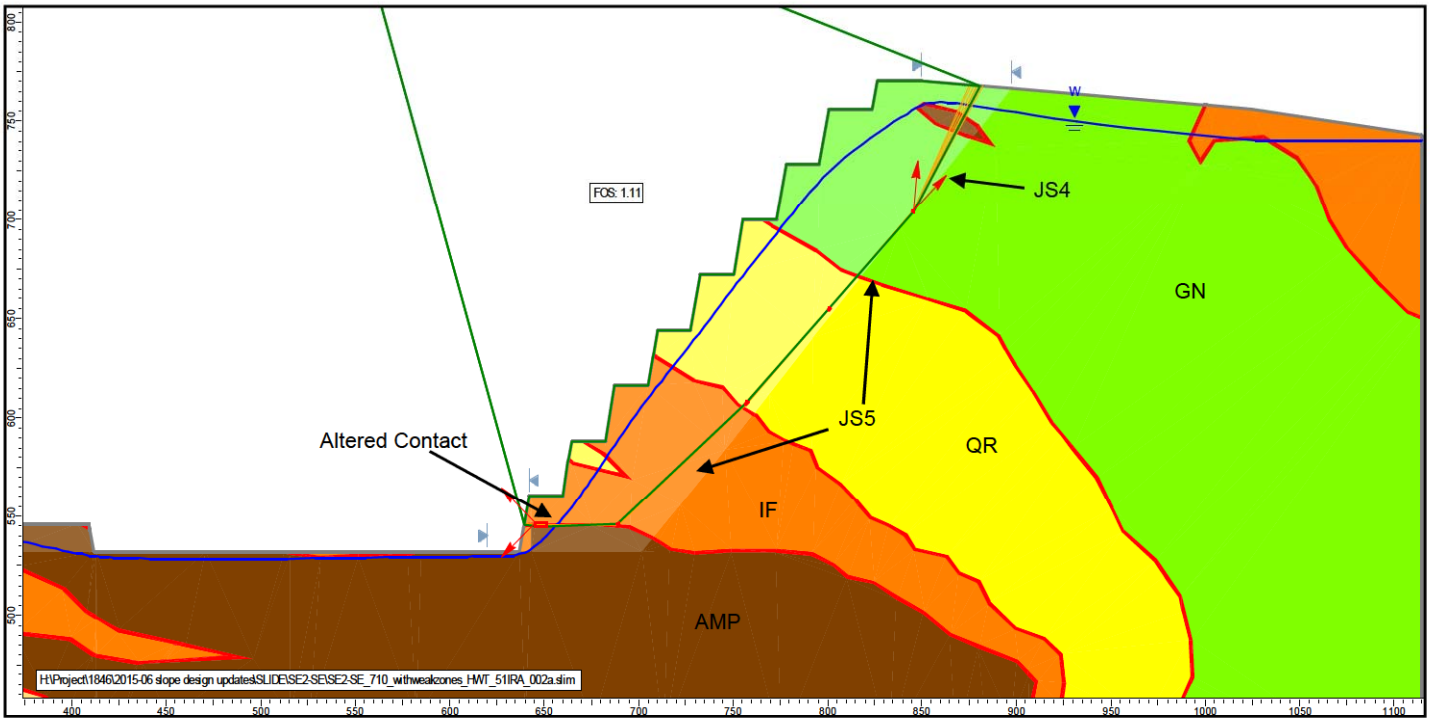


Fig. G28: Section I-SE2/SE – Anisotropic Slide analysis of optimized slopes at 51° IRA for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.11 between the 532 and 770m levels.

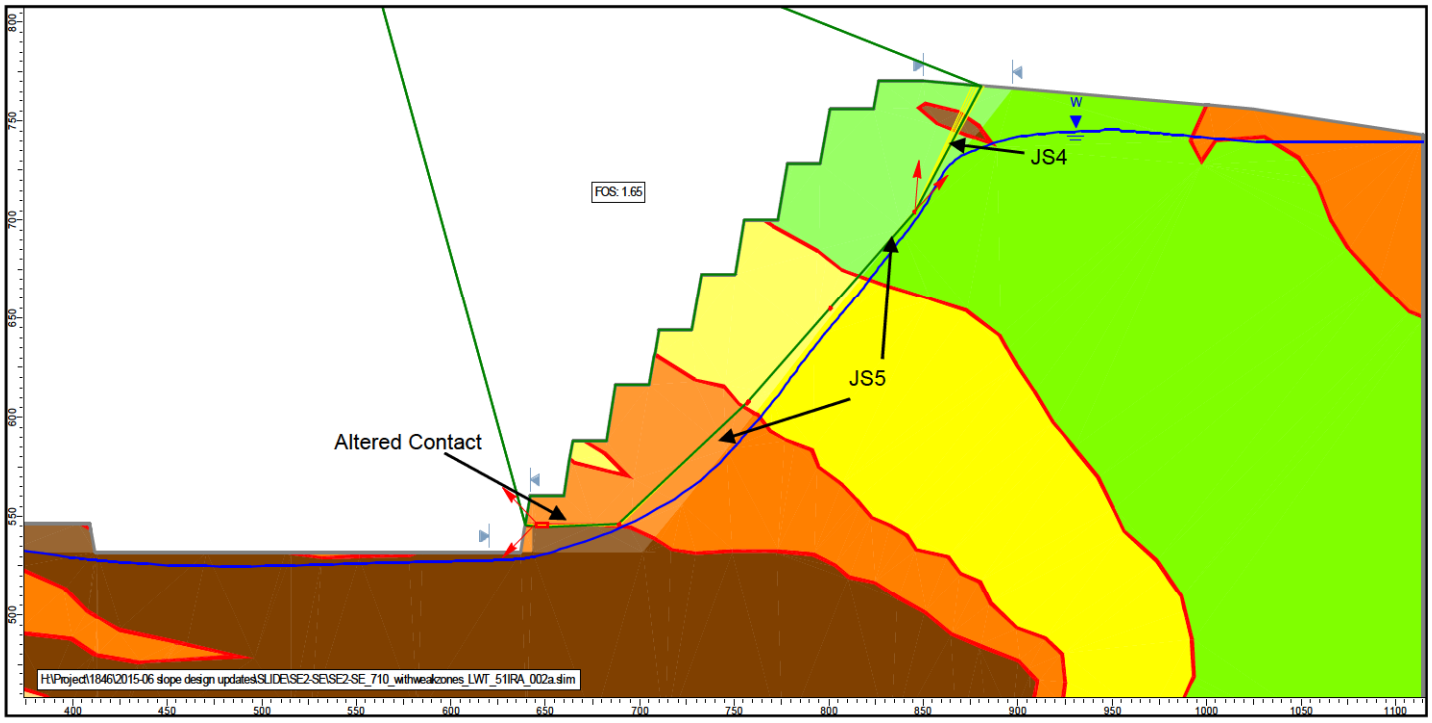


Fig. G29: Section I-SE2/SE – Anisotropic Slide analysis of optimized slopes at 51° IRA for the augmented depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.65 between the 532 and 770m levels.

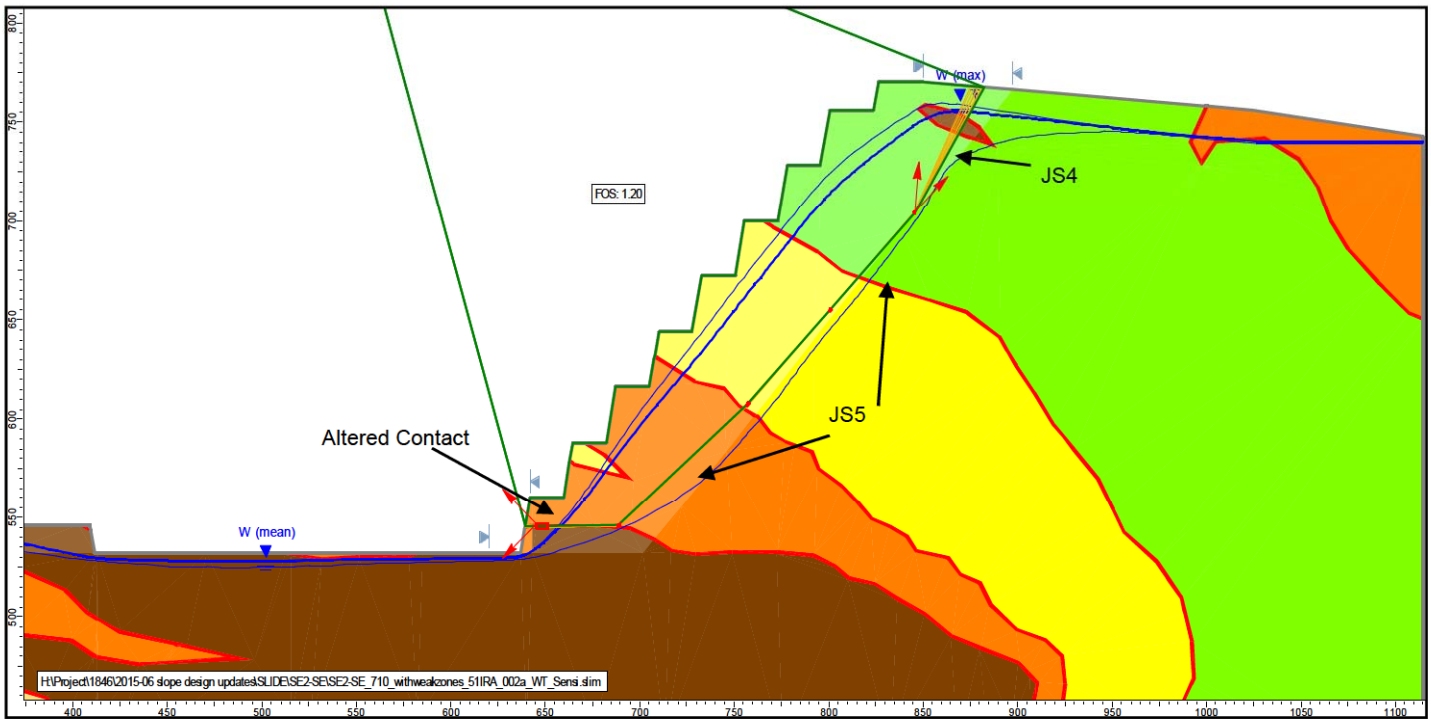


Fig. G30: Section I-SE2/SE – Anisotropic Slide analysis of optimized slopes at 51° IRA assuming 12m of depressurization. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.20 between the 532 and 770m levels.

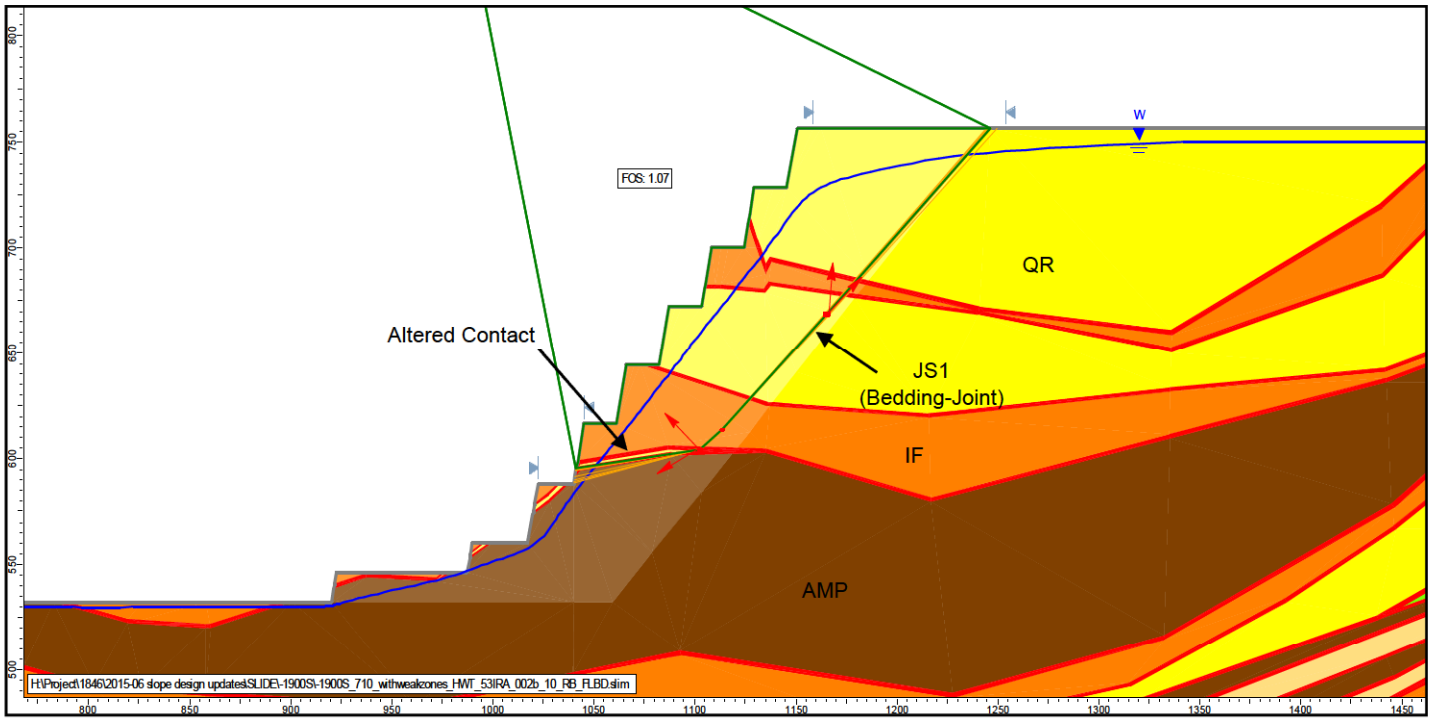


Fig. G31: Section -1900/S – Anisotropic Slide analysis of optimized slopes at 53° IRA for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.07 between the 588 and 756m levels.

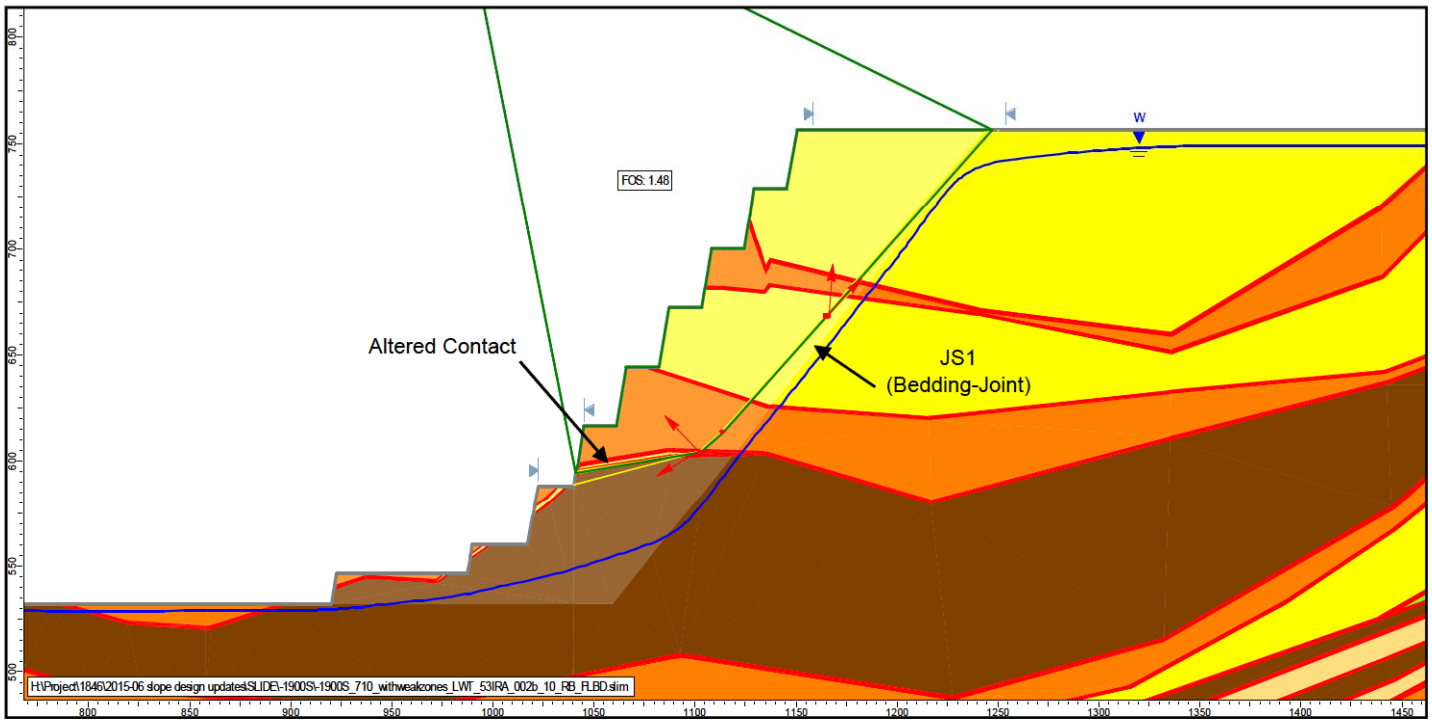


Fig. G32: Section -1900/S – Anisotropic Slide analysis of optimized slopes at 53° IRA for the augmented depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.48 between the 588 and 756m levels.

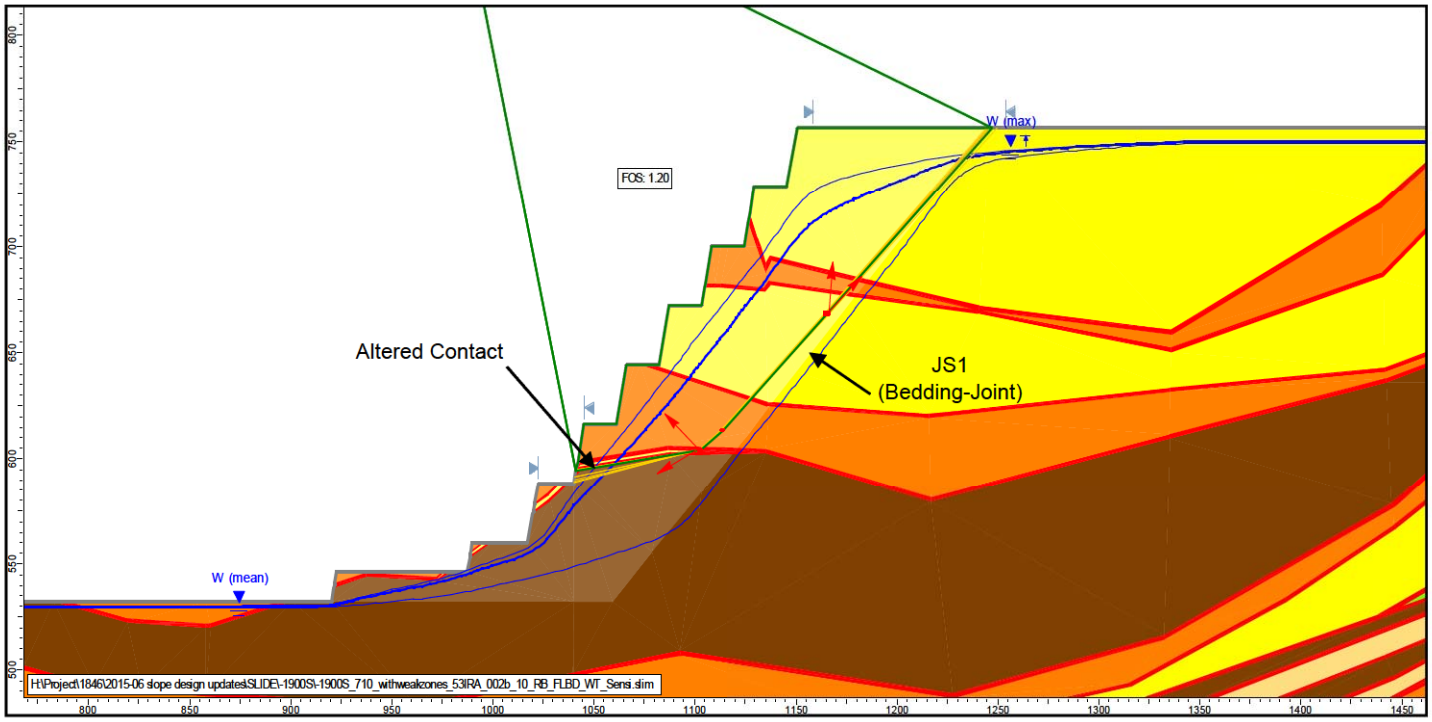


Fig. G33: Section -1900/S – Anisotropic Slide analysis of optimized slopes at 53° IRA assuming 31m of depressurization. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 1.20 between the 588 and 756m levels.

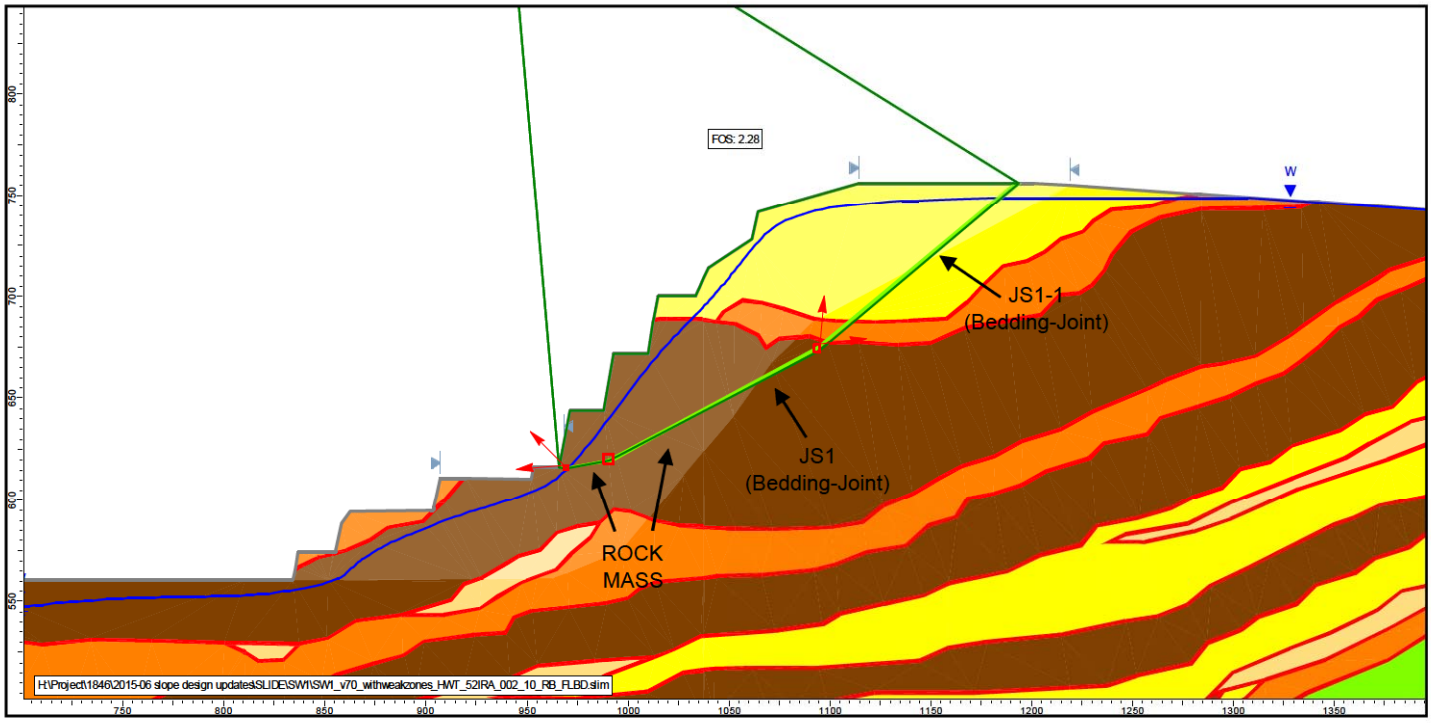


Fig. G34: Section SW1 – Anisotropic Slide analysis of optimized slopes at 52° IRA for the passive depressurization case. Rock bridge proportions of 10% for bedding-joints and faults, and 20% for joints. Minimum FoS = 2.28 between the 616 and 756m levels.

ANNEXE

F-3 *PLAN 3-1 À 3-3*

CANAL MOGRIDGE

H1

PETER POND

MONT SURVIE

H17

PAUL'S PEAK

VERSANT NORD

VERSANT SUD

H2

H3

H4

H5

H6

SOUTH HILL

H9

H14

H15

H13

FOSSE A

FOSSE B

FOSSE C

FOSSE C'

A

A'

B

B'

C

C'

D

D'

E

E'

N

0 600 1200 m

ArcelorMittal

Plan de restauration - Installations de la mine du Mont-Wright
Mise à jour 2017

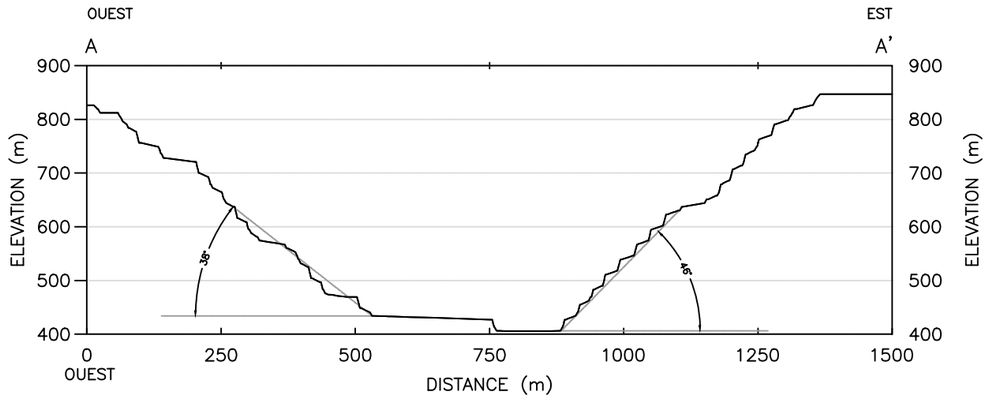
FIGURE 3-1
PLAN DES FOSSES D'EXPLOITATION AN 2045 - LOCALISATION DES COUPES

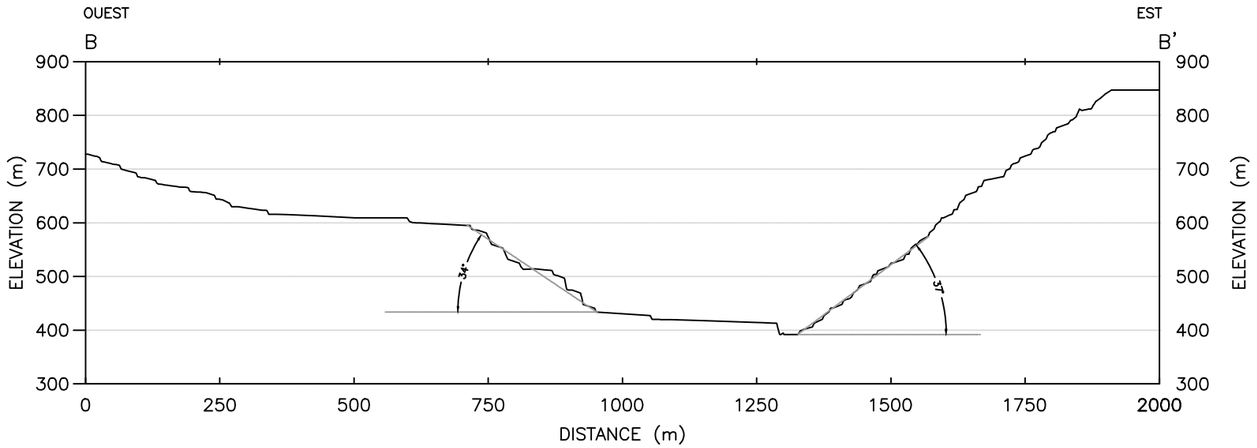
Source :
CO_PLC15C_R0_2039-45.dxf

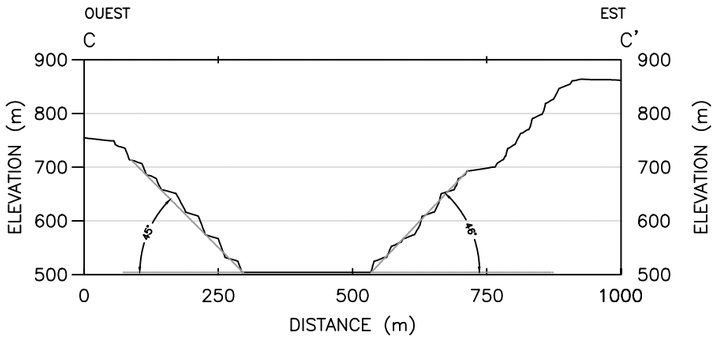
		Date
Dessiné par	P.Côté	2017-10-18
Vérifié par	V.Fortin	2017-10-18
Approuvé par	V.Fortin	2017-10-18
Fichier	171-04264-00-PR_f3_1_wspq_171018.dwg	

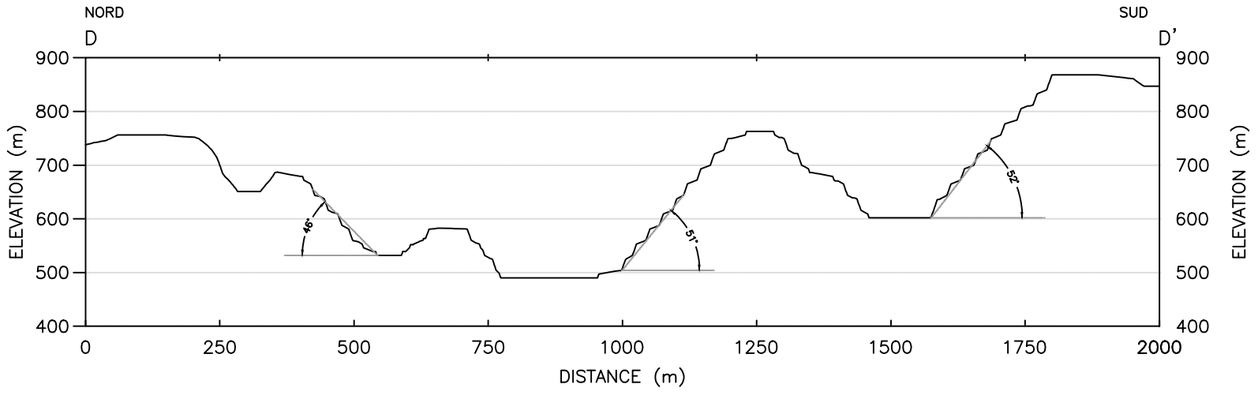
wsp

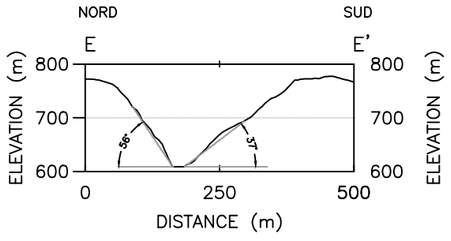
Ansi A-PRJ, N:\2014\141_15758_00_Projet_2045_AMEM\Mont_Wright\Produits\171_04264_00_PL_Plan_restauration\CAD\171-04264-00-PR_f3_1_wspq_171019.dwg, 2017-10-20 08:02:18











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Plan de restauration - Installations de la mine du Mont-Wright
Mise à jour 2017

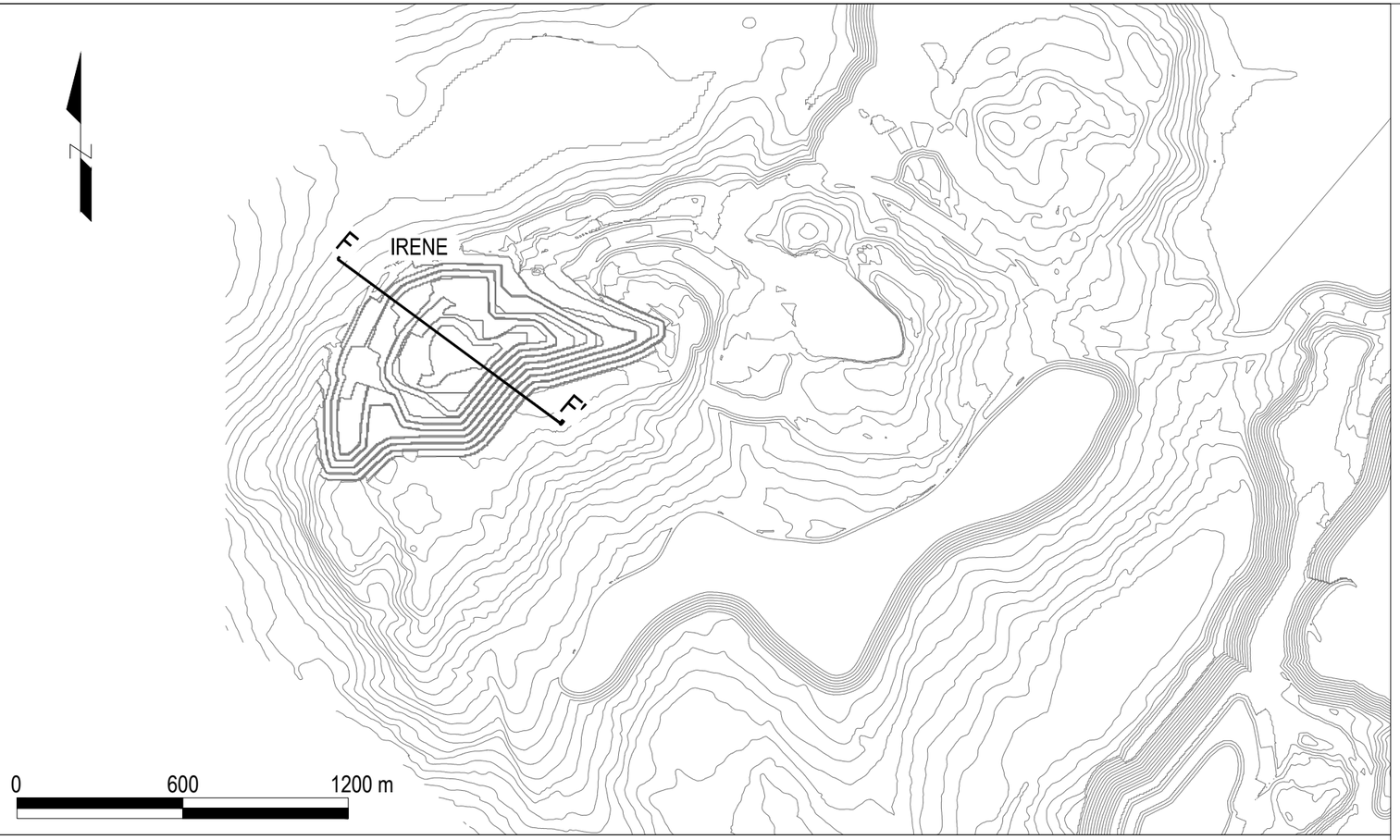
FIGURE 3-2
COUPES DES FOSSE D'EXPLOITATION AN 2045 -

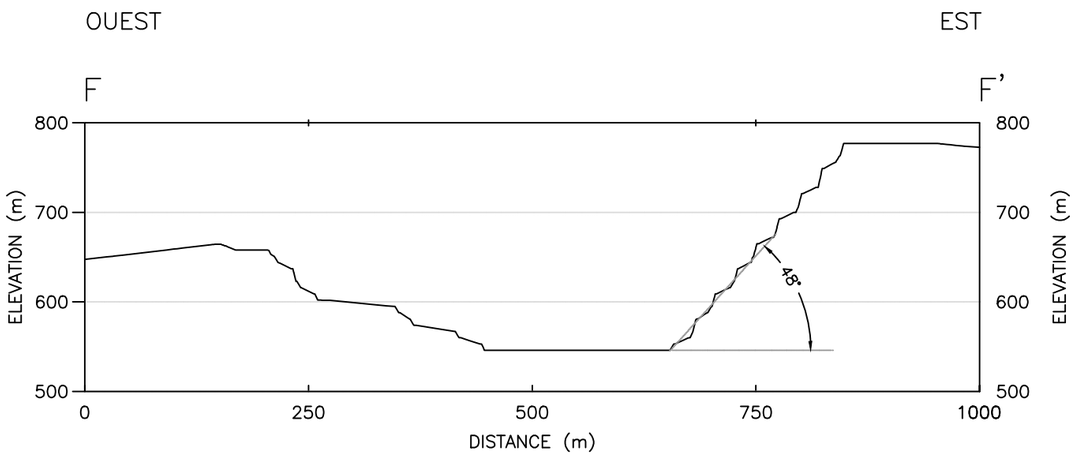
Source :
CO_PLC15C_R0_2039-45.dxf

		Date
Dessiné par	P.Côté	2017-10-18
Vérifié par	V.Fortin	2017-10-18
Approuvé par	V.Fortin	2017-10-18
Fichier	171-04264-00-PR_f3_1_wspq_171018.dwg	

wsp

Ansi A-PRJ, N:\2014\141_15758_00_Projet_2045_AMEM\Mont_Wright\Produits\171_04264_00_PL_Plan_restauration\CAD\171-04264-00-PR_f3_1_wspq_171019.dwg, 2017-11-16 16:39:20





ArcelorMittal

Plan de restauration - Installations de la mine du Mont-Wright
Mise à jour 2017

FIGURE 3-3
COUPE DE LA FOSSE D'EXPLOITATION IRENE AN 2045 -

Source :
CO_PLC15C_R0_2039-45.dxf

		Date
Dessiné par	P.Côté	2017-10-18
Vérifié par	V.Fortin	2017-10-18
Approuvé par	V.Fortin	2017-10-18
Fichier	171-04264-00-PR_f3_1_wspq_171018.dwg	

wsp

ANNEXE

G

PLANS – AMEM



Chemin d'accès

ArcelorMittal

Plan de restauration - Installations de la mine du Mont-Wright
Mise à jour 2017

Chemins d'accès

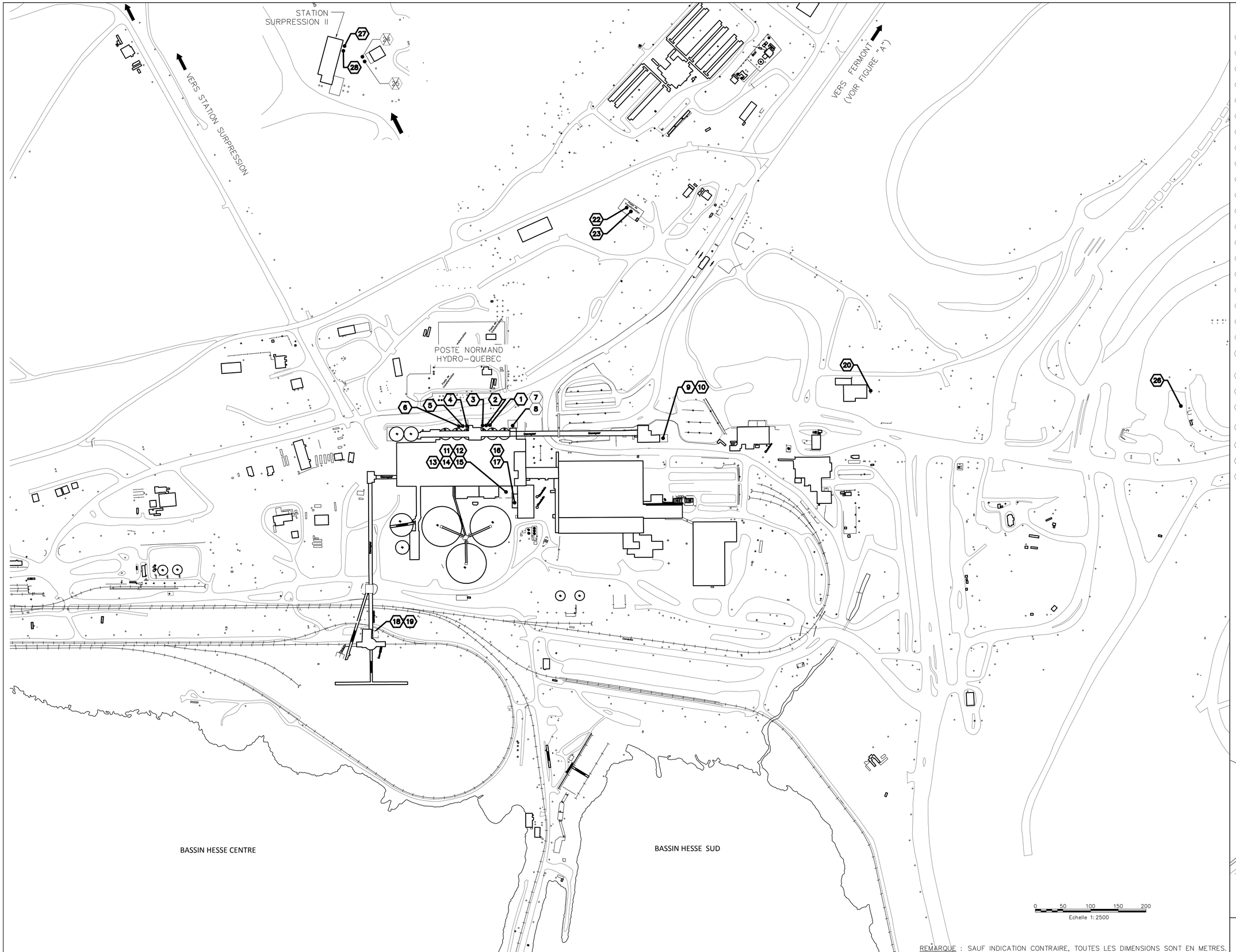
0 0,5 1 1,5 km
UTM, fuseau 19, NAD83

Source :
Ortho-image : Groupe Cadoret, 22 septembre 2015

		Date
Dessiné par	*J.-M. Tremblay*	*14-12-2017*
Vérifié par	*V.Fortin*	*14-12-2017*
Approuvé par	*M-C.Dion-St-Pierre*	*14-12-2017*
Fichier	171_04264_00_PR_ann_ch_acces_wspq_171214.mxd	

wsp

Projet : 171-04264-00



LISTE DES TRANSFORMATEURS

1. = TRANSFORMATEUR TR01, 10MVA (SILO NO 1)
2. = TRANSFORMATEUR TR02, 10MVA (SILO NO 2)
3. = TRANSFORMATEUR TR03, 10MVA (SILO NO 3)
4. = TRANSFORMATEUR TR04, 10MVA (SILO NO 4)
5. = TRANSFORMATEUR TR05, 10MVA (SILO NO 5)
6. = TRANSFORMATEUR TR06, 10MVA (SILO NO 6)
7. = TRANSFORMATEUR TR15, 15MVA (SILO NO 1)
8. = TRANSFORMATEUR TR16, 15MVA (SILO NO 1)
9. = TRANSFORMATEUR TR81, 8MVA (STATION D'ENTRAINEMENT)
10. = TRANSFORMATEUR TR82, 8MVA (STATION D'ENTRAINEMENT)
11. = TRANSFORMATEUR TR11, 10MVA (CENTRALE THERMIQUE)
12. = TRANSFORMATEUR TR12, 10MVA (CENTRALE THERMIQUE)
13. = TRANSFORMATEUR TR13, 10MVA (CENTRALE THERMIQUE)
14. = TRANSFORMATEUR TR14, 10MVA (CENTRALE THERMIQUE)
15. = TRANSFORMATEUR TR17, 21MVA (CENTRALE THERMIQUE)
16. = TRANSFORMATEUR TR611, 1.5MVA (CENTRALE THERMIQUE)
17. = TRANSFORMATEUR TR663, 1.5MVA (CENTRALE THERMIQUE)
18. = TRANSFORMATEUR TR83, 5MVA (SILO DE CHARGEMENT)
19. = TRANSFORMATEUR TR84, 5MVA (SILO DE CHARGEMENT)
20. = TRANSFORMATEUR 1MVA (ATELIER DES PNEUS)
21. = TRANSFORMATEUR TR30 1.5MVA (LAC MOGRIDGE) (VOIR FIGURE "A")
22. = TRANSFORMATEUR TR101, 15MVA (POSTE D'ISOLATION)
23. = TRANSFORMATEUR TR102, 15MVA (POSTE D'ISOLATION)
24. = TRANSFORMATEUR TR85, 5MVA (STATION SURPRESSION) HORS SERVICE
25. = TRANSFORMATEUR TR86, 5MVA (STATION SURPRESSION) HORS SERVICE
26. = TRANSFORMATEUR 750KVA (USINE D'AGREGAT)
27. = TRANSFORMATEUR TR87, 5MVA (STATION SURPRESSION II)
28. = TRANSFORMATEUR TR88, 5MVA (STATION SURPRESSION II)

LEGENDE :

○ = POTEAUX ELECTRIQUES

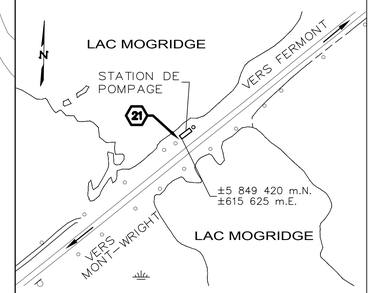


FIGURE "A"

REMARQUE : SAUF INDICATION CONTRAIRE, TOUTES LES DIMENSIONS SONT EN METRES.

DESSINS DE REFERENCE	No	DESSINS DE REFERENCE

No	AA-MM-JJ DATE	REVISIONS	PAR	APPR.
E	17-08-04	MISE A JOUR	NM	JV
D	10-04-01	MISE A JOUR	MCH	
C	07-10-11	MISE A JOUR	FT	DL
B	02-10-07	AJOUT TR101 ET TR102	YP	AB
A	06-11-14	EMIS POUR INFORMATION	FT	JD

No	AA-MM-JJ DATE	REVISIONS	PAR	APPR.

CAHIER DES CHARGES No CMQC: X

DOSSIER No CMQC: X

SCEAU DE L'INGENIEUR
INGENIEUR : X
No DU MEMBRE : X
COMPAGNIE : X
DATE AA-MM-JJ : X

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ECHELLE 1:2500	DATE AA-MM-JJ
SIGNATURES	NOMS
PROJETE PAR : JACQUES DUVAL	95-10-31
DESSINE PAR : FERNAND TREMBLAY	95-10-31
VERIFIE PAR : JACQUES DUVAL	95-11-06
APPROUVE PAR :	

MONT-WRIGHT CONCENTRATEUR & INSTALLATIONS DIVERSES

AGENCEMENT DU COMPLEXE

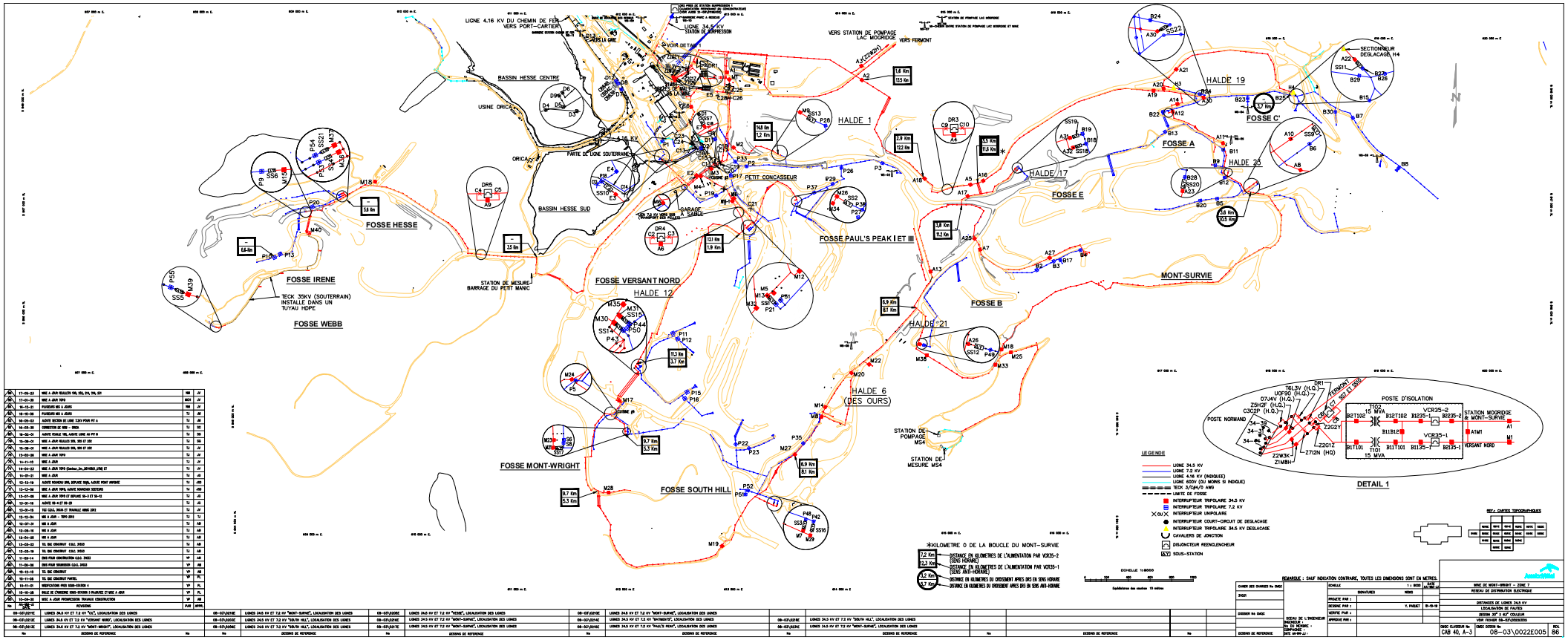
ENVIRONNEMENT, PLAN DE RESTAURATION

TRANSFORMATEURS ET LIGNES ELECTRIQUES

CMQC CLASSEUR No	CMQC DESSIN No	REV.
B-2	21-01\0013C	E

	Transformateur à l'huile (extérieurs de la mine)		
	Description	**Poids (Kg)**	**Utilisation**
1	Transfo TR611/Centrale thermique (1998)	2 427	Concentration
2	Transfo TR663/Centrale thermique	4 763	Concentration
3	Transfo Sub 1/Paul's Peak - SS1	13 227	Extraction
4	Transfo Sub 2/Paul's Peak - SS2	11 775	Extraction
5	Transfo Sub 3/South Hill - SS3	11 775	Extraction
6	Transfo Sub 4/Irène - SS4	12 655	Extraction
7	Transfo Sub 5/Irène -SS5	13 227	Extraction
8	Transfo Sub 6/Irène -SS6	11 775	Extraction
9	Transfo Sub 7/Bureaux de la mine (cuisine 3) -SS7	10 691	Extraction
10	Transfo Sub 8 /Réserve -SS8	11 775	Extraction
11	Transfo Sub 9 /Mont-Survie -SS9	11 775	Extraction
12	Transfo Sub 10 Entrée de la mine -SS10	11 775	Extraction
13	Transfo 1.5 MVA/Mogridge-TR-30	4 354	Concentration
14	Transfo 1 Sub 11/Mont-Survie (Fosse C) -SS11	35 221	Extraction
15	Transfo Fosse B -SS12	27 176	Extraction
16	Transfo Chemin (entrée) des fosses A,E,C - SS13	27 176	Extraction
17	Transfo Versant Nord -SS14	27 176	Extraction
18	Transfo Versant Nord -SS15	27 176	Extraction
19	Transfo South Hill -SS16	27 176	Extraction
20	Transfo - Fosse Mont-Wright - SS17	27 176	Extraction
21	Transfo Fosse E -SS18	27 176	Extraction
22	Transfo Fosse E -SS19	27 176	Extraction
23	Transfo Mont-Survie -SS20	15 975	Extraction
24	Transfo Irène -SS21	27 176	Extraction
25	Transfo A-SS22	27 176	Extraction
26	Transfo TR1/Silo 1	19 164	Concentration
27	Transfo TR1/Silo 2	19 164	Concentration
28	Transfo TR1/Silo 3	19 164	Concentration
29	Transfo TR1/Silo 4	19 164	Concentration
30	Transfo TR1/Silo 5	19 164	Concentration
31	Transfo TR1/Silo 6	19 164	Concentration
32	Transfo TR11/Centrale thermique	23 269	Concentration
33	Transfo TR12/Centrale thermique	23 269	Concentration
34	Transfo TR13/Centrale thermique	20 956	Concentration
35	Transfo TR14/Centrale thermique	23 269	Concentration
36	Transfo TR15/Silo 1	34 019	Concentration
37	Transfo TR16/Silo 2	34 019	Concentration
38	Transfo TR17/Centrale thermique	19 793	Concentration
39	Transfo TR81/Station mécanique d'entraînement	16 783	Extraction
40	Transfo TR82/Station mécanique d'entraînement	16 783	Extraction
41	Transfo TR83/Chargement extérieur	12 474	Concentration
42	Transfo TR84/Chargement extérieur	12 474	Concentration
43	Transfo TR101/Poste d'Isolation	43 800	Extraction
44	Transfo TR102/Poste d'Isolation	43 800	Extraction
45	Transfo TR679/400t	11 535	Autre

46	Transfo TR680/400t	11 535	Autre
47	Transfo TR87/Surpression	25 181	Concentration
48	Transfo TR88/Surpression	25 181	Concentration
	Transformateur à l'huile (à l'intérieur)		
	Transfo TR 22 /Ligne 7	27 670	Concentration
	Transfo TR 22 /Ligne 7	27 670	Concentration



No	REVISIONS	PAR	APPR.
AA\	17-09-23	MISE A JOUR ISOLATEURS 138, 202, 204, 206, 221	MM	JF
AB\	17-09-26	MISE A JOUR TEPO	MCH	JF
AC\	18-10-21	FUSIBLES MIS A JOURS	TM	JF
AD\	18-10-30	FUSIBLES MIS A JOURS	TJ	JG
AE\	18-05-03	AJOUT SECTEUR DE LIGNE 138V POUR PT A	TJ	JG
AF\	18-05-30	CORRECTION DE NOM — BRIDA	TJ	SG
AG\	18-06-01	AJOUT FUSIBLE 100, AJOUT LIGNE 46 PT B	TJ	SG
AH\	18-08-24	MISE A JOUR FUSIBLE 200, 250 ET 300	TJ	SG
AI\	18-08-28	MISE A JOUR FUSIBLE 200, 250 ET 300	TJ	JF
AJ\	19-02-28	MISE A JOUR TEPO	TJ	JF
AK\	19-11-13	MISE A JOUR	TJ	JF
AL\	19-04-23	MISE A JOUR TEPO (Fusibles_Jan_28-04-2021_ENG 1)	TJ	JF
AM\	19-07-21	MISE A JOUR	TJ	JG
AN\	19-12-19	AJOUT POSITION DPR, REPLACE 1500, AJOUT POINT HYDRO	TJ	JG
AO\	19-12-26	MISE A JOUR TEPO, AJOUT MORCHAN SECTEURS	TJ	JG
AP\	19-07-09	MISE A JOUR TEPO ET REPLACE 08-31 ET 08-32	TJ	JG
AQ\	19-07-19	AJOUT 08-4 ET 08-29	TJ	JG
AR\	19-06-19	TCC CDU, 2018 ET TRAVAUX HIVER 2021	TJ	JF
AS\	19-12-24	MISE A JOUR — TEPO 2021	TJ	TJ
AT\	19-07-21	MISE A JOUR	TJ	AB
AU\	19-08-18	MISE A JOUR	TJ	AB
AV\	19-04-20	MISE A JOUR	TJ	AB
AW\	19-09-02	TEL QUE CONSTRUIT C.D.C. 2020	TJ	AB
AX\	19-09-19	TEL QUE CONSTRUIT C.D.C. 2020	TJ	AB
AY\	19-09-14	DWG POUR CONSTRUCTION C.D.C. 2021	YP	AB
AZ\	19-06-30	DWG POUR SOUMISSION C.D.C. 2021	YP	FL
BA\	19-10-10	TEL QUE CONSTRUIT	YP	AB
BB\	19-11-08	TEL QUE CONSTRUIT PARTIEL	YP	FL
BC\	19-11-21	MODIFICATIONS POUR 2020-12-08 #	YP	FL
BD\	19-10-28	BOUT DE CÂBLERIE 5000-5700MS À MARQUEE ET MISE A JOUR	YP	FL
BE\	19-09-20	MISE A JOUR PROGRESSION TRAVAUX CONSTRUCTION	YP	AB

No	DESSINS DE REFERENCE	No	DESSINS DE REFERENCE	No	DESSINS DE REFERENCE	No	DESSINS DE REFERENCE	No	DESSINS DE REFERENCE	No	DESSINS DE REFERENCE	No	DESSINS DE REFERENCE
08-03\0021E	LIGNES 34,5 KV ET 7,2 KV "CIL", LOCALISATION DES LIGNES	08-03\0023E	LIGNES 34,5 KV ET 7,2 KV "MONT-SURVIE", LOCALISATION DES LIGNES	08-03\0025E	LIGNES 34,5 KV ET 7,2 KV "CROSS", LOCALISATION DES LIGNES	08-03\0027E	LIGNES 34,5 KV ET 7,2 KV "MONT-SURVIE", LOCALISATION DES LIGNES				
08-03\0022E	LIGNES 34,5 KV ET 7,2 KV "CROSSNET NORD", LOCALISATION DES LIGNES	08-03\0024E	LIGNES 34,5 KV ET 7,2 KV "SOUTH HILL", LOCALISATION DES LIGNES	08-03\0026E	LIGNES 34,5 KV ET 7,2 KV "MONT-SURVIE", LOCALISATION DES LIGNES	08-03\0028E	LIGNES 34,5 KV ET 7,2 KV "PAUL'S PEAK", LOCALISATION DES LIGNES	08-03\0029E	LIGNES 34,5 KV ET 7,2 KV "MONT-SURVIE", LOCALISATION DES LIGNES		

CHANGEMENTS No CHEC	2020
DESSINS No CHEC	
DESSINS DE REFERENCE	

ÉCHELLE	1 : 8000
DIMENSIONS	NOMS
PROJETÉ PAR :	
DESSINÉ PAR :	V. PAQUET
VÉRIFIÉ PAR :	
APPROUVÉ PAR :	

REMARQUE : SAUF INDICATION CONTRAIRE, TOUTES LES DIMENSIONS SONT EN METRES.

BUREAU DE L'INGÉNIEUR PRINCIPAL DU MINISTÈRE DES RICHESSES NATURELLES ET DE LA FAUNE

DATE : 2019-12-20

MINE DE MONT-WRIGHT – ZONE 7	
RÉSEAU DE DISTRIBUTION ÉLECTRIQUE	
VERSANT NORD	
DISTANCES DE LIGNES 34,5 KV	
LOCALISATION DE FAUTES	
DESSIN 30" X 42" COULEUR	
VOIR FICHIER 08-03\0068E05	
DWG CLASSEUR No: CAB 40, A-3	DWG DESSIN No: 08-03\0022E005
REV. 86	

Seule la version électronique du document est officielle.
Toute version papier est non-contrôlée.

CMQC DESSIN No 21-17\0003C002 REV 1

MASSIFS D'ANCRAGE VERTICAUX

MASSIF D'ANCRAGE HORIZONTAL

TTOG DE 30"ø (0.75mø) DE PROTECTION CONÇU POUR PC 640.

TTOG DE 30"ø (0.75mø) DE PROTECTION CONÇU POUR 240T

MASSIF D'ANCRAGE VERTICAL

MASSIF D'ANCRAGE HORIZONTAL

CONCENTRATEUR

ENTREPOT

QUAI

COUR

CONVOYEUR

TRACE DU CHEMIN PROJETE

STATION DE LIBERATION D'AIR ET MASSIF D'ANCRAGE VERTICAL

NOUVELLE LIGNE A EAU 18"ø (0.45mø) PROPOSEE
PROFIL VOIR 21-17\0003C003

LIGNE A EAU 18"ø (0.45mø) EXISTANTE A CONDAMNER

LIGNE A EAU 12"ø (0.30mø) EXISTANTE A CONDAMNER

CABLES DE RACCORDEMENT MALT
REF. DESSIN EXISTANT: 08-03\0022E001
CABLES DE CUIVRE A CHANGER POUR CABLES ISOLES GAINES

RACCORDEMENT ET DETAIL VOIR DESSINS 21-17-3103C ET 21-17\0003C004

BRANCHEMENTS (RACCORDS EN TE) DE 6" (0.15m) VOIR DETAIL SUR DESSIN 21-17\0003C005

POSTE D'ISOLATION

MALT

5 848 200m N.

5 848 000m N.

612 400m E.

612 600m E.

612 800m E.

TF-1 TF-2 TF-3 TF-4 TF-5 TF-6

0+000 0+123 0+100 0+200 0+300 0+400 0+500 0+608

LOCALISATION DU CENTRE-LIGNE DE LA NOUVELLE LIGNE A EAU

DESCRIPTION	CHAINAGE	COORD. EST (m)	COORD. NORD (m)
DEBUT DES TRAVAUX	0+000	612 379.4	5 848 087.2
CASSE (A.H.C.* = 64° A DROITE)	0+123	612 479.9	5 848 158.0
CASSE (A.H.C.* = 25° A GAUCHE)	0+200	612 547.6	5 848 121.2
CASSE (A.H.C.* = 35° A DROITE)	0+488	612 834.7	5 848 103.6
CASSE (A.H.C.* = 20° A GAUCHE) ET RACCORDEMENT	0+608	612 939.7	5 848 046.0

*A.H.C. = ANGLE HORIZONTAL CALCULE

NOTE: TOUS LES ANGLES, CHAINAGES ET COORDONNEES SONT APPROXIMATIFS ET SERONT DETERMINES SUR LE CHANTIER

NOTE:
BASE DU PLAN COMPILEE A PARTIR DE PHOTOGRAPHIES AERIENNES, A L'ECHELLE DE 1:8000, PRISES LE 18 JUILLET 2004. COORDONNEES ET ALTITUDES EN METRES.
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LA COMPAGNIE MINIÈRE QUÉBEC CARTIER
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21-17-3103C	POTABLE WATER SUPPLY PLAN & PROFILE							
21-17-3105C	POTABLE WATER SUPPLY DETAIL							
21-01-3057C	SITE LAYOUT SHEET B							
21-05-3318M	CONCENTRATOR MECHANICAL BUILDING SERVICES							

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1	06-06-16	REVISE POUR CONSTRUCTION	C.L.	J.L.
0	06-05-12	EMIS POUR CONSTRUCTION	C.L.	J.L.
S	06-01-30	EMIS POUR SOUMISSION	C.L.	J.L.
A	06-01-13	EMIS POUR COMMENTAIRES	C.L.	J.L.

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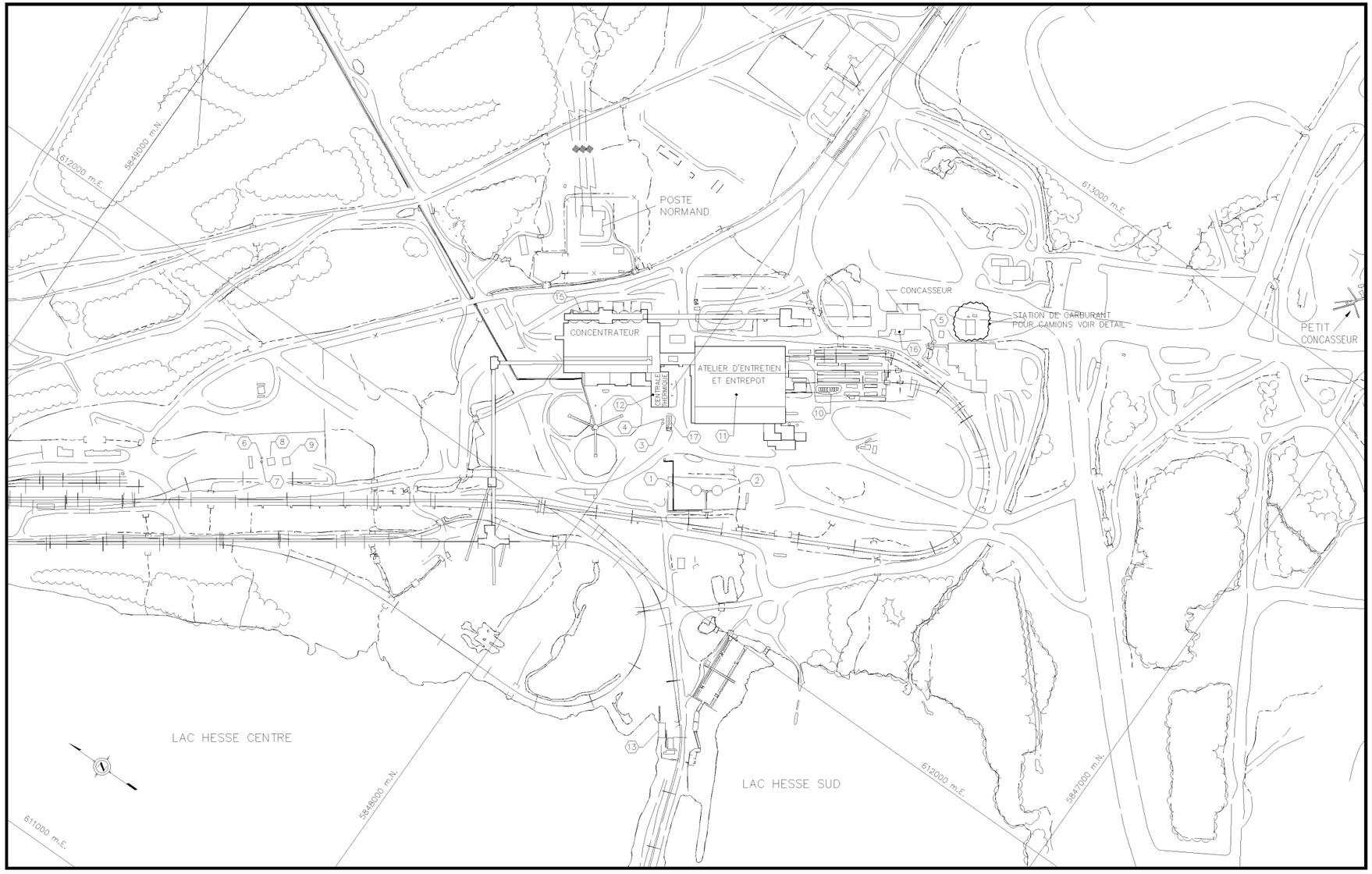
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INGÉNIEUR Claude Bédard 29770 QUÉBEC

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DESSINE PAR :	C. LAPLANTE	06-06-16
VERIFIE PAR :	J. LEMIEUX	06-06-16
APPROUVE PAR :	C. BEDARD	06-06-16

MONT-WRIGHT CONCENTRATEUR & INSTALLATIONS DIVERSES
APPROVISIONNEMENT EN EAU
EAU POTABLE, RELOCALISATION 2006
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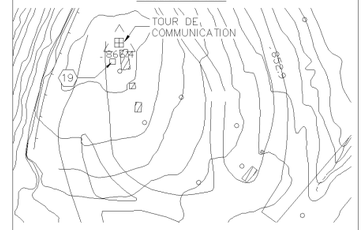
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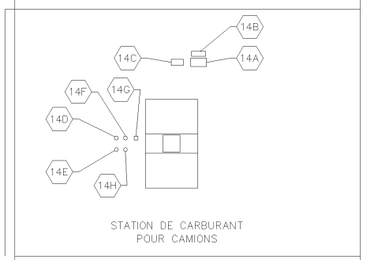


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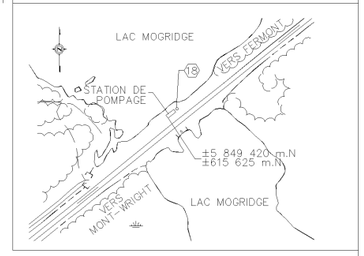
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4 = TK-22 (DIESEL) 94 120 LITRES
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11 = TK-101 A TK-105 (LUBRIFIANT)
12 = TK-69 (DIESEL)
13 = TK-73 (DIESEL) 2 273 LITRES
14A = TK-111 ROTELLA (DIESEL TONIC 40) 24 226 LITRES
14B = TK-112 (XD-3 EXTRA 15W40) 7 887 LITRES
14C = TK-113 (ESSOTRANS EXTRA) 9 474 LITRES
14D = TK-114 (LIBRE) 2 273 LITRES
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14G = TK-116 (LIBRE) 1 135 LITRES
14H = TK-123 (PRESTONE) 2 273 LITRES
15 = TK-109 (DIESEL) 757 LITRES
16 = TK-06 (DIESEL) 2 273 LITRES
17 = TK-HU-1, TK-HU-2 ET TK-H-3 (VEILLES HUILES) 50 000 LITRES X 3
18 = TK-98 (DIESEL) 1 329 LITRES
19 = TK-203 (DIESEL) 950 LITRES

PAUL'S PEAK





STATION DE CARBURANT POUR CAMIONS



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F	08-07-21	REVISION GENERALE	LL	PM
E	07-05-21	REVISION GENERALE	MCH	PM
D	06-11-06	REVISION GENERALE	MD	PM
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DESSINE PAR :	F.TREMBALY	98-08-12
VERIFIE PAR :	X	X
APPROUVE PAR :	X	X

LA COMPAGNIE MINIÈRE QUÉBEC CARTIER
PORT-CARTIER QUE.

MONT-WRIGHT CONCENTRATEUR ET INSTALLATIONS DIVERSES
STOCKAGE ET DISTRIBUTION – COMBUSTIBLES ET HUILES
SITES D'ENTREPOSAGE DES PRODUITS PETROLIERS, ENVIRONNEMENT
RESERVOIRS TK
PLAN DE LOCALISATION

CMQC CLASSEUR No	CMQC DESSIN No	REV.
B-6	21-18\0010C	G

ArcelorMittal



LÉGENDE

-NOM (no.actif)	Emplacement et type d'équipement
-SEH-PP (meOS-07)	Parc pétrolier, Séparateur eau/huile
-SEH-LO (meOS-04)	Load-out (chargement), Séparateur eau/huile
-SEH-GSL (meOS-03)	Grande salle de lavage (GSL), Séparateur eau/huile
-SEH-AE	Atelier électrique (inactif)
-SEH-PF	Plateforme de lavage des foreuses (inactif)
-UTEH-CT (meréacteur)	Unité de traitement des eaux huileuses, centrale thermique
-INT-CSEP (meOS-06)	Centre de service et d'entretien préventif, Séparateur eau/huile
-UTER	Unité de traitement des eaux rouges
-BER	Bassin des eaux de ruissellement
-SEH-HC	Batiments vers Hessé Centre (inactif)
-UTEH-400T (msWT-25)	Unité de traitement des eaux huileuses, garage 400T
-SEH-GSL-400T (meOS-05)	Salle de lavage des 400T
-SEH-EX-G	Garage explosif, Séparateur eau/huile
-SEH-EX-U	Usine explosif
-F033 (meF033)	Unité de traitement des eaux souterraines (utilisation saisonnière)

MONT-WRIGHT

Traitement des eaux huileuses et eaux rouges

2017-09-05 AUT-2787C

ANNEXE 2-A.3

ANNEXE

H

DÉMANTÈLEMENT DES INSTALLATIONS

ANNEXE

H-1 *PLAN DE DÉMANTÈLEMENT – INSTALLATIONS MINIÈRES À MONT-WRIGHT (AMEC, 2012)*

PROJET TX 12 1086 03.1000
PLAN DE DÉMANTÈLEMENT
INSTALLATIONS MINIÈRES À MONT-WRIGHT
ARCELORMITTAL

Projet TX 12 1086 03.1000

Plan de démantèlement
Installations minières Mont-Wright

Présenté à :
M. Sébastien Moreau, ing., M.G.P.

ArcelorMittal Mines Canada
Siège administratif
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Port-Cartier (Québec) G5B 2H3

Présenté par :
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CANADA

Distribution : 2 c. AMMC
2 c. AMEC

Octobre 2012

Le 10 Octobre 2012

Monsieur Sébastien Moreau
Chef de Service – Génie civil
ArcelorMittal Mines Canada
Siège administratif
24, boulevard des Îles, bureau 201
Port-Cartier (Québec) G5B 2H3

N/Réf. : TX 12 1086 03.1000

Objet : Transmission du plan de démantèlement
Installations minières d'ArcelorMittal à Mont-Wright

Monsieur,

Nous vous transmettons le plan de démantèlement des installations minières d'ArcelorMittal à Mont-Wright. Ce rapport vous sera aussi fourni dans l'annexe du plan de restauration du site de Mont-Wright.

En espérant que ce plan réponde à vos attentes, n'hésitez pas à nous contacter si vous avez besoin d'informations supplémentaires.

Veuillez agréer, Monsieur, nos salutations distinguées.

AMEC Environnement & Infrastructure
Une division d'AMEC Amériques Limitée

Olivier Carensac, B.Ing., Sciences et Technologies Industrielles
Chargé de projets

SB

P:\Project\TX1210\TX 12 1086 03, 1000 - ArcelorMittal - Extension du mandat – Plan de fermeture Mont-Wright\5.0 Rapport et calculs\5.3 Rapport et devis\Rapports transmis\Final\Plan démantèlement Mont-Wright_Final_10-10-2012_SB_RZ.docx

AMEC Environnement & Infrastructure
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AVIS IMPORTANT

Ce rapport a été préparé par AMEC Environnement & Infrastructure, une division d'AMEC Amériques Limitée (AMEC) à l'usage exclusif de ARCELORMITTAL MINES CANADA. La qualité des informations, des conclusions et des estimations contenues aux présentes reflète le niveau d'effort et d'attention fourni par les services d'AMEC. Cette qualité est basée sur : i) les informations disponibles au moment de la préparation de ce rapport, ii) les données fournies par des sources extérieures, et iii) les hypothèses, les conditions et les restrictions énoncées à ce rapport. Ce rapport est destiné à être utilisé strictement par ARCELORMITTAL MINES CANADA, sous réserve des conditions et des modalités de son contrat avec AMEC. Toute utilisation de ce rapport ou prise de décision sur la base de celui-ci par une tierce partie est faite aux risques de cette tierce partie.

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Annexe I	Plan de végétalisation du site
Annexe J	Estimation des coûts de fermeture du parc à résidus

1.0 Introduction

Dans le cadre de la révision d'un plan de restauration, réalisé actuellement par ArcelorMittal Mines Canada (AMMC) et relatif aux installations du Mont-Wright situées près de Fermont (Qc), les coûts associés au démantèlement et à la démolition des installations sur le site doivent être estimés. Ces coûts sont reliés à la remise du site dans un état satisfaisant, au sens du *Guide et modalité de préparation du plan et exigences générales en matière de restauration des sites miniers au Québec* préparé par le Ministère des Ressources naturelles et de la Faune (MRNF). De façon générale, ces travaux impliquent l'élimination des risques pour la santé et la sécurité, la limitation de la dispersion des contaminants à long terme dans le milieu récepteur et la remise du site dans un état visuellement acceptable et compatible avec l'usage futur. Ce plan prévoit également qu'à la cessation des activités de l'entreprise, une étude de caractérisation, attestée par un expert reconnu auprès du Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP), devra être réalisée sur le site, suivant les dispositions de la section IV.2.1 de la *Loi sur la qualité de l'Environnement* (LQE).

Le rapport présente plus particulièrement l'estimation des coûts 2012 pour le démantèlement des installations, dans le cadre du plan de restauration, projeté en 2042. Par conséquent, il décrit de façon générale les coûts des étapes à considérer dans le processus de restauration, et ceci, de façon à présenter un plan d'exécution réaliste qui vise la fermeture du site.

La chronologie des étapes estimées sont les suivantes :

- Études environnementales (caractérisation, avis de contamination, plan de réhabilitation, plan de démolition et de démantèlement, permis, etc.);
- Mesures de suivi environnemental post-exploitation (Directive 019);
- Démantèlement des bâtiments et de leurs infrastructures et gestion des matériaux de démolition recyclables;
- Gestion des équipements en fin de vie utile et des matériaux de démolition valorisable. Cette étape inclut aussi l'enfouissement des matières résiduelles irrécupérables;
- Sécurisation du parc à résidus et des haldes;
- Démantèlement de pipelines;
- Enlèvement des lignes électriques;
- Excavation, élimination et/ou traitement des sols contaminés et des matières résiduelles excavées;
- Profilage final du site et reconfiguration de l'écoulement des eaux de surface et consolidation de l'infrastructure de gestion des eaux;
- Mise en eau des fosses d'exploitation;
- Ajout de couvert végétal et ensemencement du site;
- Suivi environnemental post-restauration (Directive 019);

2.0 Gestion environnementale

2.1 Historique environnemental

À la cessation des activités, une évaluation environnementale de site (phase I) est prévue pour l'ensemble du site de Mont-Wright. Celle-ci doit être réalisée préalablement aux travaux de caractérisation environnementale (phase II). Cette première phase aura pour but d'identifier les zones potentiellement affectées par une contamination, suite aux activités actuelles, futures (d'ici 2042) et/ou antérieures sur le site. L'étude sera effectuée dans le cadre d'une cessation d'activité (art. 31.51 de la LQE) visée aux annexes III et IV du *Règlement sur la protection et la réhabilitation des terrains* (RPRT).

Le portrait de l'historique environnemental du site sera basé sur la revue exhaustive des dossiers, la visite du site et les entrevues auprès des personnes ressources pour les installations. Ces recherches presque essentiellement documentaires s'échelonneront sur une durée estimée à 3 mois.

Il est à noter que seule une revue complète de l'historique du site (phase I) permettra de statuer précisément sur les limites industrielles à couvrir pour la suite des travaux de caractérisation et de réhabilitation environnementale.

2.2 Étude de caractérisation environnementale

L'étude de caractérisation environnementale visera à évaluer les volumes de sols excédant les valeurs limites réglementaires applicables au site. Elle prévoira les modes de gestion appropriés pour les sols, les eaux souterraines et de surface et comprendra également un volet pour les sédiments qui excèderont les critères retenus. Les coûts de réhabilitation environnementale ne pourront être établis raisonnablement qu'à la suite de cette étude.

L'approche de la présente estimation est basée sur l'établissement d'un maillage à la fois systématique et ciblé sur le site. Le premier maillage (systématique) est appliqué sur la majeure partie de l'aire industrielle (159 hectares), où une tranchée d'exploration (*test-pit*) est prévue pour chaque maille de 2500 m^2. Le second (ciblé), porte sur des secteurs potentiellement plus problématiques (ex. : parcs pétroliers, ateliers mécaniques et ferroviaires, quais de chargement/déchargement, centrale thermique, etc.), totalisant environ 35 hectares (ha). Dans ces secteurs, notamment, des forages et des puits d'observation des eaux souterraines sont prévus. Un forage ou puits d'observation est prévu selon un maillage de 625 m^2 aux fins de cette estimation. À noter que ce maillage est représentatif des exigences du MDDEP dans le cadre d'études attestées de même ordre. Un puits d'observation est présentement estimé pour chaque cinq forages réalisés, dans les secteurs ciblés plus problématiques.

De façon générale, la présente estimation prévoit un programme d'analyses chimiques qui comprend 2 à 3 analyses par sondage effectué, ces analyses couvrent les paramètres énoncés dans le *Guide de caractérisation et de réhabilitation des terrains* du MDDEP. Le développement des puits, les relevés piézométriques, les essais de perméabilité,

l'échantillonnage de l'eau souterraine et les déplacements du personnel de terrain sont également intégrés à cette estimation.

Un calendrier de l'ordre de 190 jours est estimé pour effectuer l'ensemble de ces travaux de caractérisation sur le terrain. Les coûts comprennent tous les honoraires pour les ressources dédiées au projet.

La figure incluse à l'annexe B présente les limites où s'exercent actuellement les activités et considère les activités futures (expansion), selon les plans fournis dans le cadre du mandat. Cette figure présente le maillage recommandé par l'actuel *Guide de caractérisation et de réhabilitation des terrains,* publié par le MDDEP. Les secteurs présentant de plus hauts risques du point de vue environnemental sont identifiés sur le plan, en plus des aires d'entreposage du concassé et du minerai.

Un total de 4,6 millions $ en dollars 2012 est estimé pour ces travaux. Une contingence de 20 % a été incluse dans ce montant.

2.3 Suivi environnemental post-exploitation et post-restauration

Pendant la période suivant l'arrêt définitif de l'exploitation et avant que les travaux de restauration ne soient achevés, un programme de suivi des eaux minières et souterraines doit être mis en œuvre, en fonction des exigences de la *Directive 019 sur l'industrie minière*, publié par le MDDEP.

Ce suivi s'appliquera, au parc à résidus, aux effluents finaux, aux eaux souterraines, aux résurgences et au ruissellement issu des aires d'entreposage du concentré et/ou du minerai.

Le coût pour le suivi d'effluents est estimé à environ 30 000$ par année, tandis que celui pour le suivi des eaux souterraines, des résurgences et de ruissellement serait de l'ordre de 263 000$ par année sur une période de 5 ans.

L'installation d'une trentaine de puits d'observation est également estimée pour le parc à résidus et les aires d'accumulation. À ce nombre, certains puits d'observation installés dans le cadre de l'étude de caractérisation environnementale pourraient être laissés en place, de façon à faciliter cette étape de suivi. Les présentes estimations sont basées sur un programme de suivi de cinq ans, sur une cinquantaine puits d'observation. Les coûts relatifs aux analyses chimiques pourraient varier d'un puits à l'autre, en conséquent, un prix moyen de l'ordre de 450 $/échantillon est retenu.

Le suivi environnemental postrestauration sera effectué durant les cinq premières années qui suivront la cessation des activités de production.

3.0 Démantèlement des installations

3.1 Bâtiments, structures

Le démantèlement des installations comprend la démolition et la gestion des débris de démolition de 130 bâtiments ou édicules, présentés sur un plan général à l'annexe A. L'inventaire de ces installations est quant à lui présenté à l'annexe C.

L'estimation des coûts est actualisée à partir de la précédente évaluation (SNF, 2006) à laquelle il a été ajouté 5 annuités avec un indice de 3% par année (Chan, 2006). Les taux des efforts ont été actualisés de la même façon en tenant compte de la mobilisation et de la démobilisation sur une période de six mois. Pour la main d'œuvre, le taux de 2006, qui était un peu sous-estimé, a été actualisé de 5 annuités avec un indice de 9% par année pour arriver à un taux 2012 de 85$ (plus les frais de gîte et couverts et la mob./démob.) sur une base de 70 heures par semaine avec un roulement de 28 jours (les taux des efforts sont présentés à l'annexe E).

L'approche utilisée pour ventiler le coût de démantèlement de l'estimation 2006 est basée sur le rapport entre la masse des matériaux (SNF 2006) et la surface d'emprise. Ainsi, le coût de démantèlement d'une installation est déterminé en proportion du coût total de démantèlement. La ventilation des coûts par installation se trouve à l'annexe F, tandis que le sommaire des coûts de démantèlement est présenté à l'annexe G. Les coûts de démantèlement des installations de l'expansion projetées pour 2012 ont été estimés de la même façon et s'ajoute au coût évalué en 2006 et actualisé en 2012. Concernant les gains de récupération de métal, ils ne sont pas intégrés dans l'estimation.

Le démantèlement des installations est également estimé en tenant compte des aspects suivants :

- les bâtiments possèdent généralement une structure d'acier et un recouvrement de tôle à retirer. Les bâtiments seront déshabillés et les principaux équipements enlevés, les éléments de métal seront découpés, ségrégués et entreposés en vue d'un transport par convoi ferroviaire. Les composantes de béton des installations (murs, silos, bassins, fosses, etc.) seront quant à elles démolies et les débris seront ensuite concassés pour servir de matériaux de remblayage grossier sur le site. Les fragments de béton utilisés comme remblai devront être fragmentés à des dimensions n'excédant pas 125 mm. L'acier d'armature devra être retiré;

- La gestion des matériaux de démantèlement s'effectuera selon le *Guide des bonnes pratiques sur la gestion des matériaux de démantèlement*, publié par le MDDEP. Les agrégats de béton issus du démantèlement pourront également être réutilisés lorsque possible comme remblai pour le site;

- Les fondations seront laissées en place et recouvertes d'un minimum de 50 cm de sols. Les murs de soubassement seront démolis jusqu'à 50 cm sous le niveau de la surface du

sol. Pour les dalles de fondation pleine emprise, elles seront percées ou brisées pour laisser passer les eaux souterraines ou éviter les accumulations d'eau de surface;

- Le béton provenant des installations et des équipements fixes sera disposé à même le site, à moins qu'il ne soit contaminé. Dans ce cas, il sera alors préalablement concassé et criblé pour séparer les matériaux grossiers des fins pour minimiser les quantités de matériaux qui pourraient être gérées comme des matières résiduelles contaminées;

- Les équipements électriques à l'intérieur des installations à démanteler, notamment les transformateurs, les ballasts d'éclairage et les appareils au mercure seront enlevés, entreposés puis évacués selon les différentes règles en vigueur;

- Les matières résiduelles non dangereuses, telles que les débris de démolition non recyclables (isolation d'enveloppe, gypse, bois, bardage, etc.), seront enfouis dans un dépôt en tranchée autorisé, à l'intérieur des limites de la propriété et de façon à respecter le *Règlement sur l'enfouissement et l'incinération de matières résiduelles* (REIMR);

- Les matériaux seront triés de façon optimale et le verre, le plastique, le carton, etc. seront acheminés vers un centre de tri pour leur recyclage.

Par ailleurs, l'estimation visant le démantèlement des installations ne tient pas compte des éléments suivants :

- Les gains de revente de métal et les coûts potentiels de gestion de l'amiante;

- Les coûts de transport et les gains de revente de mobile-homes (camps et installations mobiles présents sur le site en 2012);

- Les lignes de transport, les transformateurs extérieurs et les massifs de conduits souterrains des installations ou connexes à celles-ci. En effet, ces équipements devront faire l'objet d'une gestion environnementale, suivant les règles applicables (pompage des huiles de refroidissement des transformateurs et nettoyage des réservoirs, gestion des ballasts d'éclairage et des appareils au mercure, etc.);

- Le démantèlement de toutes infrastructures souterraines comprenant les massifs de conduits électriques et les lignes de gaz naturel, d'aqueduc, d'égouts, et d'incendie. Ces éléments qui devront vraisemblablement être retirés lors des travaux de fermeture, en tenant compte de l'étude de caractérisation environnementale;

- Les équipements pétroliers, tels que les réservoirs, les tuyauteries, les séparateurs d'huiles, les caniveaux, etc., devront faire l'objet d'une gestion environnementale en fonction des règles en vigueur;

- Les sols contaminés sur le site. Ces derniers devront être gérés conformément à la *Grille de gestion des sols contaminés excavés intérimaire* du MDDEP et en respectant les valeurs limites réglementaires tirées du *Règlement sur la protection et la réhabilitation des terrains* (RPRT) du Québec. Ces coûts seront évalués une fois que le portrait

environnemental complet du site aura été établi par l'étude de caractérisation environnementale;

3.2 Équipements fixes

L'estimation des coûts de démantèlement des équipements fixes a été réalisée en évaluant le coût net de rachat des équipements (SNF 2006). Ceci afin d'en déterminer les proportions suivantes : le prix de vente de métal, le coût de transport, et le coût de démantèlement. Le coût net de rachat correspond au coût de rachat moins les frais liés aux aléas et aux bénéfices de l'acheteur (voir liste des équipements à l'annexe D).

Ainsi, un montant d'environ 260$/tonne d'équipement est estimé pour démanteler et convoyer les équipements fixes vers le port de Port-Cartier. Concernant les gains de récupération de métal, ils ne sont pas intégrés dans l'estimation.

3.3 Équipements mobiles

Le plan de gestion des pneus surdimensionnés du Mont-Wright fourni par AMMC indique qu'il y aurait 36 camions (sans préciser les modèles) pour la production minière. Nous en déduisons que l'accroissement de la production visée par AMMC entrainera une multiplication par 2 de la flotte de camions et du nombre de pelles mécaniques. Ainsi, il est raisonnable de penser que l'inventaire principal d'équipement mobile sera constitué de 72 camions 400t qui satureront la production de 8 excavatrices 1400t. Le montant considéré pour le démantèlement de toute cette flotte est d'environ 180$/tonne de métal et le transport vers le port de Port-Cartier est estimé à 85$/tonne. Concernant les gains de récupération de métal, ils ne sont pas intégrés dans l'estimation.

Les coûts de gestion des petits véhicules n'ont pas été considérés dans l'étude.

3.4 Pneus surdimensionnés

Le plan de gestion des pneus surdimensionnés du Mont-Wright fourni par AMMC indique qu'un atelier de 36 camions mettrait au rebut des pneus surdimensionnés à raison de 200 par année. En 2012, il y aurait 2426 pneus surdimensionnés sur le site. AMMC prévoit d'en éliminer 400 par année jusqu'en 2028. La multiplication par 2 de la production visée par AMMC devrait augmenter le nombre de pneus rebutés. Toutefois AMMC prévoit de gérer la totalité des pneus surdimensionnés avant la fermeture du site.

Aucun coût associé à la gestion des pneus surdimensionnés n'a donc été considéré dans le présent plan de démantèlement.

3.5 Équipement du parc à résidus

Les tuyaux de résidus miniers devront être enlevés à la fermeture du parc à résidus. Les montants estimés sont présentés à l'annexe J.

La figure 1 en annexe J montre l'emplacement final des points de déposition. À la fin de la vie du parc, il y aura 23 km de tuyaux à ôter à partir du concentrateur, jusqu'aux points de déposition. Ces tuyaux sont en acier, mesurent 20po de diamètre et sont revêtus de caoutchouc à l'intérieur. Au total, cela représente près de 3 200 t d'acier (un tuyau de 40 pi pèse 3 500 lb).

Le coût de démantèlement d'une tonne d'acier au Mt-Wright est évalué à 260$.

Le démantèlement de la station de surpression est inclus dans le démantèlement des installations.

4.0 Sécurisation des installations

Les chemins d'accès aux fosses du secteur Paul's Peak se rejoignent en un seul point. De plus, l'accès au secteur Hesse se fait à partir de ce même point. La sécurisation du site inclut donc l'installation d'une clôture cadenassée à l'entrée de la mine et le maintien de certains chemins d'accès. Pour le parc à résidus, on conserve trois entrées qui seront contrôlées par une barrière cadenassée. Les autres chemins d'accès au parc à résidus ou à la mine verront leur entrée bloquée par un talus de sable ou d'enrochement ou par un fossé creusé.

Le coût de sécurisation couvre la main-d'œuvre, le matériau et l'équipement nécessaires à l'obstruction d'un chemin, d'une largeur de 20 mètres.

Le démantèlement complet du chemin de fer reliant Mont-Wright et Port-Cartier n'est actuellement pas envisagé par la compagnie. Toutefois, les rails et les traverses présentes sur la digue, qui relient la mine de Mont-Wright aux installations de Dyno Nobel seraient à enlever en prévision de l'installation d'un déversoir.

Les coûts reliés à ces travaux sont présentés à l'annexe J du présent plan.

5.0 Réhabilitation environnementale

Diverses études environnementales seront anticipées au fil des prochaines années. Ces dernières devraient permettre de définir la portée de la gestion environnementale des sols, des eaux de ruissellement et des sédiments sur le site, en vue d'une fermeture. Ces études devraient également permettre d'établir et de statuer sur les techniques de réhabilitation à privilégier (ex : traitement, excavation, encapsulation, stabilisation, etc.).

À ce stade-ci, les montants pour réaliser les travaux de réhabilitation sont inconnus et seront évalués dans le cadre des études de caractérisation environnementales à réaliser.

6.0 Fermeture du parc à résidus

En 2026, le parc à résidus de Mt-Wright aura atteint sa capacité maximale dans le mode de remplissage actuel. Le bassin Hesse Nord sera complètement remblayé par des résidus et les bassins B et B+ au pied du barrage A assureront le rôle de bassin de sédimentation.

À la fermeture du parc, la structure de décantation du bassin B+ sera condamnée (bétonnée) et un déversoir d'opération mis en place pour permettre à l'eau issue des précipitations de s'écouler librement vers le bassin Hesse Centre. Les structures de contrôle du niveau d'eau de Hesse 4 et du bassin B auront déjà été condamnées durant les années antérieures, dans le cadre des opérations de rehaussement. Le « cause way » séparant Hesse Centre et Hesse Sud sera ouvert afin de permettre aux niveaux d'eau de s'équilibrer et facilitera le suivi environnemental. Les rails sur cette digue ainsi que les portions de voie ferrée aux alentours de Dyno Nobel seront à démantelés (voir section 4.0).

Le tableau en annexe J présente les coûts de restauration 2012 dans le cas d'une fermeture du parc en 2026. La figure présentée à l'annexe J du plan de restauration présente la configuration du parc à résidus selon ce dernier scénario.

Après la fermeture du parc, des inspections seront menées sur une base mensuelle ou bimestrielle. Ces visites auront pour but de s'assurer de l'intégrité des ouvrages (inspection visuelle) de leur comportement (lecture d'instruments), de la santé des parcelles ensemencées. À l'issu de chaque visite, une série de recommandations permettra de cibler les entretiens à réaliser.

6.1 Démantèlement des infrastructures du parc

Lors de la fermeture du parc, les tuyaux de résidus seront ôtés (voir section 3.5). Les trois point d'entrée du parc (boulevard Jean Fortin, route d'accès au barrage A et route d'accès au Bassins B/B+) seront contrôlés par une clôture cadenassée. Un déversoir devra être aménagé sur les digues du bassin B+.

6.2 Végétalisation

Le plan de végétalisation est présenté à l'annexe I

En fait, toutes les zones qui sont actuellement inactives peuvent être végétalisées avant la fin de la vie du parc à résidus. En effet, l'ensemencement pourrait débuter puisqu'il qu'il n'y a plus d'écoulement de pulpe dans ces zones. La restauration de ces zones a déjà débuté. Elles sont soit ensemencées selon la méthode utilisée par NORCO, soit recouvertes de mort-terrain issu du décapage des travaux sur les digues du parc.

Le coût de l'ensemencement du sable de résidus est de l'ordre de 15 000 $ par hectare. Ce prix se base sur les opérations de NORCO en 2011 et 2012 au parc à résidus de Mont-Wright. Le transport et l'épandage du mort-terrain par l'entrepreneur coûte 11 300 $/ha. Cette opération, débutée en 2011 aura permis de recouvrir environ 80ha sur la pente de Hesse d'ici 2026. Ce chiffre se base sur l'extraction de 24 000 m³ de terre végétale étalée sur 15cm d'épaisseur.

En outre, l'ensemencement au parc à résidus nécessite un nivèlement des surfaces à restaurer afin de permettre le passage des engins agricoles. Ce nivèlement se fera au moyen d'équipement lourd. Le nivèlement du parc consiste à gommer des sillons d'érosions creusés

au milieu du parc par la pulpe, le gel/dégel et le vent. Seule la zone d'écoulement des résidus grossiers en aval des futures rampes hivernales est considérée.

L'estimation des coûts de végétalisation inclut les coûts pour les surfaces actives et inactives séparément.

La zone d'écoulement des résidus fins est jugée impropre à porter des équipements lourds pour l'instant. Cette superficie représente environ 30% du parc. Pour niveler les secteurs situés à l'extérieur de cette dernière zone, 2 bouteurs de type D8 pendant 1 mois (entre juin et novembre) sont jugés nécessaires. La location d'un D8 en 2012 est de 30 000 $/mois. Le coût de ce nivèlement partiel du parc serait donc de l'ordre de 60 000$.

En 2012, le coût de l'ensemencement est de 15 000 $/ha. L'ensemencement se fera sur la même zone que celle nivelée. En effet la zone d'écoulement des résidus fins ne nécessitera pas d'ensemencement, car les particules plus fines qui s'y trouvent sont capables de retenir suffisamment d'eau pour favoriser le développement de la végétation. Actuellement, de la végétation de type mousse et algue pousse sur les résidus fins au pied des digues Mogridge et Hesse 3.

La zone industrielle fera également l'objet de travaux d'ensemencement lors du réaménagement du site. Ces travaux seront réalisés une fois que les travaux de réhabilitation environnementale et le recouvrement des fondations par des sols auront été complétés. Une scarification de la surface au moyen d'équipements adaptés aux conditions favorisera une meilleure reprise de la végétation dans cette portion du site.Les coûts estimés pour la mise en place de sols dans l'empreinte des installations sont d'environ 1 750 000$. La surface de l'aire industrielle sera également à scarifier, de façon à végétaliser le terrain selon la méthode de Norco. Les travaux d'ensemencement sont évalués à 15 000$ par hectare.

7.0 Sommaire des coûts

Le tableau suivant présente les coûts 2012 estimés pour la restauration du site de Mont-Wright en 2042, sur la base des hypothèses discutées dans les précédentes sections.

Type de travaux	unité	Quantité	Taux	Montant	Montant pour garantie (1)
Démantèlement des installations (bâtiment et équipements)	*unité*	*1*		*29,239,700 $*	
Sous-total				***29,239,700 $***	
Parc à résidus, bassins et haldes					
- Démantèlement des installations du parc	unité	1		1,180,000 $	
- Ensemencement du parc	unité	1		27,413,338 $	19,189,337 $
				28,593,338 $	***19,189,337 $***

Suite du sommaire des coûts

Type de travaux	unité	Quantité	Taux	Montant	Montant pour garantie (1)
Secteur minier					
- Ensemencement des haldes	ha	1807	15,000 $	27,105,000 $	18,973,500 $
Sous-total				***27,105,000 $***	***18,973,500 $***
Zone industrielle					
- Étude de caractérisation environnementale (phases I et II)	unité	1	4,600,000 $	4,600,000 $	
- Restauration de la zone industrielle	unité	1		1,751,600 $	
Sous-total				***6,351,600 $***	
Programme de surveillance					
- Suivi environnemental des effluents	an	5	30,000 $	150,000 $	
- Suivi agronomique (parc, haldes, bassins)	an	5	35,000 $	175,000 $	122,500 $
- Suivi agronomique (zone industrielle)	an	5	20,000 $	100,000 $	
- Installation des puits de surveillance	unité	30	3,000 $	90,000 $	63,000 $
- Suivi des eaux souterraines (parc, haldes et zone industr.) 5 ans	unité	50	5,262 $	263,100 $	
- Suivi de l'intégrité des ouvrages et rapport	visite	5	20,000 $	100,000 $	70,000 $
Sous-total				***878,100 $***	***255,500 $***
Total :				**92,167,738 $**	**38,418,337 $**

(1) Seule les aires d'accumulations sont assujetties à une garantie financière, selon le Guide et modalités de préparation d'un plan de restauration du MRNF, 1997. La garantie représente 70% des montants affairant aux aires d'accumulation.

AMEC Environnement & Infrastructure
Une division d'AMEC Amériques Limitée

le 10 octobre 2012

Olivier Carensac, B.Ing., Sciences et Technologies Industrielles
Chargé de projets

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Olivier Carensac, B.Ing., Sciences et Technologies Industrielles

SB/

Références

1 AMEC E&I, *Révision du plan de restauration des installations de Mont-Wright*, octobre 2012, réf. : TX12 1089 03.

2 SNF Solution Environnementale Logic inc., Évaluation des coûts de démantèlement et de démolition de l'usine de QCM à Mont-Wright, Québec, 12 juin 2006

5 Guide et modalité de préparation du plan et exigences générales en matière de restauration des sites miniers au Québec préparé par le Ministère des Ressources naturelles et de la Faune (MRNF)

6 Chan S. Park, Ronald Pelot, Kenneth C. Porteous, Ming J. Zuo, Analyse économique en ingénierie, ERPI, 2002, chap. 2.

7 Ministère des Ressources naturelles (MRN), *Guide et modalités de préparation du plan et exigences générales en matière de restauration des sites miniers au Québec*, gouvernement du Québec, 1997.

8 Ministère de l'Environnement, du Développement durable et des Parcs (MDDEP), *Directive 019 sur l'industrie minière*, mars 2012

9 Ministère de l'Environnement, du Développement durable et des Parcs (MDDEP), *Politique de protection des sols et de réhabilitation des terrains*, 2003.

10 Ministère de l'Environnement, du Développement durable et des Parcs (MDDEP), *Guide des bonnes pratiques sur la gestion des matériaux de démantèlement*, publié par le MDDEP en 2003.

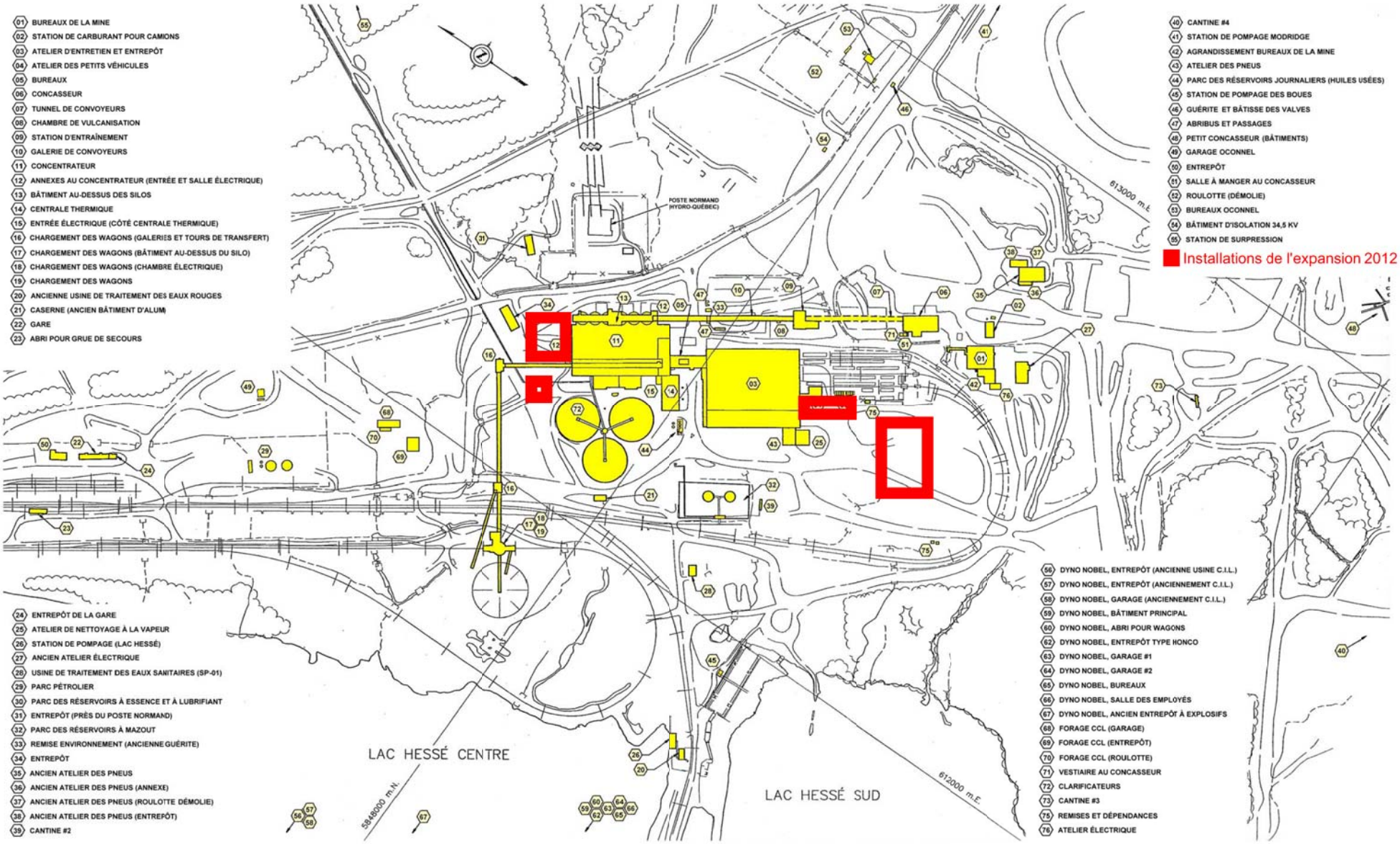
11 Ministères de l'Environnement, du Développement durable et des Parcs (MDDEP), *Guide valorisation des matières résiduelles inorganiques non dangereuses de source industrielle comme matériau de construction*, 2002.

12 Ministère de l'Environnement, du Développement durable et des Parcs (MDDEP), *Guide de caractérisation des terrains*, 2003.

Annexe A

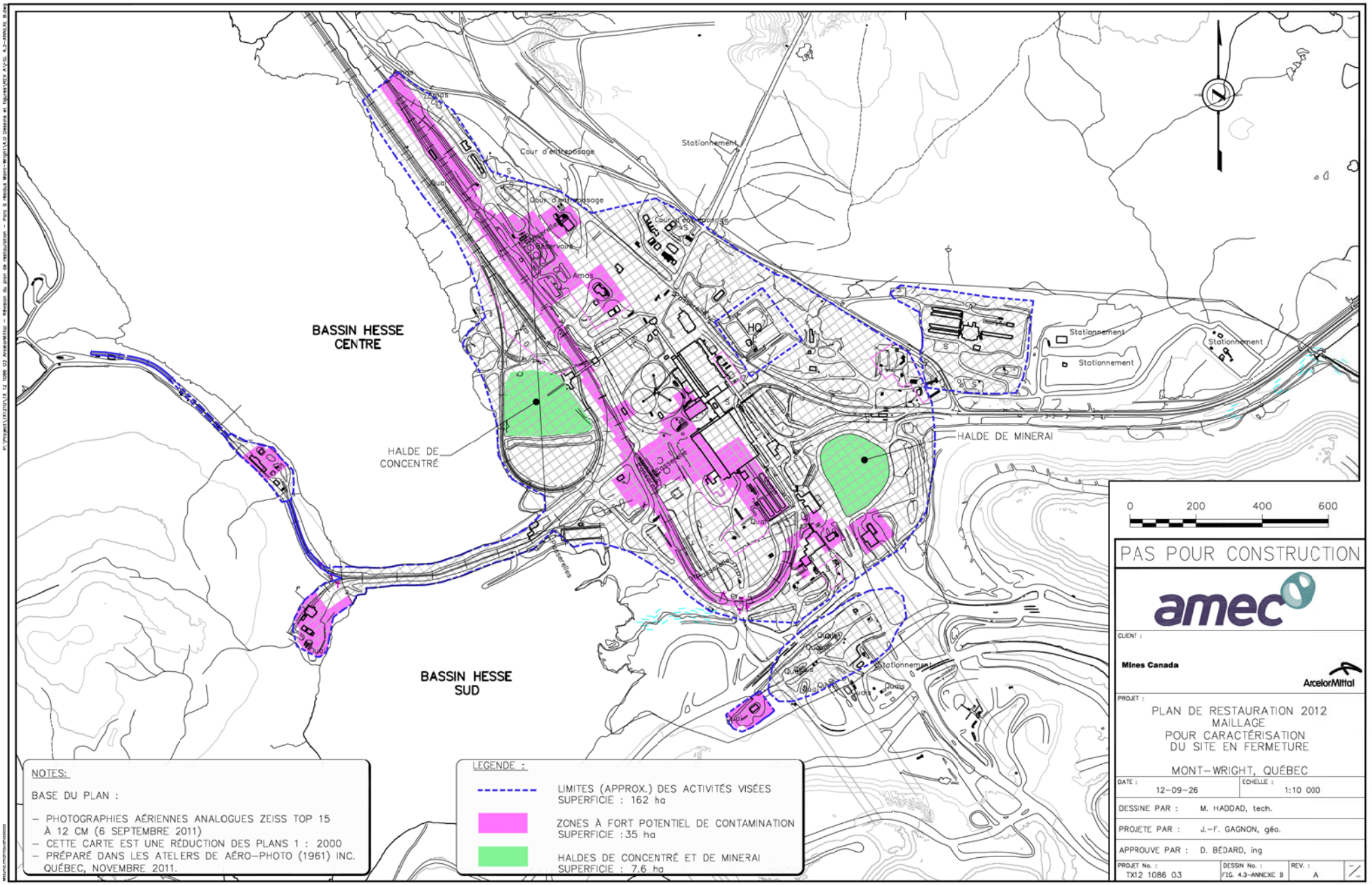
Plan des installations

PLAN D'ENSEMBLE



Annexe B

Plan de maillage environnemental



NOTES:

BASE DU PLAN :

- PHOTOGRAPHIES AÉRIENNES ANALOGUES ZEISS TOP 15 À 12 CM (6 SEPTEMBRE 2011)
- CETTE CARTE EST UNE RÉDUCTION DES PLANS 1 : 2000
- PRÉPARÉ DANS LES ATELERS DE AÉRO-PHOTO (1961) INC. QUÉBEC, NOVEMBRE 2011.

LEGENDE :

- LIMITES (APPROX.) DES ACTIVITÉS VISÉES SUPERFICIE : 162 ha
- ZONES À FORT POTENTIEL DE CONTAMINATION SUPERFICIE : 35 ha
- HALDES DE CONCENTRÉ ET DE MINERAI SUPERFICIE : 7.6 ha

PAS POUR CONSTRUCTION

amec

CLIENT :

Mines Canada

ArcelorMittal

PROJET :

PLAN DE RESTAURATION 2012
MAILLAGE
POUR CARACTÉRISATION
DU SITE EN FERMETURE

MONT-WRIGHT, QUÉBEC

DATE : 12-09-26	ECHELLE : 1:10 000
DESSINE PAR : M. HADDAD, tech.	
PROJETE PAR : J.-F. GAGNON, géo.	
APPROUVE PAR : D. BÉDARD, ing	

PROJET No. :	DESSIN No. :	REV. :
TX12 1086 03	FIG. 4.3-ANNEXE B	A

Annexe C

Inventaire des installations

INVENTAIRE DES INSTALLATIONS

MONT-WRIGHT

W-001-00



Bureaux de la mine
Emprise:1872.8m² Acier:63.8t
Béton:426.16112m³
Mat.sec:430.2m³

Engin:449
Main.d'œuvre:111
Camion:53

W-001-01



Dépendance (passage couvert)
Emprise:66.9m² Acier:t
Béton:m³ Mat.sec:21m³

Engin:14
Main.d'œuvre:3
Camion:2

W-002-00



Station de carburant pour camions Emprise:430m²
Acier:34.6t Béton:47.90288m³
Mat.sec:0m³

Engin:96
Main.d'œuvre:24
Camion:11

Dépendance(s): W-002-01

Dépendance 1 (remise sur la plateforme) Emprise:4.5m²
Acier:t Béton:m³

Engin:1
Main.d'œuvre:0
Camion:0

Dépendance(s): W-002-02

Dépendance 2 (remise)
Emprise:25.3m² Acier:t
Béton:m³ Mat.sec:m³

Engin:5
Main.d'œuvre:1
Camion:1

Dépendance(s): W-002-03

Réservoir hors-terre, vertical en acier Emprise:0m² Acier:t
Béton:m³ Mat.sec:m³

Peu d'effort

W-003-00



Atelier d'entretien et entrepôt
Emprise:22444.3m²
Acier:4255t
Béton:2584.40464m³
Mat.sec:0m³

Engin:6028
Main.d'œuvre:1490
Camion:712

W-004-00





Atelier des petits véhicules
Emprise:447.4m² Acier:16t
Béton:48.5m³ Mat.sec:0m³

Engin:104
Main.d'œuvre:26
Camion:12

Dépendance(s): W-004-01

Dépendance 1 (Abri)
Emprise:22.8m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:5
Main.d'œuvre:1
Camion:1

Dépendance(s): W-004-02

Dépendance 2 (Remise)
Emprise:4.6m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:1
Main.d'œuvre:0
Camion:0

Dépendance(s): W-004-03

Dépendance 3 (Conteneur)
Emprise:18.6m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:4
Main.d'œuvre:1
Camion:0

Dépendance(s): W-004-04

Dépendance 4 (Conteneur)
Emprise:18.6m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:4
Main.d'œuvre:1
Camion:0

Dépendance(s): W-004-05

Réservoir (1) vertical en acier
Emprise:0m² Acier:0t
Béton:0m³ Mat.sec:0m³

Peu d'effort

W-005-00



Bureaux Emprise:1263.2m²
Acier:273t
Béton:1409.58928m³
Mat.sec:718m³

Engin:730
Main.d'œuvre:180
Camion:86

W-006-00



Concasseur
Emprise:1664.7m² Acier:620t
Béton:554.78144m³
Mat.sec:0m³

Engin:630
Main.d'œuvre:156
Camion:74

MONT-WRIGHT

W-007-00



Tunnel de convoyeurs (100% sous terre) Emprise:1482m²
Acier:0t Béton:0m³
Mat.sec:0m³

Engin:301
Main.d'œuvre:74
Camion:36

W-008-00



Chambre de vulcanisation
Emprise:75.6m² Acier:2.3t
Béton:10.3m³ Mat.sec:0m³

Engin:18
Main.d'œuvre:4
Camion:2

W-009-00



Station d'entraînement
Emprise:1028.5m²
Acier:134.4t Béton:545.5m³
Mat.sec:90m³

Engin:328
Main.d'œuvre:81
Camion:39

W-010-00



Galerie de convoyeurs
Emprise:1988m² Acier:592t
Béton:251.93m³
Mat.sec:140m³

Engin:423
Main.d'œuvre:105
Camion:50

W-011-00



Concentrateur
Emprise:16907.9m²
Acier:10635t
Béton:7992.9912m³
Mat.sec:55m³

Engin:8876
Main.d'œuvre:2195
Camion:1049

W-011-01



Silos (6) Emprise:2270m²
Acier:150t Béton:13190m³
Mat.sec:0m³

Engin:3985
Main.d'œuvre:985
Camion:471

W-012-01



Annexe au concentrateur (entrée) Emprise:106m²
Acier:7.9t Béton:80.9m³
Mat.sec:0m³

Engin:35
Main.d'œuvre:9
Camion:4

W-012-02



Annexe au concentrateur (salle électrique) Emprise:253.7m²
Acier:8.4t Béton:91.07592m³
Mat.sec:0m³

Engin:63
Main.d'œuvre:15
Camion:7

MONT-WRIGHT

W-013-00



Bâtiment au-dessus des silos
Emprise:1803m² Acier:760t
Béton:415.24032m³
Mat.sec:106m³

Engin:531
Main.d'œuvre:131
Camion:63

W-014-00



Centrale thermique
Emprise:1829.5m²
Acier:258.8t
Béton:190.6152m³
Mat.sec:0m³

Engin:447
Main.d'œuvre:111
Camion:53

W-015-00



Entrée électrique (côté centrale thermique) Emprise:138.3m²
Acier:2.7t Béton:18.7m³
Mat.sec:0m³

Engin:29
Main.d'œuvre:7
Camion:3

W-016-01



Chargement des wagons (galeries et tunnels)
Emprise:718.6m² Acier:322t
Béton:352.0932m³
Mat.sec:0m³

Engin:207
Main.d'œuvre:51
Camion:24

W-016-02



Chargement des wagons (tour de transfert #1)
Emprise:271.8m² Acier:50.8t
Béton:62m³ Mat.sec:0m³

Engin:71
Main.d'œuvre:18
Camion:8

W-016-03



Chargement des wagons (tour de transfert #3)
Emprise:236m² Acier:153.8t
Béton:105.3652m³
Mat.sec:0m³

Engin:128
Main.d'œuvre:32
Camion:15

W-017-00



Chargement des wagons (bât. au-dessus du silo)
Emprise:345m² Acier:152.1t
Béton:164.09336m³
Mat.sec:24m³

Engin:235
Main.d'œuvre:58
Camion:28

W-018-00



Chargement des wagons (chambre électrique)
Emprise:331.1m² Acier:15.6t
Béton:48.5m³ Mat.sec:24m³

Engin:76
Main.d'œuvre:19
Camion:9

MONT-WRIGHT

W-019-00



Chargement des wagons
Emprise:322.6m² Acier:20.1t
Béton:33.9m³ Mat.sec:0m³

Engin:74
Main.d'œuvre:18
Camion:9

W-019-01



Silo de chargement
Emprise:398.8m² Acier:45t
Béton:8525m³ Mat.sec:0m³

Engin:4059
Main.d'œuvre:1004
Camion:480

W-020-00



Ancienne usine de traitement des eaux rouges
Emprise:176.6m² Acier:4.6t
Béton:8.03256m³
Mat.sec:0m³

Engin:38
Main.d'œuvre:9
Camion:5

W-021-00



Caserne (ancien bâtiment d'alum) Emprise:201.2m²
Acier:12.1t Béton:10.5m³
Mat.sec:0m³

Engin:44
Main.d'œuvre:11
Camion:5

W-022-00



Gare Emprise:484m²
Acier:11.5t Béton:13.2m³
Mat.sec:0m³

Engin:99
Main.d'œuvre:25
Camion:12

W-023-00



Abri pour grue de secours
Emprise:246.2m² Acier:9.1t
Béton:0m³ Mat.sec:0m³

Engin:51
Main.d'œuvre:13
Camion:6

W-024-00



Entrepôt de la gare
Emprise:96.7m² Acier:2.7t
Béton:24.1m³ Mat.sec:0m³

Engin:20
Main.d'œuvre:5
Camion:2

W-025-00



Atelier de nettoyage à la vapeur
Emprise:578.4m² Acier:32.7t
Béton:17.6m³ Mat.sec:0m³

Engin:123
Main.d'œuvre:30
Camion:15

MONT-WRIGHT

W-026-00



Station de pompage (Lac Hessé) Emprise:320.1m² Acier:12.7t Béton:508.414m³ Mat.sec:0m³

Engin:126
Main.d'œuvre:31
Camion:15

W-027-00



Atelier électrique (Ancien) Emprise:780.6m² Acier:25.3t Béton:0m³ Mat.sec:0m³

Engin:160
Main.d'œuvre:39
Camion:19

W-028-00



Traitement des eaux sanitaires (QUONSET) Emprise:223m² Acier:0t Béton:0m³ Mat.sec:15m³

Engin:46
Main.d'œuvre:11
Camion:5

W-029-00



Parc pétrolier (bâtiment des pompes) Emprise:78.1m² Acier:2.9t Béton:31.9m³ Mat.sec:0m³

Engin:17
Main.d'œuvre:4
Camion:2

Dépendance(s):
W-029-01



Réservoirs acier, 3.96mØ x 11.06m haut (2) Emprise:12.310056m² Acier:0t Béton:0m³ Mat.sec:0m³

Engin:3
Main.d'œuvre:1
Camion:0

Dépendance(s):
W-029-02



Réservoirs acier, 18.29mØ x 12.19m haut (2) Emprise:262.6014185m² Acier:0t Béton:0m³ Mat.sec:0m³

Engin:53
Main.d'œuvre:13
Camion:6

Dépendance(s):
W-029-03

Dépendances (2) Emprise:4.4m² Acier:0t Béton:0m³ Mat.sec:0m³

Engin:1
Main.d'œuvre:0
Camion:0

W-030-00



Bâtiment des pompes (rés. à essence et lub.) Emprise:41.8m² Acier:0.3t Béton:43.3m³ Mat.sec:0m³

Engin:10
Main.d'œuvre:2
Camion:1

Dépendance(s):
W-030-01

Réservoirs en acier (8) Emprise:25m² Acier:0t Béton:0m³ Mat.sec:0m³

Engin:5
Main.d'œuvre:1
Camion:1

W-031-00



Entrepôt (près du poste Normand) Emprise:413.8m² Acier:5.7t Béton:0m³ Mat.sec:16m³

Engin:85
Main.d'œuvre:21
Camion:10

MONT-WRIGHT

W-032-00



Parc des réservoirs à mazout (bâtiment) Emprise:91.5m² Acier:1.4t Béton:23.9m³ Mat.sec:0m³

Engin:19
Main.d'œuvre:5
Camion:2

Dépendance(s):
W-032-01



Réservoir en acier 3843m³ (2) Emprise:0m² Acier:0t Béton:0m³ Mat.sec:0m³

Peu d'effort

W-033-00



Remise Environnement (ancienne guérite) Emprise:34.7m² Acier:0.1t Béton:0m³ Mat.sec:0m³

Engin:7
Main.d'œuvre:2
Camion:1

W-034-00



Entrepôt Emprise:652.6m² Acier:23.9t Béton:19.9m³ Mat.sec:0m³

Peu d'effort

W-035-00



Ancien atelier des pneus Emprise:1070m² Acier:62.5t Béton:10.2m³ Mat.sec:0m³

Engin:225
Main.d'œuvre:56
Camion:27

W-036-00



Ancien atelier des pneus (annexe) Emprise:134.8m² Acier:0t Béton:0m³ Mat.sec:168m³

Engin:28
Main.d'œuvre:7
Camion:3

W-038-00

Ancien atelier des pneus (entrepôt) Emprise:371.6m² Acier:10.6t Béton:3.7m³ Mat.sec:0m³

Engin:76
Main.d'œuvre:19
Camion:9

W-039-00



Cantine #2 (Roulotte) Emprise:155.1m² Acier:0t Béton:0m³ Mat.sec:0m³

Engin:31
Main.d'œuvre:8
Camion:4

W-040-00



Cantine #4 (Roulotte) Emprise:93.7m² Acier:0t Béton:0m³ Mat.sec:116m³

Engin:19
Main.d'œuvre:5
Camion:2

MONT-WRIGHT

W-040-01



Dépendance (garage)
Emprise:55.8m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:11
Main.d'œuvre:3
Camion:1

W-041-00



Station de pompage Modridge
Emprise:74.4m² Acier:2t
Béton:17.8m³ Mat.sec:0m³

Engin:16
Main.d'œuvre:4
Camion:2

W-042-00



Agrandissement bureaux de la mine Emprise:679.3m²
Acier:39.3t Béton:55.39152m³
Mat.sec:38m³

Engin:155
Main.d'œuvre:38
Camion:18

W-043-00



Atelier des pneus
Emprise:929m² Acier:72.2t
Béton:30.02808m³
Mat.sec:0m³

Engin:207
Main.d'œuvre:51
Camion:24

W-044-00





Parc des réservoirs journaliers (améliorations) Emprise:0m²
Acier:0.4t Béton:17.9m³
Mat.sec:0m³

Peu d'effort

Dépendance(s): W-044-01

Réservoirs des huiles usées (3)
Emprise:0m² Acier:0t
Béton:0m³ Mat.sec:0m³

Peu d'effort

Dépendance(s): W-044-02

Réservoir à bunker (1)
Emprise:0m² Acier:0t
Béton:0m³ Mat.sec:0m³

Peu d'effort

Dépendance(s): W-044-03

Réservoir diesel (1)
Emprise:0m² Acier:0t
Béton:0m³ Mat.sec:0m³

Peu d'effort

Dépendance(s): W-044-04

Réservoir solvant usé (1)
Emprise:0m² Acier:0t
Béton:0m³ Mat.sec:0m³

Peu d'effort

Dépendance(s): W-044-05

Dépendance 1 (Remise)
Emprise:10m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:2
Main.d'œuvre:0
Camion:0

Dépendance(s): W-044-06

Dépendance 2 (Remise modulaire) Emprise:30.5m²
Acier:0t Béton:0.5m³
Mat.sec:137m³

Engin:6
Main.d'œuvre:2
Camion:1

W-045-00



Station de pompage des boues
Emprise:65.5m² Acier:4.1t
Béton:9.6m³ Mat.sec:0m³

Engin:14
Main.d'œuvre:3
Camion:2

MONT-WRIGHT

W-046-01



Guérite Emprise:33.8m² Engin:7
Acier:0.3t Béton:7m³ Main.d'œuvre:2
Mat.sec:0m³ Camion:1

W-046-02



Bâtisse des valves (Roulotte) Engin:3
Emprise:14.9m² Acier:0t Main.d'œuvre:1
Béton:0m³ Mat.sec:0m³ Camion:0

W-047-00



Abribus Emprise:69.3m² Engin:14
Acier:0t Béton:0m³ Main.d'œuvre:3
Mat.sec:0m³ Camion:2

Dépendance(s): W-047-01

Passage 1 Emprise:59.4m² Engin:12
Acier:0t Béton:0m³ Main.d'œuvre:3
Mat.sec:121m³ Camion:1

Dépendance(s): W-047-02

Passage 2 Emprise:33.4m² Engin:7
Acier:0t Béton:0m³ Main.d'œuvre:2
Mat.sec:0m³ Camion:1

W-048-00



Roulotte au petit concasseur Engin:7
Emprise:35.7m² Acier:0t Main.d'œuvre:2
Béton:0m³ Mat.sec:0m³ Camion:1

Dépendance(s): W-048-01

Dépendances (5 remises) au petit concasseur Engin:9
Emprise:44.3m² Acier:0t Main.d'œuvre:2
Béton:0m³ Mat.sec:0m³ Camion:1

W-049-00



Garage Oconnel Engin:47
Emprise:223m² Acier:2.6t Main.d'œuvre:12
Béton:21.4m³ Mat.sec:256m³ Camion:6

Dépendance(s): W-049-01

Roulotte Oconnel Engin:8
Emprise:36.3m² Acier:0t Main.d'œuvre:2
Béton:0m³ Mat.sec:0m³ Camion:1

W-050-00



Entrepôt Emprise:505m² Engin:103
Acier:6.6t Béton:0m³ Main.d'œuvre:25
Mat.sec:0m³ Camion:12

Dépendance(s): W-050-01

Dépendance 1 (Remise) Engin:3
Emprise:15.6m² Acier:0t Main.d'œuvre:1
Béton:0m³ Mat.sec:11m³ Camion:0

Dépendance(s): W-050-02

Dépendance 2 (Remise) Engin:6
Emprise:31.6m² Acier:0t Main.d'œuvre:2
Béton:0m³ Mat.sec:0m³ Camion:1

W-051-00



Salle à manger au concasseur Engin:20
Emprise:95m² Acier:0.2t Main.d'œuvre:5
Béton:0m³ Mat.sec:0m³ Camion:2

W-053-00



Bureaux Oconnel (Agencement de 4 roulottes) Engin:40
Emprise:197m² Acier:0t Main.d'œuvre:10
Béton:0m³ Mat.sec:96m³ Camion:5

Dépendance(s): W-053-01

Dépendance 1 (Remise) Engin:4
Emprise:18.4m² Acier:0t Main.d'œuvre:1
Béton:0m³ Mat.sec:0m³ Camion:0

Dépendance(s): W-053-02

Dépendance 2 (Roulotte) Engin:12
Emprise:57.5m² Acier:0t Main.d'œuvre:3
Béton:0m³ Mat.sec:6m³ Camion:1

MONT-WRIGHT

W-054-00



Bâtiment d'isolation 34,5 Kv
Emprise:22.8m² Acier:0.6t
Béton:3.5m³ Mat.sec:0m³

Engin:5
Main.d'œuvre:1
Camion:1

W-055-00



Station de surpression
Emprise:325.9m² Acier:16.6t
Béton:57.81976m³
Mat.sec:6m³

Engin:78
Main.d'œuvre:19
Camion:9

W-056-00



Dyno Nobel, entrepôt (ancienne usine C.I.L.) Emprise:733.8m²
Acier:20.7t Béton:94.6m³
Mat.sec:11m³

Engin:159
Main.d'œuvre:39
Camion:19

Dépendance(s):
W-056-01

Dépendance (Remise)
Emprise:6m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:1
Main.d'œuvre:0
Camion:0

Dépendance(s):
W-056-02

Dépendances (3 conteneurs à explosifs) Emprise:54.3m²
Acier:0t Béton:0m³
Mat.sec:0m³

Engin:11
Main.d'œuvre:3
Camion:1

W-057-00



Dyno Nobel, entrepôt (anciennement C.I.L.)
Emprise:124.3m²
Acier:3132.3t Béton:5.7m³
Mat.sec:0m³

Engin:45
Main.d'œuvre:11
Camion:5

W-058-00



Dyno Nobel, garage (anciennement C.I.L.)
Emprise:143.6m² Acier:4.6t
Béton:0m³ Mat.sec:0m³

Engin:30
Main.d'œuvre:7
Camion:4

W-059-00



Dyno Nobel, bâtiment principal
Emprise:518.2m² Acier:21.6t
Béton:170.88784m³
Mat.sec:0m³

Engin:134
Main.d'œuvre:33
Camion:16

W-060-00



Dyno Nobel, abri pour wagons
Emprise:166.2m² Acier:3.1t
Béton:0m³ Mat.sec:0m³

Engin:34
Main.d'œuvre:8
Camion:4

W-062-00



Dyno Nobel, entrepôt (TYPE HONCO) Emprise:152.4m²
Acier:0t Béton:0m³
Mat.sec:0m³

Engin:31
Main.d'œuvre:8
Camion:4

MONT-WRIGHT

W-063-00



Dyno Nobel, garage #1
Emprise:153.9m² Acier:4.9t
Béton:0m³ Mat.sec:0m³

Engin:31
Main.d'œuvre:8
Camion:4

Dépendance (Conteneur aménagé) Emprise:30.4m²
Acier:0t Béton:0m³
Mat.sec:0m³

Engin:6
Main.d'œuvre:1
Camion:1

Dépendance(s):
W-063-01

W-064-00



Dyno Nobel, garage #2
Emprise:153.9m² Acier:4.9t
Béton:0m³ Mat.sec:118m³

Engin:32
Main.d'œuvre:8
Camion:4

W-065-00



Dyno Nobel, bureaux (Roulottes) Emprise:117.3m²
Acier:0t Béton:0m³
Mat.sec:1670m³

Engin:28
Main.d'œuvre:7
Camion:3

W-066-00



Dyno Nobel, salle des employés (Roulotte) Emprise:132.8m²
Acier:0t Béton:0m³
Mat.sec:0m³

Engin:27
Main.d'œuvre:7
Camion:3

W-067-00



Dyno Nobel, ancien entrepôt à explosifs Emprise:205m²
Acier:2t Béton:2.2m³
Mat.sec:0m³

Engin:42
Main.d'œuvre:10
Camion:5

W-068-00



Forage CCL (garage)
Emprise:439.2m² Acier:5t
Béton:0m³ Mat.sec:0m³

Engin:91
Main.d'œuvre:22
Camion:11

Dépendance(s):
W-068-01

Dépendance 1 (Remise)
Emprise:14.6m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:3
Main.d'œuvre:1
Camion:0

Dépendance(s):
W-068-02

Dépendance 2 (Remise)
Emprise:13.1m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:3
Main.d'œuvre:1
Camion:0

Dépendance(s):
W-068-03

Dépendance 3 (Conteneur)
Emprise:65.1m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:13
Main.d'œuvre:3
Camion:2

W-069-00



Forage CCL (entrepôt)
Emprise:150.4m² Acier:2t
Béton:0m³ Mat.sec:434m³

Engin:32
Main.d'œuvre:8
Camion:4

MONT-WRIGHT

W-070-00



Forage CCL (roulotte)
Emprise:57.1m² Acier:0t
Béton:0m³ Mat.sec:110m³

Engin:12
Main.d'œuvre:3
Camion:1

W-071-00



Vestiaire au concasseur
Emprise:119m² Acier:1.6t
Béton:0m³ Mat.sec:25m³

Engin:25
Main.d'œuvre:6
Camion:3

W-072-00



Clarificateurs (3 bassins de 76.20mØ)
Emprise:6837.0831m²
Acier:1100t Béton:770m³
Mat.sec:25m³

Engin:1421
Main.d'œuvre:351
Camion:168

W-072-01



Bâtisse des pompes aux clarificateurs Emprise:33.8m²
Acier:0.8t Béton:17.1m³
Mat.sec:2m³

Engin:9
Main.d'œuvre:2
Camion:1

W-073-00



Cantine #3 (Roulotte)
Emprise:155.1m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:31
Main.d'œuvre:8
Camion:4

Dépendance(s):
W-073-01



Dépendance 1 (Remise)
Emprise:13m² Acier:0t
Béton:0m³ Mat.sec:0m³

Engin:3
Main.d'œuvre:1
Camion:0

Dépendance(s):
W-073-02

Dépendance 2 (Remise)
Emprise:9.3m² Acier:0t
Béton:0m³ Mat.sec:5m³

Engin:2
Main.d'œuvre:0
Camion:0

W-074-01



Unité de filtration (Remorque)
Emprise:0m² Acier:0t
Béton:0m³ Mat.sec:0m³

Peu d'effort

W-074-02



Unité de filtration (Conteneur)
Emprise:0m² Acier:0t
Béton:0m³ Mat.sec:0m³

Peu d'effort

MONT-WRIGHT

W-074-03



Traitement des sols (Remise)
Emprise:4.5m² Acier:0t
Béton:0m³ Mat.sec:67m³

Engin:1
Main.d'œuvre:0
Camion:0

W-075-01



Autres dépendances sur le site (Guérite) Emprise:18.6m²
Acier:0t Béton:0m³
Mat.sec:228m³

Engin:5
Main.d'œuvre:1
Camion:1

W-075-02



Autres dépendances sur le site (Remise) Emprise:7.5m²
Acier:0t Béton:0m³
Mat.sec:228m³

Engin:2
Main.d'œuvre:1
Camion:0

W-075-03



Autres dépendances sur le site (Remise) Emprise:6m²
Acier:0t Béton:0m³
Mat.sec:0m³

Engin:1
Main.d'œuvre:0
Camion:0

W-076-00



Atelier électrique
Emprise:617.7m² Acier:32.9t
Béton:67.01464m³
Mat.sec:0m³

Engin:130
Main.d'œuvre:32
Camion:15

W-100-01



Concentrateur de l'expansion
Emprise:11200m² Acier:1200t
Béton:2500m³ Mat.sec:375m³

Engin:4357
Main.d'œuvre:1077
Camion:515

W-100-02



Silos de l'expansion
Emprise:1500m² Acier:11[illegible]
Béton:4300m³ Mat.sec:0m

Engin:2029
Main.d'œuvre:502
Camion:240

W-100-03

Tour de tra[illegible] de l'expansio[illegible]
Acier:200t [illegible]
Ma[illegible]

Engin:203
Main.d'œuvre:50
Camion:24

W-100-04



Garages entretien 400 tonnes (expansion) Emprise:9200m²
Acier:1200t Béton:3680m³
Mat.sec:417m³

Engin:4350
Main.d'œuvre:1075
Camion:514

PRELIMINAIRE

Annexe D

Inventaire des équipements fixes

Estimation pour le démantèlement des installations

Estimation du coût de démantèlement équipements fixes : Mont-Wright

Éval	Catégorie	Description	Masse	Prix 2007 (Prix de rachat)	Prix 2012 (Prix de rachat)
Actifs "Mont-Wright"					
SIS	?	2 CRUSHED ORE CONVEYORS	300 t	150000 $	173891 $
SIS	?	STATION POMPAGE PORTATIVE 500	1 t	500 $	580 $
SIS	?	SYST.COLLECTION DE POUSSIERE			
SIS	?	INSONORISATION CONCENTRATEUR			
SIS	?	ANALYSEUR EN CONTINU BELTCON			
SIS	?	5 TON JIB CRANE	2 t	1000 $	1159 $
SIS	?	PONT ROULANT DESSUS BASSIN REC	100 t	50000 $	57964 $
SIS	?	OVER.TRAVEL.CRANE CAP.IMPR.-#1	75 t	37500 $	43473 $
SIS	?	AUG.CAPACITE PONT ROULANT			
SIS	?	LIGHT PLANT & LISTER 3.5 KV			
SIS	?	ENROULEUR DE CABLE/CHARGEUR980	2 t	1000 $	1159 $
SIS	?	WALK IN BAKE OVEN HEATED	35 t	17500 $	20287 $
SIS	?	VENTIL. IMPROV.-WELDING SHOP			
SIS	?	EQUIPMEN STEAM SYSTEM	350 t	175000 $	202873 $
SIS	?	CHAUD.ELECT.POMPE&CONT.PNEUM.	75 t	37500 $	43473 $
SIS	?	TNSTE WATER SUPPLY SYST			
SIS	?	DOMESTIC WATER SYSTEM	120 t	60000 $	69556 $
SIS	?	BOUILLOIRE ELEC. 330 KVA	35 t	17500 $	20287 $
SIS	?	CHAUDIERE ELECTRIQUE 24000KW	45 t	22500 $	26084 $
SIS	?	WASTE WATER MGT - MW - PHASE I			
SIS	?	WASTE WATER MGT-MW-PHASE II			
SIS	?	STEAM HEAT&LEV.MON./CRUDE ORE			
SIS	?	MINE ELCT.DISTR.-PHASE I-1999			
SIS	?	ELECTR SYST DISTR MW MINE	100 t	50000 $	57964 $
SIS	?	ELECTRICAL DIST SYSTEM MW	100 t	50000 $	57964 $
SIS	?	TNSTE POWER DIST STRE LIGHT			
SIS	?	POWER DIST STREET T PARK			
SIS	?	COMMUNIC & ALARM SYSTEM			
SIS	?	SYSTEME DE TELEVISION			
SIS	?	POSTE METEOROLOGIQUE			
SIS	?	FIRE PROTECTION SYSTEM MW	75 t	37500 $	43473 $
SIS	?	PROTECTION IMPRO.-1997-#3			
SIS	?	FIRE PROTECTION IMPRO.-1998-#4			
SIS	?	SEWER SYSTEM MT-WRIGHT			
SIS	?	TANK MILD STEEL 10000 GAL	10 t	5000 $	5796 $
SIS	?	TANK FARM MW	175 t	87500 $	101436 $
SIS	?	DIESEL PIPELINE REPLACEMENT			
SIS	?	GESTION EAUX USEES-PHASE III			
SIS	?	PETROLUM PROD MGMT PHASE IV			
SIS	?	WATER POLUT CONT SYST			
SIS	?	BASSIN RECUPERATION BOUE ROUGE			
SIS	?	BASSIN/DECANTATION/EAUX HUIL.			
SIS	?	SYST.NETT.CENT.HOFFMAN-CONC			
SIS	?	SEDIMENTATION DES RESIDUS M.W.			
SIS	?	PARC DECHETS DANGER.ENVQ MW			
SIS	?	RES.50KL&BRUL.HUIL US ENVQ MW			
SIS	?	CIT 50KL&BRUL HUIL US ENVIQ MW			
SIS	?	CIT 50KL&BRUL HUIL US ENVQ MW			
SIS	?	INST.-RESERVOIRS CAPTAGE-HUILE			
SIS	?	SITE TRAITEMENT SOLS CONTAMINE			
SIS	?	MINE DEWATERING PUMPHOUSE	25 t	12500 $	14491 $
SIS	?	MINE DEWATERING-MW	35 t	17500 $	20287 $
SIS	?	PUMPHOUSE-MW	25 t	12500 $	14491 $
SIS	?	MINE DEWATERING-2000	25 t	12500 $	14491 $
SIS	?	MINE DEWATERING	25 t	12500 $	14491 $
SIS	?	FILED MAINTENNCE SHOP REPLAC.			
SIS	?	MANGANESE FUME COLLECTION			
SIS	?	DETAILED ENG.STUDY-MTCE FACIL.			
SIS	?	SALLE DE LAV,& EQUIP.AUX.			
SIS	?	ATELIER DE PETITS VEHICULES			
SIS	?	AJOUT CANONS (SIS) & PASSERELLES (RLA)	20 t	10000 $	11593 $
SIS	?	ABRI POUR CONTENEUR A DECHET	5 t	2500 $	2898 $
SIS	?	PORTE#19 ATELIER SOUDURE	0 t	500 $	580 $
SIS	?	MAINT.SHOP & WASHING FAC.IMPR.			
SIS	?	TOILETTES & SALLE DE REPOS			
SIS	?	CRUSHER HANDL STORAGE EQUIP	40 t	20000 $	23185 $
SIS	?	2 CRUSHERS	200 t	100000 $	115927 $
SIS	?	CRUSH & STOR TUNN&STRUCT MW	175 t	87500 $	101436 $
SIS	?	CRUSH & STOR HANDL FACIL MW	175 t	87500 $	101436 $

Estimation pour le démantèlement des installations

Estimation du coût de démantèlement équipements fixes : Mont-Wright

Éval	Catégorie	Description	Masse	Prix 2007 (Prix de rachat)	Prix 2012
SIS	?	CRUSH & HANDL PROC EQUIP MW	175 t	87500 $	101436 $
SIS	?	AGGREG.CRUSH.PLT.IMPROV.97-PHI			
SIS	?	SYSTEME DE DEPOUSSIERAGE			
SIS	?	VENT.ATELIER DE CAOUTC.CONC.			
SIS	?	ATEL.REP.PETIT VEHI.ENT-MW-CAR			
SIS	?	AMEL.VENT.-ATEL.EQPT AUX.COMP.			
SIS	?	DEPOUSSIEREUR-CONVOYEUR NAVETT	25 t	75000 $	86946 $
SIS	?	AMEL.VENT.-ATELIERS-MW			
SIS	?	MOD STRUCTURALES ATEL.ELECT			
SIS	?	VENTILATION ATELIER-CONCENTRAT			
SIS	?	REMPLACEMENT DU DEPOUSSIEREUR			
SIS	?	CONCEN BLDG SERV FACIL M W			
SIS	?	CONCENTR AUTOG GRINDMILL MW			
SIS	?	CONCEN GRIND & SCREEN NO 2			
SIS	?	CONCE GRIND & SCREEN NO 3			
SIS	?	CONCENTR AUTOG GRINDMILL MW			
SIS	?	CONCENTR AUTOG GRINDMILL MW			
SIS	?	CONCENTR AUTOG GRINDMILL MW			
SIS	?	CONC SPIRAL LAUND&PIPING MW	1000 t	500000 $	579637 $
SIS	?	CONC FILTER SYSTEM MW	150 t	75000 $	86946 $
SIS	?	CONC TAIL & WATER RECSYS MW	85 t	42500 $	49269 $
SIS	?	MT-WRIGHT FLOW SHEET MOD.			
SIS	?	TAILING PUMPING COMPLETE	0 t	35000 $	40575 $
SIS	?	ENVIRONMENTAL PROTECTION			
SIS	?	TAILING PIPELINE	0 t	100000 $	115927 $
SIS	?	CHEMIN D'INSPECTION CANAL C" "			
SIS	?	CHAUF.DE L.EAU DE PROCEDE-CONC			
SIS	?	WAT SUPP HESS LK PUMPSTN MW			
SIS	?	WAT SUP SERV FACIL PUMP STN	20 t	10000 $	11593 $
SIS	?	PIPEL HESS L STN TO CONCENT	100 t	50000 $	57964 $
SIS	?	WAT CLAR SYST THICKN STRUCT	200 t	100000 $	115927 $
SIS	?	WAT SUP SERV FAC	35 t	17500 $	20287 $
SIS	?	COUVERCLES SUR EPAISSISSEURS			
SIS	?	WAT SUP THICKENERS 3	150 t	75000 $	86946 $
SIS	?	WAT SUP ALUM & JAGUAR SYST			
SIS	?	INSTRUMENT-CONTR CENTER SYS			
SIS	?	POMPE A VIS HELICOIDALE			
SIS	?	TUYAUT-ASSECHEM.FOSSE			
SIS	?	POMPES -ASSECHEM.FOSSE			
SIS	?	TAILINGS PIPELINE TO HESSE	0 t	75000 $	86946 $
SIS	?	AREA RUN-OFF DIVERSION DITCHES			
SIS	?	GRAVITY RETURN LINE (DAM B)		75000 $	86946 $
SIS	?	BORROW PIT PREPARATION			
SIS	?	TAILINGS DISPOSAL SYSTEM			
SIS	?	BARRAGE LAC HESSE ET RESIDUS		750000 $	869456 $
SIS	?	BARAGE LAC HESSE-RESIDUS/SUITE			
SIS	?	BARAGE LAC HESSE-RESIDUS-SUITE			
SIS	?	BARRAGE LAC HESSE-RESIDU SUITE			
SIS	?	BARRAGE LAC HESSE RESIDUS 93			
RLA	?	MINE TAILING CONFINEMENT 91			
SIS	?	MINE TAILING CONFINEMENT 92			
SIS	?	ENERGY CONSUMPTION TAILINGS			
SIS	?	142139AILINGS CONFINEMENT 94			
SIS	?	MINE TAILINGS CONFINEMENT -95			
SIS	?	MINE TAILINGS CONFINEMENT 1996			
SIS	?	MINE TAILINGS CONF.-PROGR.1997			
SIS	?	MINE TAILINGS CONF-PROGRAM 98			
SIS	?	MINE TAILINGS CONF-PROGRAM 99			
SIS	?	MINE TAILINGS CONF.-PROG. 2000			
SIS	?	CONFINEMENT RESIDUS MW 2001			
SIS	?	CONFINEMENT DES RESIDUS2002 MW			
SIS	?	CONFINEMENT DES RESIDUS 2003			
SIS	?	MINE TAILING CONFINMENT			
SIS	?	TRANSFORMER&SWITCHOUSE	75 t	37500 $	43473 $
SIS	?	TRANSFORMATEUR 15KVA	15 t	7500 $	8695 $
SIS	?	POSTE DE COMMMUTATION PORTATIF			
SIS	?	REGULATEUR DE PUISSANCE APPLEE			
SIS	?	DISJONCTEUR 15 KV			
SIS	?	TRANSFORMATEUR	12 t	6000 $	6956 $
SIS	?	NORMAND SUB STATION			

Estimation du coût de démantèlement équipements fixes : Mont-Wright

(Prix de rachat)

Éval	Catégorie	Description	Masse	Prix 2007	Prix 2012
SIS	?	DEVELOP.DU SECTEUR B-MT-WRIGHT			
SIS	?	EXTEN.LIGNES ELECT.MINE			
SIS	?	ATELIERS DE LA MINE			
SIS	?	EXTEN LIGNE ELECT-MINE-SUITE			
SIS	?	EXTENS.LIGNE ELECT.MINE SUITE			
SIS	?	EXTEN.LIGN.ELECT. 7.2KV-1996			
SIS	?	EXTENSION LIGNES ELECT.-1997			
SIS	?	EXTENSION LIGNES ELECT. - 1998			
SIS	?	EXT.LIGNES ELECT.MW -2000			
SIS	?	EXT. LIGNE ELECT. MW 2002			
SIS	?	TRANSMISSION LINE			
SIS	?	PIPE LINE DIESEL & VAPEUR-SUIT			
SIS	?	BALANCE MINERAI BRUT	35 t	17500 $	20287 $
SIS	?	BALANCE POUR MINERAI BRUT	35 t	17500 $	20287 $
SIS	?	REMPL.LECTEURS CODE BARRES			
SIS	?				
SIS	?	CB-03 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB-04 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB-05 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB-06 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB-07 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB-09 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB1-1 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB1-2 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB1-3 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB1-4 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB1-5 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB1-6 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB1-7 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB2-1 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB2-2 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB2-3 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB2-4 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB2-5 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB2-6 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB2-7 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB3-1 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB3-2 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB3-3 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB3-4 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB3-5 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB3-6 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB3-7 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB4-1 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB4-2 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB4-3 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB4-4 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB4-5 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB4-6 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB4-7 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB5-1 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB5-2 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB5-3 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB5-4 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB5-5 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB5-6 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB5-7 CONVOYEUR	15 t	7500 $	8695 $
RLA	?	CB6-1 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB6-2 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB6-3 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB6-4 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB6-5 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB6-6 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CB6-7 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CS-01 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	CS-02 CONVOYEUR	15 t	7500 $	8695 $
SIS	?	BROYEUR DE CONCENTRE "A" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x10	175 t	85000 $	98538 $

Estimation pour le démantèlement des installations

Estimation du coût de démantèlement équipements fixes : Mont-Wright

Éval	Catégorie	Description	Masse	Prix 2007 (Prix de rachat)	Prix 2012 (Prix de rachat)
RLA	?	BROYEUR DE CONCENTRE "B" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x11	175 t	85000 $	98538 $
RLA	?	BROYEUR DE CONCENTRE "C" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x12	175 t	85000 $	98538 $
RLA	?	BROYEUR DE CONCENTRE "D" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x13	175 t	85000 $	98538 $
RLA	?	BROYEUR DE CONCENTRE "E" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x14	175 t	85000 $	98538 $
RLA	?	BROYEUR DE CONCENTRE "F" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x15	175 t	85000 $	98538 $
RLA	?	PONT ROULANT 3P 2 TONS	10 t	5000 $	5796 $
SIS	?	PONT ROULANT 2P 2 TONS 40'	20 t	10000 $	11593 $
SIS	?	PONT ROULANT 2P 125T ET 5 TONS	65 t	32500 $	37676 $
SIS	?	PONT ROULANT 2P 25 TONS 80-100	75 t	37500 $	43473 $
SIS	?	PONT ROULANT 15 TONS	25 t	12500 $	14491 $
SIS	?	5 TON STACKER CRANE	3 t	1500 $	1739 $
SIS	?	ECHANTILLONEUR AUTO.DES TRAINS		0 $	0 $

Masse	2007	2012
6460t	**4313000 $**	**4999949 $**

Coût de démantèlement par tonne : **774 $/t**

Éval	Catégorie	Description	Masse	Prix 2007	Prix 2012
Actifs "Expansion Mont-Wright"					
RLA	?	BROYEUR DE CONCENTRE "E" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x14	525 t	255000 $	295615 $
SIS	?	CONVOYEURS	105 t	52500 $	60862 $
SIS	?	BALANCE MINERAI BRUT	70 t	35000 $	40575 $
SIS	?	PONT ROULANT 2P 25 TONS 80-100	75 t	37500 $	43473 $
SIS	?	CONVOYEUR TRANSFERT	15 t	7500 $	8695 $

Masse	2007	2012
790t	**387500 $**	**449219 $**

Coût de rachat à tonne : **569 $/t**

Coût de rachat moyen à la tonne : **752 $/t**

Aléas et bénéfices prévus au rachat (40%) : **301 $/t**

Coût net de gestion à la tonne : **451 $/t**

Répartion des côuts de gestion pour une tonne :

Démantèlement :	42%	**189 $/t**
Transport vers le port :	19%	**86 $/t**
Vente métal :	39%	**176 $/t**

Estimation du coût de démantèlement des installations fixes :

		Taux	
Masse de métal à démanteler :	7250 t	180 $/t	1305000 $
Transport vers le port :	7250 t	85 $/t	616250 $

Annexe E

Tableau sommaire des taux

Estimation pour le démantèlement des installations

Taux de base pour l'estimation : Mont-Wright

Désignation	Taux 2007	Indice	Taux 2012	Quantité	Montant	Durée	PMQ	Mobi/démobi.	Taux pour l'estimation	Montant estimé
Pelle hydraulique marteau et/ou cisaille	190 $/h	3%	220 $/h	7200 h	1585887 $	100 jours	9	18000 $	**223 $/h**	1603887 $
Pelle hydraulique godet	190 $/h	3%	220 $/h	7200 h	1585887 $	100 jours	9	18000 $	**223 $/h**	1603887 $
Bob cat	115 $/h	3%	133 $/h	7200 h	959879 $	100 jours	9	18000 $	**136 $/h**	977879 $
Loader	150 $/h	3%	174 $/h	7200 h	1252016 $	100 jours	9	18000 $	**176 $/h**	1270016 $
Grue	280 $/h	3%	325 $/h	321 h	104196 $	20 jours	2	4000 $	**337 $/h**	108196 $
main-d'œuvre	55 $/h	9%	85 $/h	7200 h	609295 $	100 jours	9	216000 $	**115 $/h**	825295 $
Nacelle	8000 $/h	3%	9274 $/unité	15	139113 $	20 jours	1	2000 $	**9408 $/unité**	141113 $
Camions transport de matériaux secs	300 $/unité	3%	348 $/unité	841	292485 $	105 jours	8	16000 $	**367 $/unité**	308485 $
Camions transport de béton	275 $/unité	3%	319 $/unité	1800	573841 $	100 jours	18	36000 $	**339 $/unité**	609841 $
Camions transport de métaux	275 $/unité	3%	319 $/unité	800	255040 $	100 jours	8	16000 $	**339 $/unité**	271040 $

Total : 7719600 $

Efforts supplémentaires estimés

Désignation	Taux pour l'estimation	Quantité	Durée	PMQ	Montant estimé
Pelle hydraulique marteau et/ou cisaille	**223 $/h**	3523 h	88 jours	5	784740 $
Pelle hydraulique godet	**223 $/h**	3523 h	88 jours	5	784740 $
Bob cat	**136 $/h**	3523 h	88 jours	5	478451 $
Loader	**176 $/h**	3523 h	88 jours	5	621386 $
Grue	**337 $/h**	157 h	20 jours	1	52937 $
main-d'œuvre	**115 $/h**	3523 h	110 jours	4	403795 $
Nacelle	**9408 $/unité**	7	20 jours	1	69043 $
Camions transport de matériaux secs	**367 $/unité**	411	103 jours	4	150934 $
Camions transport de béton	**339 $/unité**	881	88 jours	10	298379 $
Camions transport de métaux	**339 $/unité**	391	98 jours	4	132613 $

Total supplémentaire : 3777000 $

Calcul du taux horaire 2012 de la main d'œuvre sur une base de 70 heures de travail/semaine et une mobilisation de 28 jours

Travailleur	85 $/h
Gîte et couvert	25 $/h
Mobilisation/Démobilisation/transport	5 $/h
TOTAL	115 $/h

(ce taux ne comprend les coûts affairant à l'installation de chantier)

Total Mont-Wright 2012 : 11496600 $

Annexe F

Estimation des coûts de démantèlement des installations (EDI)

Estimation pour le démantèlement des installations

Estimation des coûts de démantèlement des installations de Mont-Wright

Installation	Dépendance	Désignation	Emprise	Hauteur	Toiture	Enveloppe	Plancher	Acier	Béton	Mat.sec	EDI 2007	EDI 2012
W-001-00		Bureaux de la mine	1873m²	7m	1873m²	812m²	2049m²	64t	426m³	430m³	150000 $	119100 $
W-001-01		Dépendance (passage couvert)	67m²	2m	67m²	178m²	67m²			21m³		3700 $
W-002-00		Station de carburant pour camions	430m²	8m	430m²	119m²	154m²	35t	48m³	0m³	45000 $	25500 $
	W-002-01	Dépendance 1 (remise sur la plateforme)	5m²		0m²	0m²	0m²					200 $
	W-002-02	Dépendance 2 (remise)	25m²		0m²	0m²	0m²					1400 $
	W-002-03	Réservoir hors-terre, vertical en acier	0m²		0m²	0m²	0m²					
W-003-00		Atelier d'entretien et entrepôt	22444m²	19m	22444m²	19658m²	35025m²	4255t	2584m³	0m³	1175000 $	1598000 $
W-004-00		Atelier des petits véhicules	447m²	10m	447m²	1023m²	447m²	16t	49m³	0m³	85000 $	27500 $
	W-004-01	Dépendance 1 (Abri)	23m²		0m²	0m²	0m²	0t	0m³	0m³		1200 $
	W-004-02	Dépendance 2 (Remise)	5m²		0m²	0m²	0m²	0t	0m³	0m³		200 $
	W-004-03	Dépendance 3 (Conteneur)	19m²		0m²	0m²	0m²	0t	0m³	0m³		1000 $
	W-004-04	Dépendance 4 (Conteneur)	19m²		0m²	0m²	0m²	0t	0m³	0m³		1000 $
	W-004-05	Réservoir (1) vertical en acier	0m²		0m²	0m²	0m²	0t	0m³	0m³		
W-005-00		Bureaux	1263m²	22m	1263m²	2030m²	11525m²	273t	1410m³	718m³		193500 $
W-006-00		Concasseur	1665m²	30m	1665m²	5622m²	4356m²	620t	555m³	0m³	1150000 $	166900 $
W-007-00		Tunnel de convoyeurs (100% sous terre)	1482m²		0m²	0m²	0m²	0t	0m³	0m³	475000 $	79700 $
W-008-00		Chambre de vulcanisation	76m²	11m	76m²	355m²	275m²	2t	10m³	0m³	35000 $	4800 $
W-009-00		Station d'entraînement	1029m²	17m	1029m²	2982m²	1251m²	134t	546m³	90m³	185000 $	86900 $
W-010-00		Galerie de convoyeurs	1988m²	4m	1988m²	5743m²	3975m²	592t	252m³	140m³	225000 $	112100 $
W-011-00		Concentrateur	16908m²	30m	16908m²	33102m²	75714m²	10635t	7993m³	55m³	510000 $	2352900 $
W-011-01		Silos (6)	2270m²	25m	2270m²	0m²	2270m²	150t	13190m³	0m³	750000 $	1056300 $
W-012-01		Annexe au concentrateur (entrée)	106m²	9m	106m²	729m²	212m²	8t	81m³	0m³		9300 $
W-012-02		Annexe au concentrateur (salle électrique)	254m²	6m	254m²	591m²	507m²	8t	91m³	0m³		16600 $
W-013-00		Bâtiment au-dessus des silos	1803m²	17m	1803m²	7978m²	6231m²	760t	415m³	106m³		140800 $
W-014-00		Centrale thermique	1830m²	18m	1830m²	4951m²	2455m²	259t	191m³	0m³	435000 $	118500 $
W-015-00		Entrée électrique (côté centrale thermique)	138m²	4m	138m²	94m²	138m²	3t	19m³	0m³		7700 $
W-016-01		Chargement des wagons (galeries et tunnels)	719m²	5m	719m²	10250m²	6429m²	322t	352m³	0m³		54900 $
W-016-02		Chargement des wagons (tour de transfert #1)	272m²	13m	291m²	1563m²	872m²	51t	62m³	0m³	125000 $	18800 $
W-016-03		Chargement des wagons (tour de transfert #3)	236m²	45m	236m²	3314m²	1651m²	154t	105m³	0m³	75000 $	34000 $
W-017-00		Chargement des wagons (bât. au-dessus du silo)	345m²	66m	345m²	5026m²	2173m²	152t	164m³	24m³	75000 $	62300 $
W-018-00		Chargement des wagons (chambre électrique)	331m²	8m	331m²	557m²	331m²	16t	49m³	24m³		20200 $
W-019-00		Chargement des wagons	323m²	9m	323m²	1247m²	323m²	20t	34m³	0m³	110000 $	19700 $
W-019-01		Silo de chargement	399m²	60m	399m²	0m²	734m²	45t	8525m³	0m³	180000 $	1076000 $
W-020-00		Ancienne usine de traitement des eaux rouges	177m²	6m	177m²	616m²	205m²	5t	8m³	0m³	35000 $	10100 $
W-021-00		Caserne (ancien bâtiment d'alum)	201m²	7m	201m²	771m²	201m²	12t	11m³	0m³	75000 $	11600 $
W-022-00		Gare	484m²	3m	484m²	786m²	0m²	12t	13m³	0m³	45000 $	26300 $
W-023-00		Abri pour grue de secours	246m²	9m	246m²	802m²	0m²	9t	0m³	0m³	55000 $	13600 $
W-024-00		Entrepôt de la gare	97m²	3m	97m²	457m²	0m²	3t	24m³	0m³	85000 $	5400 $
W-025-00		Atelier de nettoyage à la vapeur	578m²	13m	578m²	2584m²	0m²	33t	18m³	0m³		32700 $
W-026-00		Station de pompage (Lac Hessé)	320m²	7m	320m²	1453m²	57m²	13t	508m³	0m³	95000 $	33300 $
W-027-00		Atelier électrique (Ancien)	781m²	5m	781m²	1829m²	167m²	25t	0m³	0m³	125000 $	42300 $
W-028-00		Traitement des eaux sanitaires (QUONSET)	223m²	5m	223m²	431m²	0m²	0t	0m³	15m³	45000 $	12100 $
W-029-00		Parc pétrolier (bâtiment des pompes)	78m²	3m	78m²	187m²	6m²	3t	32m³	0m³	45000 $	4500 $
	W-029-01	Réservoirs acier, 3.96mØ x 11.06m haut (2)	12m²	11m	0m²	0m²	0m²	0t	0m³	0m³	10000 $	700 $
	W-029-02	Réservoirs acier, 18.29mØ x 12.19m haut (2)	263m²	12m	0m²	0m²	0m²	0t	0m³	0m³	75000 $	14100 $
	W-029-03	Dépendances (2)	4m²		0m²	0m²	0m²	0t	0m³	0m³	15000 $	200 $
W-030-00		Bâtiment des pompes (rés. à essence et lub.)	42m²	3m	42m²	0m²	42m²	0t	43m³	0m³		2600 $
	W-030-01	Réservoirs en acier (8)	25m²	8m	0m²	0m²	0m²	0t	0m³	0m³	28000 $	1300 $
W-031-00		Entrepôt (près du poste Normand)	414m²	4m	414m²	815m²	0m²	6t	0m³	16m³	135000 $	22400 $
W-032-00		Parc des réservoirs à mazout (bâtiment)	92m²	3m	92m²	347m²	0m²	1t	24m³	0m³	75000 $	5100 $
	W-032-01	Réservoir en acier 3843m³ (2)	0m²	0m	0m²	0m²	0m²	0t	0m³	0m³		
W-033-00		Remise Environnement (ancienne guérite)	35m²	5m	35m²	95m²	15m²	0t	0m³	0m³	10000 $	1900 $
W-034-00		Entrepôt	653m²	6m	653m²	1321m²	0m²	24t	20m³	0m³	25000 $	0 $
W-035-00		Ancien atelier des pneus	1070m²	12m	1070m²	4202m²	0m²	63t	10m³	0m³	65000 $	59600 $
W-036-00		Ancien atelier des pneus (annexe)	135m²	3m	135m²	244m²	0m²	0t	0m³	168m³		7400 $
W-038-00		Ancien atelier des pneus (entrepôt)	372m²	4m	372m²	736m²	0m²	11t	4m³	0m³	65000 $	20100 $
W-039-00		Cantine #2 (Roulotte)	155m²		0m²	0m²	0m²	0t	0m³	0m³	15000 $	8300 $
W-040-00		Cantine #4 (Roulotte)	94m²		0m²	0m²	0m²	0t	0m³	116m³	15000 $	5100 $
W-040-01		Dépendance (garage)	56m²	4m	56m²	161m²	0m²	0t	0m³	0m³	5000 $	3000 $
W-041-00		Station de pompage Modridge	74m²	4m	74m²	402m²	0m²	2t	18m³	0m³	10000 $	4200 $
W-042-00		Agrandissement bureaux de la mine	679m²	8m	679m²	1707m²	1394m²	39t	55m³	38m³		41200 $
W-043-00		Atelier des pneus	929m²	15m	929m²	1733m²	1052m²	72t	30m³	0m³		54800 $
W-044-00		Parc des réservoirs journaliers (améliorations)	0m²		0m²	0m²	0m²	0t	18m³	0m³		
	W-044-01	Réservoirs des huiles usées (3)	0m²		0m²	0m²	0m²	0t	0m³	0m³		
	W-044-02	Réservoir à bunker (1)	0m²		0m²	0m²	0m²	0t	0m³	0m³		
	W-044-03	Réservoir diesel (1)	0m²		0m²	0m²	0m²	0t	0m³	0m³		
	W-044-04	Réservoir solvant usé (1)	0m²		0m²	0m²	0m²	0t	0m³	0m³		
	W-044-05	Dépendance 1 (Remise)	10m²		0m²	0m²	0m²	0t	0m³	0m³		500 $
	W-044-06	Dépendance 2 (Remise modulaire)	31m²		0m²	0m²	0m²	0t	1m³	137m³	5000 $	1700 $
W-045-00		Station de pompage des boues	66m²	5m	66m²	300m²	0m²	4t	10m³	0m³	5000 $	3600 $
W-046-01		Guérite	34m²	2m	34m²	42m²	0m²	0t	7m³	0m³	5000 $	1900 $
W-046-02		Bâtisse des valves (Roulotte)	15m²		0m²	0m²	0m²	0t	0m³	0m³	8000 $	800 $
W-047-00		Abribus	69m²	2m	69m²	104m²	0m²	0t	0m³	0m³	5000 $	3700 $
	W-047-01	Passage 1	59m²	2m	59m²	0m²	0m²	0t	0m³	121m³	7500 $	3300 $
	W-047-02	Passage 2	33m²	2m	33m²	0m²	33m²	0t	0m³	0m³	5000 $	1800 $
W-048-00		Roulotte au petit concasseur	36m²		0m²	0m²	0m²	0t	0m³	0m³	5000 $	1900 $
	W-048-01	Dépendances (5 remises) au petit concasseur	44m²		0m²	0m²	0m²	0t	0m³	0m³		2400 $
W-049-00		Garage Oconnel	223m²	4m	223m²	466m²	0m²	3t	21m³	256m³	8000 $	12400 $
	W-049-01	Roulotte Oconnel	36m²		0m²	0m²	0m²	0t	0m³	0m³		2000 $
W-050-00		Entrepôt	505m²	4m	505m²	921m²	0m²	7t	0m³	0m³	5000 $	27300 $
	W-050-01	Dépendance 1 (Remise)	16m²		0m²	0m²	0m²	0t	0m³	11m³		800 $
	W-050-02	Dépendance 2 (Remise)	32m²		0m²	0m²	0m²	0t	0m³	0m³		1700 $
W-051-00		Salle à manger au concasseur	95m²	4m	0m²	236m²	95m²	0t	0m³	0m³	8000 $	5200 $
W-053-00		Bureaux Oconnel (Agencement de 4 roulottes)	197m²		0m²	0m²	0m²	0t	0m³	96m³	15000 $	10700 $

Estimation pour le démantèlement des installations

Estimation des coûts de démantèlement des installations de Mont-Wright

Installation	Dépendance	Désignation	Emprise	Hauteur	Toiture	Enveloppe	Plancher	Acier	Béton	Mat.sec	EDI 2007	EDI 2012
	W-053-01	Dépendance 1 (Remise)	18m²		0m²	0m²	0m²	0t	0m³	0m³	3000 $	1000 $
	W-053-02	Dépendance 2 (Roulotte)	58m²		0m²	0m²	0m²	0t	0m³	6m³	5000 $	3100 $
W-054-00		Bâtiment d'isolation 34,5 Kv	23m²	3m	23m²	144m²	0m²	1t	4m³	0m³	5000 $	1300 $
W-055-00		Station de surpression	326m²	9m	326m²	1062m²	338m²	17t	58m³	6m³	25000 $	20800 $
W-056-00		Dyno Nobel, entrepôt (ancienne usine C.I.L.)	734m²	5m	734m²	2174m²	120m²	21t	95m³	11m³	25000 $	42200 $
	W-056-01	Dépendance (Remise)	6m²	0m	0m²	0m²	0m²	0t	0m³	0m³		300 $
	W-056-02	Dépendances (3 conteneurs à explosifs)	54m²	0m	0m²	0m²	0m²	0t	0m³	0m³	3000 $	2900 $
W-057-00		Dyno Nobel, entrepôt (anciennement C.I.L.)	124m²	4m	124m²	313m²	0m²	3132t	6m³	0m³	8000 $	11900 $
W-058-00		Dyno Nobel, garage (anciennement C.I.L.)	144m²	5m	144m²	591m²	0m²	5t	0m³	0m³	8000 $	7900 $
W-059-00		Dyno Nobel, bâtiment principal	518m²	8m	518m²	1612m²	953m²	22t	171m³	0m³	35000 $	35500 $
W-060-00		Dyno Nobel, abri pour wagons	166m²	7m	166m²	379m²	0m²	3t	0m³	0m³	8000 $	9100 $
W-062-00		Dyno Nobel, entrepôt (TYPE HONCO)	152m²	5m	152m²	306m²	0m²	0t	0m³	0m³	5000 $	8300 $
W-063-00		Dyno Nobel, garage #1	154m²	5m	154m²	584m²	0m²	5t	0m³	0m³	6000 $	8300 $
	W-063-01	Dépendance (Conteneur aménagé)	30m²		0m²	0m²	0m²	0t	0m³	0m³		1600 $
W-064-00		Dyno Nobel, garage #2	154m²	5m	154m²	584m²	0m²	5t	0m³	118m³		8400 $
W-065-00		Dyno Nobel, bureaux (Roulottes)	117m²		0m²	0m²	0m²	0t	0m³	1670m³	8000 $	7400 $
W-066-00		Dyno Nobel, salle des employés (Roulotte)	133m²		0m²	0m²	0m²	0t	0m³	0m³	5000 $	7100 $
W-067-00		Dyno Nobel, ancien entrepôt à explosifs	205m²	3m	205m²	407m²	205m²	2t	2m³	0m³	5000 $	11200 $
W-068-00		Forage CCL (garage)	439m²	5m	439m²	1575m²	0m²	5t	0m³	0m³	13500 $	24000 $
	W-068-01	Dépendance 1 (Remise)	15m²		0m²	0m²	0m²	0t	0m³	0m³	2000 $	800 $
	W-068-02	Dépendance 2 (Remise)	13m²		0m²	0m²	0m²	0t	0m³	0m³		700 $
	W-068-03	Dépendance 3 (Conteneur)	65m²		0m²	0m²	0m²	0t	0m³	0m³		3500 $
W-069-00		Forage CCL (entrepôt)	150m²	4m	150m²	612m²	0m²	2t	0m³	434m³	3000 $	8400 $
W-070-00		Forage CCL (roulotte)	57m²		0m²	0m²	0m²	0t	0m³	110m³	5000 $	3100 $
W-071-00		Vestiaire au concasseur	119m²	3m	119m²	157m²	119m²	2t	0m³	25m³		6500 $
W-072-00		Clarificateurs (3 bassins de 76.20mØ)	6837m²	5m	0m²	0m²	115m²	1100t	770m³	25m³	225000 $	376600 $
W-072-01		Bâtisse des pompes aux clarificateurs	34m²	5m	34m²	54m²	47m²	1t	17m³	2m³	3000 $	2300 $
W-073-00		Cantine #3 (Roulotte)	155m²		0m²	0m²	0m²	0t	0m³	0m³	8000 $	8300 $
	W-073-01	Dépendance 1 (Remise)	13m²		0m²	0m²	0m²	0t	0m³	0m³	2000 $	700 $
	W-073-02	Dépendance 2 (Remise)	9m²		0m²	0m²	0m²	0t	0m³	5m³		500 $
W-074-01		Unité de filtration (Remorque)	0m²		0m²	0m²	0m²	0t	0m³	0m³	3000 $	
W-074-02		Unité de filtration (Conteneur)	0m²		0m²	0m²	0m²	0t	0m³	0m³	3000 $	
W-074-03		Traitement des sols (Remise)	5m²		0m²	0m²	0m²	0t	0m³	67m³	1500 $	300 $
W-075-01		Autres dépendances sur le site (Guérite)	19m²	2m	19m²	42m²	0m²	0t	0m³	228m³	2000 $	1200 $
W-075-02		Autres dépendances sur le site (Remise)	8m²	0m	0m²	0m²	0m²	0t	0m³	228m³	2500 $	600 $
W-075-03		Autres dépendances sur le site (Remise)	6m²		0m²	0m²	0m²	0t	0m³	0m³		300 $
W-076-00		Atelier électrique	618m²	0m	618m²	1331m²	1274m²	33t	67m³	0m³		34400 $
W-099-01		Améliorations, c. de fer (17691m + 25 aiguil.)	0m²		0m²	0m²	0m²	0t	0m³	19m³		
W-099-02		Divers (acier et béton)	0m²		0m²	0m²	0m²	275t	325m³	19m³		
W-100-01		Concentrateur de l'expansion	11200m²	30m	11200m²	15000m²	25000m²	1200t	2500m³	375m³		1155100 $
W-100-02		Silos de l'expansion	1500m²	30m	1500m²	0m²	1500m²	1100t	4300m³	0m³		537900 $
W-100-03		Tour de transfert de minerai de l'expansion	400m²	45m	400m²	700m²	400m²	200t	200m³	11m³		53700 $
W-100-04		Garages entretien 400 tonnes (expansion)	9200m²	35m	9200m²	27800m²	9200m²	1200t	3680m³	417m³		1153100 $
			102555m²				Récupération de métal =		37748t		7447000 $	**11496600 $**

Etimation du béton à traiter :

		Côut de traitement	
Quantité de béton :	100435t	20 $	2008709 $

Estimation de récupération de métal :

		Prix de vente de métal	
Quantité de métal provenant du béton :	7694t (à raison de 150 kg par m³)		
Quantité de métal des enveloppes :	1871t (à raison de 15 kg par m²)		
Quantité de métal provenant des structures d'acier :	27248t		
Total :	36813t	175 $	6442217 $

Annexe G

Sommaire des coûts de démantèlement des installations

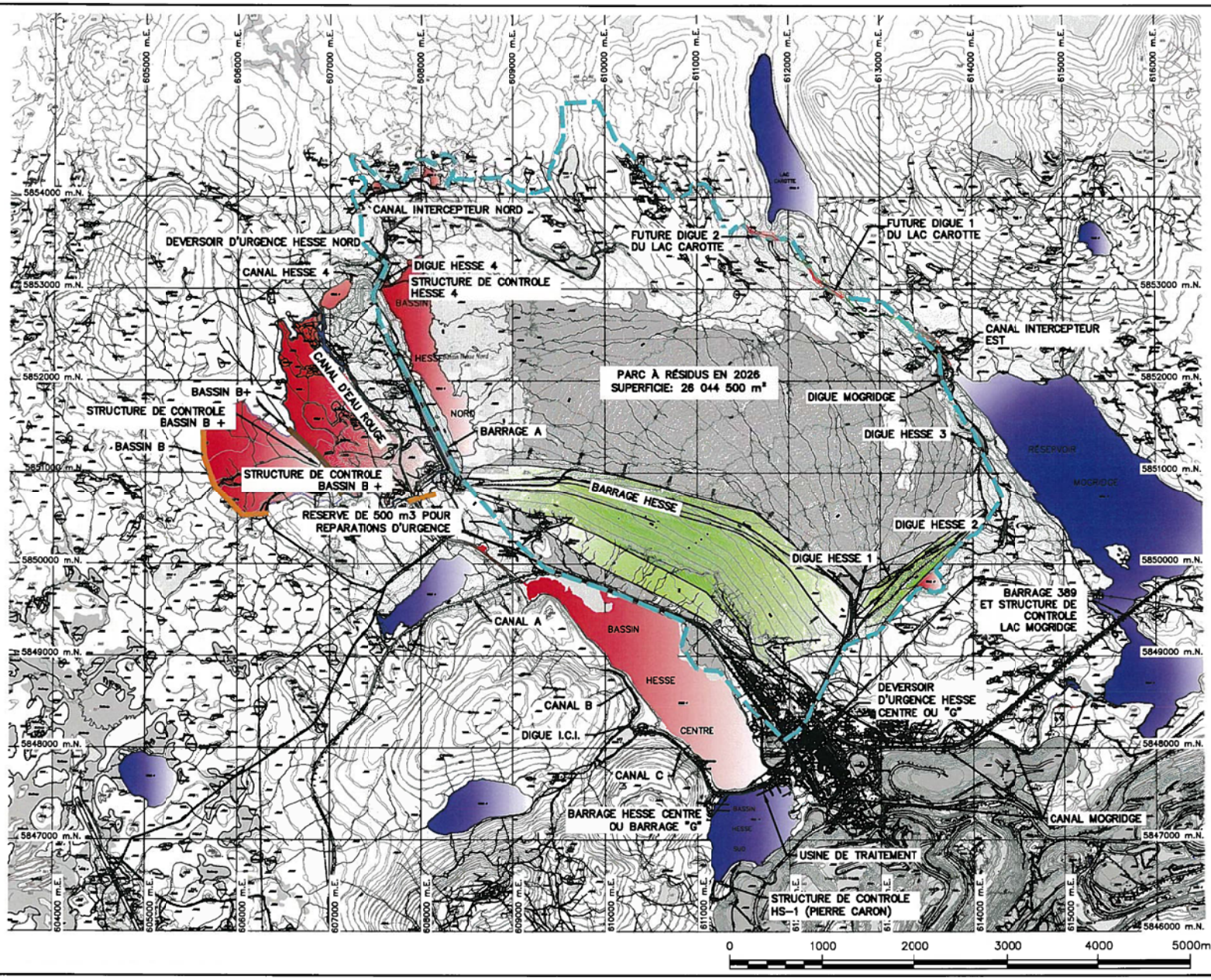
Estimation pour le démantèlement des installations

Sommaire des coûts estimés pour le démantèlement : Mont-Wrigth

Désignation	Quantité		Estimation 2012
Estimation du coût de démantèlement des installations	130 installations		11496600 $
Traitement du béton (concassage / criblage)	100435 t	20 $/t	2008700 $
Transport du métal vers le port (Port-Cartier)	36813 t	86 $/t	3165900 $
Etimation du coût de démantèlement des équipements fixes	7250 t	180 $/t	1305000 $
Transport du métal vers le port (Port-Cartier)	7250 t	86 $/t	623500 $
Démantèlement des engins de mine (72 camions + 8 pelles à cables)	40000 t	180 $/t	7200000 $
Transport du métal vers le port (Port-Cartier)	40000 t	86 $/t	3440000 $
		TOTAL	**29239700 $**

Annexe H

Plan du parc à résidus en 2026





LÉGENDE:

- EAU PROPRE
- EAU DE PROCÉDÉ
- BARRAGE / DIGUE

NOTE:

COMPILE A PARTIR DE PHOTOGRAPHIES AERIENNES, A L'ECHELLE DE 1:20000, PRISES EN JUIN 1994. COORDONNEES ET ALTITUDES EN METRES CARROYAGE UTM MODIFIE.
MISE A JOUR A PARTIR DES PHOTOGRAPHIES AERIENNES ANALOGUES ZEISS TOP 15 A 12 CM, PRISES LE 6 SEPTEMBRE 2011.

PAS POUR CONSTRUCTION

amec

CLIENT :
Mines Canada
ArcelorMittal

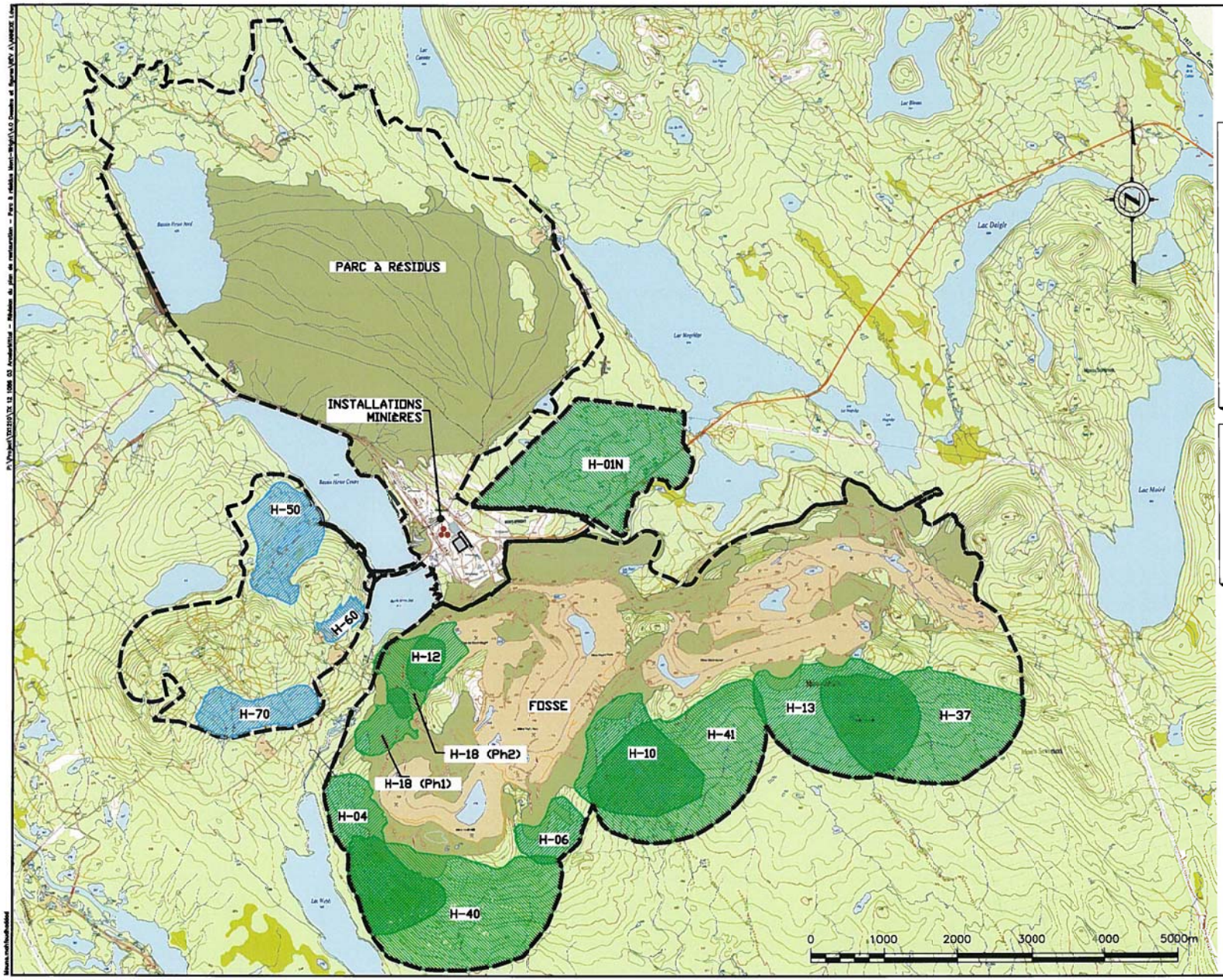
PROJET :
PLAN DE RESTAURATION
PARC À RÉSIDUS MONT-WRIGHT

STRUCTURES ACTUELLES ET FUTURES DE CONTRÔLE DES EAUX
MONT-WRIGHT, QUÉBEC

DATE : 12-09-07	ECHELLE : 1:40 000
DESSINÉ PAR : C. LAPLANTE, tech.	
PROJETÉ PAR : D. BÉDARD, ing.	
APPROUVÉ PAR : D. DENG, ing.	
PROJET No. : TX12 1086 03	DESSIN No. : FIG 323 -ANNEXE H
REV. : A	1/1

Annexe I

Plan de végétalisation du site



LÉGENDE

- EMPREINTE DES ACTIVITÉS
- EMPREINTE DU PARC À RÉSIDUS (EN 2026) ET DES INSTALLATIONS MINIÈRES (EN 2042) (100% DE LA SURFACE) (2797 ha)
- EMPREINTE DES HALDES DU PAUL'S PEAK EN 2042 (80% DE LA SURFACE HACHURÉE) (1446 ha)
- EMPREINTE DES HALDES DU SECTEUR HESSE EN 2042 (80% DE LA SURFACE HACHURÉE) (163 ha)

RÉFERANCES :

- EMPLACEMENT DU SECTEUR HESSE 2042 SELON LE PLAN DE AMMC (LIMITE-RF1.DXF)
- BASE DU PLAN DU MINISTÈRE DES RESSOURCES NATURELLES DU QUÉBEC À PARTIR DE LA BASE DEDONNÉES TOPOGRAPHIQUE DU QUÉBEC (BDTQ), BASÉ SUR DES PHOTOGRAPHIES AÉRIENNES DE 2004, ÉCHELLE DE 1:40 000, RÉVISÉ EN 2005.

PAS POUR CONSTRUCTION

amec

CLIENT :

Mines Canada

ArcelorMittal

PROJET :

PLAN DE RESTAURATION

PLAN DE VÉGÉTALISATION DU SITE

MONT-WRIGHT, QUÉBEC

DATE : 12-09-26	ÉCHELLE : 1:50 000
DESSINÉ PAR :	M. HADDAD, tech.
PROJETÉ PAR :	F. CHOQUET, ing. jr.
APPROUVÉ PAR :	D. DENG, ing.
PROJET No. : TX12 1086 03	DESSIN No. : ANNEXE I
REV. : A	

Annexe J

Estimation des coûts de fermeture du parc à résidus

Sommaires des coûts de démantèlement et de restauration du parc à résidus

Démantèlement

	Quantité	Unité	Coût unitaire	Sous-total
Démantèlement des tuyaux 20po et transport vers Port-Cartier	3,200	t	260 $	832,000 $
Station de surpression				
Déversoir dans la digue du bassin B+	1	un.	200,000 $	200,000 $
Déversoir digue Hesse Centre/Sud	1	un.	100,000 $	100,000 $
Obstruction des chemins d'accès	11	un.	3,000 $	33,000 $
Clôture cadenassée	3	un.	5,000 $	15,000 $
			Total	1,180,000 $

Ensemencement du parc

		Quantité	Unité	Coût unitaire	Sous-total
Zones inactives	(1)				
Barrage Hesse (mort-terrain)	(2)	80	ha	11,300 $	904,000 $
Barrage Hesse (ensemencement)	(3)	274		15,000 $	4,114,857 $
BarrageHesse 1		42	ha	15,000 $	629,604 $
Plateau en arrière des rampes hivernales		178	ha	15,000 $	2,669,840 $
				Total	8,318,301 $
Zone active	(4)				
Nivellement	(5)	1	un.	60,000 $	60,000 $
Ensemencement	(6)	1,269	ha	15,000 $	19,035,038 $
				Total	19,095,038 $

Restuaration zone industrielle

	Quantité	Unité	Coût unitaire	Sous-total
Démantèlement des rails (digue Hesse Centre/Sud)	160	t	85 $	13,600 $
Ensemencement	158	ha	11,000 $	1,738,000 $
			Total	1,751,600 $

Notes:

(1) Ce sont les zones où il ne coulera plus de pulpe avant la fin des activités. À savoir les barrages Hesse et Hesse 1 ainsi que la zone qui se trouve en arrière du futur point de déposition hivernal. Ces zones seront certainement ensemencer avant 2026.

(2) L'entrepreneur peut récupérer environ 48 000 m³ de mort-terrain tous les trois ans. Seul la moitié de ce mort-terrain (terre végétale) est épandue sur le début du barrage Hesse

(3) Le reste du barrage Hesse est en train d'être ensemencé. D'ici 2026, l'ensemble du barrage devrait avoir été ensemencé.

(4) La zone active comprend la zzone où sont déposés les résidus grossiers, les résidus fins ainsi que le mélange hivernal fins et grossiers

(5) Seule la zone où se sont déposés les résidus grossiers et le mélange fins+grossier peut être nivelée. Même là, seuls 80% de la zone où sont déposés les résidus fins et grossiers mélangés doit être nivelée à l'aide de deux bouteurs de type D8.

(6) La zone de déposition des résidus fins a été retranchée de la surface à ensemencer. Voir Section 6.2

LIMITATIONS

1. Les travaux effectués dans la préparation de ce rapport et les conclusions présentées sont soumis à :

(a) Les modalités et les conditions standards qui font partie de notre contrat;

(b) Les objectifs de services;

(c) Les limites budgétaires et de temps comme mentionnés dans notre contrat; et

(d) Les restrictions indiquées ici.

2. Aucune autre garantie ou représentation, exprimée ou implicite, n'est accordée quant aux services professionnels fournis en vertu des conditions de notre contrat, ou conclusion présentée.

Selon l'observation d'AMEC, les conclusions présentées dans ce rapport sont fondées en partie sur les observations visuelles du site et des structures. Nos conclusions ne peuvent pas et ne sont pas étendues pour inclure ces parties du site ou de structure qui ne sont pas normalement disponibles.

Les conditions environnementales sur le site ont été évaluées, dans les limites indiquées ci-dessus et dans le respect des règles environnementales applicable à la date de l'inspection. Un examen de conformité sur les propriétaires ou les derniers occupants du site n'a pas été effectué conformément à la loi applicable au niveau local, provincial ou fédéral ainsi que les décrets, les textes réglementaires et législatifs.

La recherche sur l'historique du site contient des informations sur des tiers et des employés ou mandataires. Aucune vérification n'a été faite sur l'exactitude de ces informations, à moins que spécifiquement noté dans notre rapport.

Le lieu où le test a été réalisé, il a été effectué conformément aux termes de notre contrat. D'autres substances, ou différentes quantités de substances peuvent être présentes sur le site et également être révélées par d'autre test non prévu dans notre contrat.

En raison des limites mentionnées ci-dessus, des conditions environnementales différentes de celles exposées dans notre rapport peuvent exister. Si de telles conditions différentes sont rencontrées, AMEC doit être avisé afin qu'il puisse déterminer si les modifications à la conclusion dans le rapport sont nécessaires.

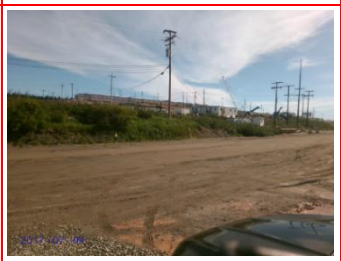
L'utilisation des services d'AMEC pendant la mise en place de n'importe quelles mesures de modifications permettra à AMEC de respecter la conformité des conclusions et des recommandations contenues dans le rapport. La participation d'AMEC tiendra aussi compte des changements liés aux conditions de terrain.

Ce rapport est à usage exclusif de la partie à qui il est adressé, sauf si formellement indiqué dans le rapport ou le contrat. AMEC n'assume aucune responsabilité quant aux dommages ou pertes de quelque nature que ce soit, subi, par ces tiers à la suite de mesures prises ou non prises ou ses décisions en s'appuyant sur le rapport ou quoi que ce soit qui y sont énoncés.

Dès lors que le rapport est toujours authentique et moins de 12 mois, AMEC émettra une lettre de confiance à la tierce partie, moyennant le paiement de la taxe en vigueur. Les tierces personnes faisant partie du rapport d'AMEC seront ainsi liées par cette lettre. Il est également indiqué dans cette lettre qu'AMEC n'est pas responsable de tous les dommages causés par la mauvaise utilisation du rapport. Aucun recours par une partie n'est autorisé sans cet accord.

ANNEXE

H-2 INVENTAIRE DES INSTALLATIONS 2017

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
MW-041	1		Station pompage Modridge	Emprise : 74,4 m^2 Acier : 2 t Béton : 17,8 m^3 Mat. sec : 0 m^3 Engin :16 Main-d'œuvre :4 Camion : 2
	2		Pad d'emballage de roulottes	
	3		Garage Soucy	
	4		Garage Hewitt	
	5		Ancien campement des travailleurs (en cours de démantèlement)	
	6		Réservoir d'eau potable du camp (en cours de démantèlement)	

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
	7		Garage GSC	
	8		Pad d'entreposage remorques 53'	
MW-046	9		Guérite	Emprise : 33,8 m^2 Acier : 0,3 t Béton : 7 m^3 Mat. sec : 0 m^3 Engin :7 Main-d'œuvre :2 Camion : 1
MW-053	10		Bureaux Oconnel et Carothèque	Emprise : 197 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 96 m^3 Engin : 40 Main-d'œuvre : 10 Camion : 5
			Dépendance 1 (Remise) - W-053-01	Emprise : 18,4 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 4 Main-d'œuvre : 1 Camion : 0
			Dépendance 2 (Roulotte) - W-053-02	Emprise : 57,5 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 6 m^3 Engin : 12 Main-d'œuvre : 3 Camion : 1

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
MW-054	11		Sous-station électrique et bâtiment d'isolation 34,5 kV	Emprise : 22,8 m^2 Acier : 0,6 t Béton : 3,5 m^3 Mat. sec : 0 m^3 Engin : 5 Main-d'œuvre : 1 Camion : 1
	12		Secteur d'entreposage de carottes	
	13		Mégadome AMEM	
	14		Poste Normand d'Hydro Québec	
MW-031	15		Entrepôt (près du poste Normand)	Emprise : 413,8 m^2 Acier : 5,7 t Béton : 0 m^3 Mat. sec : 16 m^3 Engin : 85 Main-d'œuvre : 21 Camion : 10
	16		Série de conteneurs	

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
	17		Entrepôt "SNC Lavalin" (AMEM)	
	18		Mégadome Descimco (AMEM)	
	19		Ancienne guérite	
	20		Garage des spirales (AMEM)	
MW-055	21		Station surpression résidus miniers	Emprise : 733,8 m^2 Acier : 16,6 t Béton : 0 m^3 Mat. sec : 57,81976 m^3 Engin : 78 Main-d'œuvre : 19 Camion : 9
	22		Biopiles- traitement des hydrocarbures pétroliers	

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
	23		Roulottes AMEC-Parc à résidus	
	24		Roulottes-Pratique sécurité incendie	
	25		Pads d'entreposage	
	26		Roulottes appartenant à divers entrepreneurs	
MW-049	27		Garage O'Connel	Emprise : 223 m^2 Acier : 2,6 t Béton : 21,4 m^3 Mat. sec : 256 m^3 Engin : 47 Main-d'œuvre : 12 Camion : 6
			Dépendance 1 (Roulotte O'Connel) W-049-01	Emprise : 36,3 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 8 Main-d'œuvre : 2 Camion : 1

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
	28		Parc à déchets dangereux (près du garage O'Connel)	
MW-022	29		Gare	Emprise : 484 m^2 Acier : 11,5 t Béton : 13,2 m^3 Mat. sec : 0 m^3 Engin : 8 Main-d'œuvre : 2 Camion : 1
MW-024	30		Entrepôt de la gare	Emprise : 96,7 m^2 Acier : 2,7 t Béton : 24,1 m^3 Mat. sec : 0 m^3 Engin : 20 Main-d'œuvre : 5 Camion : 2
MW-050	31		Entrepôt	Emprise : 505 m^2 Acier : 6,6 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 103 Main-d'œuvre : 25 Camion : 12
			Dépendance 1 (Remise) - W-050-01	Emprise : 15,6 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 11 m^3 Engin : 3 Main-d'œuvre : 1 Camion : 0
			Dépendance 2 (Remise) - W-050-02	Emprise : 31,6 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 6 Main-d'œuvre : 2 Camion : 1
MW-023	32		Abri pour grue de secours	Emprise : 246,2 m^2 Acier : 9,1 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 51 Main-d'œuvre : 13 Camion : 6

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
MW-029	33		Parc pétrolier	Emprise : 78,1 m^2 Acier : 2,9 t Béton : 31,9 m^3 Mat. sec : 0 m^3 Engin : 17 Main-d'œuvre : 4 Camion : 2
			Dépendance 1 - W-029-01	Emprise : 12,310056 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 3 Main-d'œuvre : 1 Camion : 0
			Dépendance 2 - W-029-02	Emprise : 262,6014185 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 53 Main-d'œuvre : 13 Camion : 6
			Dépendance 3 - W-029-03	Emprise : 4,4 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 1 Main-d'œuvre : 0 Camion : 0
MW-068	34		Garage Forage CCL	Emprise : 652,6 m^2 Acier : 23,9 t Béton : 19,9 m^3 Mat. sec : 0 m^3 Peu d'effort
	35		Garage MYK	
MW-011	36		Concentrateur	Emprise : 16907,9 m^2 Acier : 10 635 t Béton : 7 992,9912 m^3 Mat. sec : 55 m^3 Engin : 8 876 Main-d'œuvre : 2 195 Camion : 1 049

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
MW-100-01	37		Concentrateur de l'expansion	Emprise : 11 200 m^2 Acier : 1200 t Béton : 2500 m^3 Mat. sec : 375 m^3 Engin : 4357 Main-d'œuvre : 1077 Camion : 515
MW-012-01	38		Annexe au concentrateur (entrée)	Emprise : 106 m^2 Acier : 7,9 t Béton : 80,9 m^3 Mat. sec : 0 m^3 Engin : 35 Main-d'œuvre : 9 Camion : 4
MW-012-02	39		Annexe au concentrateur (salle électrique)	Emprise : 253 m^2 Acier : 8.4 t Béton : 91.07592 m^3 Mat. sec : 0 m^3 Engin : 63 Main-d'œuvre : 15 Camion : 7
MW-011-01	40		Silos (6)	Emprise : 2 270 m^2 Acier : 150 t Béton : 13 190 m^3 Mat. sec : 0 m^3 Engin : 35 Main-d'œuvre : 985 Camion : 471
MW-100-02	40		Silos de l'expansion	Emprise : 1 500 m^2 Acier : 1100 t Béton : 43 00 m^3 Mat. sec : 0 m^3 Engin : 2029 Main-d'œuvre : 502 Camion : 240
MW-013-00	41		Bâtiment au-dessus des silos	Emprise : 1 803 m^2 Acier : 760 t Béton : 415,24032 m^3 Mat. sec : 106 m^3 Engin : 531 Main-d'œuvre : 131 Camion : 63

AMEC 2012	WSP 2017	PHOTO	INFRASTRUCTURES	DÉTAILS
MW-014-00	42		Centrale thermique	Emprise : 1 829,5 m^2 Acier : 258,8 t Béton : 190,6152 m^3 Mat. sec : 0 m^3 Engin : 447 Main-d'œuvre : 111 Camion : 53
MW-015-00	43		Entrée électrique (côté centrale thermique)	Emprise : 138,3 m^2 Acier : 2,7 t Béton : 18,7 m^3 Mat. sec : 0 m^3 Engin : 29 Main-d'œuvre : 7 Camion : 3
MW-016-01	44		Chargement des wagons (galeries et tunnels)	Emprise : 718.6 m^2 Acier : 322 t Béton : 352.0932 m^3 Mat. sec : m^3 Engin : 207 Main-d'œuvre : 51 Camion :24
MW-016-02	44		Chargement des wagons (tour de transfert 1)	Emprise : 271.8 m^2 Acier :50.8 t Béton : 62 m^3 Mat. sec : 0 m^3 Engin : 71 Main-d'œuvre : 18 Camion : 8
MW-016-03	44		Chargement des wagons (tour de transfert 3)	Emprise :236 m^2 Acier :153.8 t Béton : 105.3652 m^3 Mat. sec : 0 m^3 Engin : 128 Main-d'œuvre : 32 Camion : 15
MW-017-00	44		Chargement des wagons (bât. au-dessus du silo)	Emprise :345 m^2 Acier :152.1 t Béton : 164.09336 m^3 Mat. sec : 24 m^3 Engin : 235 Main-d'œuvre : 58 Camion : 28
MW-018-00	45		Chargement des wagons (chambre électrique)	Emprise : 331,1 m^2 Acier : 15,6 t Béton : 48,5 m^3 Mat. sec : 24 m^3 Engin : 76 Main-d'œuvre : 19 Camion : 9

MW-019-00	46		Chargement des wagons	Emprise : 322,6 m^2 Acier : 20,1 t Béton : 33,9 m^3 Mat. sec : 0 m^3 Engin : 74 Main-d'œuvre : 18 Camion : 9
MW-072-00	47		Clarificateurs (3 bassins de 76,20mØ)	Emprise : 6 837,0831 m^2 Acier : 1 100 t Béton : 770 m^3 Mat. sec : 25 m^3 Engin : 1 421 Main-d'œuvre : 351 Camion : 168
	48		Clarificateurs de l'expansion	
MW-001-00	49		Bureaux de la mine	Emprise : 1 872,8 m^2 Acier : 63,8 t Béton : 426,16112 m^3 Mat. sec : 430,2 m^3 Engin : 449 Main-d'œuvre : 111 Camion : 53
MW-042-00	50		Agrandissement bureaux de la mine	Emprise : 679,3 m^2 Acier : 39,3 t Béton : 55,39152 m^3 Mat. sec : 38 m^3 Engin : 155 Main-d'œuvre : 38 Camion : 18
MW-076-00	51		Atelier électrique	Emprise : 617,7 m^2 Acier : 32,9 t Béton : 67,01464 m^3 Mat. sec : 0 m^3 Engin : 130 Main-d'œuvre : 32 Camion : 15
MW-002-00	52		Station de carburant pour camions	Emprise : 430 m^2 Acier : 34,6 t Béton : 47,90288 m^3 Mat. sec : 0 m^3 Engin : 96 Main-d'œuvre : 24 Camion : 11

MW-035-00	53		Ancien atelier des pneus	Emprise : 1 070 m^2 Acier : 62,5 t Béton : 10,2 m^3 Mat. sec : 0 m^3 Engin : 225 Main-d'œuvre : 56 Camion : 27
MW-036-00	54		Ancien atelier des pneus (annexe)	Emprise : 134.8 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 168 m^3 Engin : 28 Main-d'œuvre : 7 Camion : 3
MW-038-00	55		Ancien atelier des pneus (entrepôt)	Emprise : 371,6 m^2 Acier : 10,6 t Béton : 3,7 m^3 Mat. sec : 0 m^3 Engin : 76 Main-d'œuvre : 19 Camion : 9
MW-006-00	56		Concasseur	Emprise : 1 664,7 m^2 Acier : 620 t Béton : 554,78114 m^3 Mat. sec : 0 m^3 Engin : 630 Main-d'œuvre : 156 Camion : 74
MW-051-00	57		Salle à manger au concasseur	Emprise : 95 m^2 Acier : 0,2 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 20 Main-d'œuvre : 5 Camion : 2
MW-071-00	58		Vestiaire au concasseur	Emprise : 119 m^2 Acier : 1,6 t Béton : 0 m^3 Mat. sec : 25 m^3 Engin : 25 Main-d'œuvre : 6 Camion : 3
MW-007-00	59		Tunnel de convoyeurs (100% sous terre)	Emprise : 1 482 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 301 Main-d'œuvre : 74 Camion : 36

MW-009-00	60		Station d'entraînement	Emprise : 1 028,5 m^2 Acier : 134,4 t Béton : 545,5 m^3 Mat. sec : 90 m^3 Engin : 328 Main-d'œuvre : 81 Camion : 39
MW-008-00	61		Chambre de vulcanisation	Emprise : 75,6 m^2 Acier : 2,3 t Béton : 10,3 m^3 Mat. sec : 0 m^3 Engin : 18 Main-d'œuvre : 4 Camion : 2
MW-010-00	62		Galerie de convoyeurs	Emprise : 1988 m^2 Acier : 592 t Béton : 251,93 m^3 Mat. sec : 140 m^3 Engin : 423 Main-d'œuvre : 105 Camion : 50
MW-047-00	64		Abribus	Emprise : 69,3 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 14 Main-d'œuvre : 3 Camion : 2
MW-005-00	65		Bureaux	Emprise : 1 263,2 m^2 Acier : 273 t Béton : 1 409,58928 m^3 Mat. sec : 718 m^3 Engin : 730 Main-d'œuvre : 180 Camion : 86
MW-003-00	66		Atelier d'entretien et entrepôt	Emprise : 22 444,3 m^2 Acier : 4 255 t Béton : 2584,40464 m^3 Mat. sec : 0 m^3 Engin : 6 028 Main-d'œuvre : 1 490 Camion : 712

MW-043-00	67		Atelier des pneus	Emprise : 929 m^2 Acier : 72,2 t Béton : 30,02808 m^3 Mat. sec : 0 m^3 Engin : 207 Main-d'œuvre : 51 Camion : 24
MW-025-00	68		Atelier de nettoyage à la vapeur	Emprise : 578,4 m^2 Acier : 32,7 t Béton : 17,6 m^3 Mat. sec : 0 m^3 Engin : 123 Main-d'œuvre : 30 Camion : 15
MW-004-00	69		Atelier des petits véhicules	Emprise : 447,4 m^2 Acier : 16 t Béton : 48,5 m^3 Mat. sec : 0 m^3 Engin : 104 Main-d'œuvre : 26 Camion : 12
MW-030-00	70		Bâtiment des pompes (rés. à essence et lub.)	Emprise : 41,8 m^2 Acier : 0,3 t Béton : 43,3 m^3 Mat. sec : 0 m^3 Engin : 10 Main-d'œuvre : 2 Camion : 1
MW-100-04	71		Garages entretien 400 tonnes (expansion)	Emprise : 9 200 m^2 Acier : 1 200 t Béton : 3 680 m^3 Mat. sec : 417 m^3 Engin : 4 350 Main-d'œuvre : 1 075 Camion : 514
MW-044-00	72		Parc des réservoirs journaliers	Emprise : 0 m^2 Acier : 0,4 t Béton : 17,9 m^3 Mat. sec : 0 m^3 Peu d'effort

W-021-00	73		Caserne (ancien bâtiment d'alum)	Emprise : 201,2 m^2 Acier : 12,1 t Béton : 10,5 m^3 Mat. sec : 0 m^3 Engin : 44 Main-d'œuvre : 11 Camion : 5
MW-032-00	74		Parc des réservoirs à mazout (bâtiment)	Emprise : 91,5 m^2 Acier : 1,4 t Béton : 23,9 m^3 Mat. sec : 0 m^3 Engin : 19 Main-d'œuvre : 5 Camion : 2
MW-028-00	77		Traitement des eaux sanitaires (SP-01)	Emprise : 223 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 15 m^3 Engin : 46 Main-d'œuvre : 11 Camion : 5
	78		Cantine #1	
MW-039-00	79		Cantine #2 (Roulotte)	Emprise : 155,1 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 31 Main-d'œuvre : 8 Camion : 4
MW-073-00	80		Cantine #3 (Roulotte)	Emprise : 155,1 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 31 Main-d'œuvre : 8 Camion : 4

MW-040-00	81		Cantine #4 (Roulotte)	Emprise : 93,7 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 116 m^3 Engin : 19 Main-d'œuvre : 5 Camion : 2
	82		Cantine #5	
	83		Aire d'entreposage à minerai	
	84		Quai de chargement	
MW-045-00	85		Station de pompage des boues	Emprise : 65,5 m^2 Acier : 4,1 t Béton : 9,6 m^3 Mat. sec : 0 m^3 Engin : 14 Main-d'œuvre : 3 Camion : 2
MW-020-00	86		Usine de traitement des eaux rouges	Emprise : 176,6 m^2 Acier : 4,6 t Béton : 8,03256 m^3 Mat. sec : 0 m^3 Engin : 38 Main-d'œuvre : 9 Camion : 5
MW-026-00	87		Station de pompage (Lac Hessé)	Emprise : 320,1 m^2 Acier : 12,7 t Béton : 508,414 m^3 Mat. sec : 0 m^3 Engin : 126 Main-d'œuvre : 31 Camion : 15
	88		Balance à camion	

W-056-00	89		Orica, Usine de fabrication B1	Emprise : 733,8 m^2 Acier : 20,7 t Béton : 94,6 m^3 Mat. sec : 11 m^3 Engin : 159 Main-d'œuvre : 39 Camion : 19
W-056-01	90		Orica, Abri puits d'eau fraiche	Emprise : 6 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 1 Main-d'œuvre : 0 Camion : 0
W-056-02	91		Dépendances (conteneurs)	Emprise : 54,3 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 11 Main-d'œuvre : 3 Camion : 1
W-057-00	92		Orica, Entrepôt des pièces E8	Emprise : 124,3 m^2 Acier : 3132,3 t Béton : 5,7 m^3 Mat. sec : 0 m^3 Engin : 45 Main-d'œuvre : 11 Camion : 5
W-058-00	93		Orica, Garage G2	Emprise : 143,6 m^2 Acier : 4,6 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 30 Main-d'œuvre : 7 Camion : 4
W-059-00	94		Orica, Garage G4	Emprise : 518,2 m^2 Acier : 21,6 t Béton : 170,88784 m^3 Mat. sec : 0 m^3 Engin : 134 Main-d'œuvre : 33 Camion : 16

W-060-00	95		Orica, Garage G1	Emprise : 166,2 m^2 Acier : 3,1 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 34 Main-d'œuvre : 8 Camion : 4
	96		Orica, Garage G6	
W-062-00	97		Orica, Garage G5	Emprise : 152,4 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 31 Main-d'œuvre : 8 Camion : 4
W-063-00	98		Orica, Silo E9	Emprise : 153,9 m^2 Acier : 4,9 t Béton : 0 m^3 Mat. sec : 0 m^3 Engin : 31 Main-d'œuvre : 8 Camion : 4
	99		Conteneur et réservoir	
W-064-00	101		Orica, garage G3	Emprise : 153,9 m^2 Acier : 4,9 t Béton : 0 m^3 Mat. sec : 118 m^3 Engin : 32 Main-d'œuvre : 8 Camion : 4
W-065-00	102		Orica, Roulotte	Emprise : 117,3 m^2 Acier : 0 t Béton : 0 m^3 Mat. sec : 1 670 m^3 Engin : 28 Main-d'œuvre : 7 Camion : 3

ANNEXE

H-3 *DÉTAIL DES COÛTS DE DÉMANTÈLEMENT DES INSTALLATIONS*

Estimation des coûts de démantèlement des installations de Mont-Wright

	Désignation des installations et des différents secteurs	Dimension		Quantité						EDI 2007	EDI 2012	EDI 2017	Coût de démantèlement (2017)	Volume de rebus projetté (estimé en fct de l'emprise)	Coût transport au LET (halde 6)	Transport ammeublement et roulottes/ conteneurs à Port-Cartier	Coût transport acier à Contrecoeur		Coût concassage du béton
		Emprise bâtiment	Hauteur	Toiture	Enveloppe	Plancher	Acier	Béton	Mat.sec								Manutention	Transport	
2.01	**Station pompage Mogridge**																		
W-041-00	Station de pompage Modridge	74 m²	4 m	74 m²	402 m²	0 m²	2 t	18 m³	0 m³	10 000 $	4 200 $	11 880,50 $	10 344,00 $	26 m³	906,50 $	- $	- $	- $	630,00 $
												- $	- $		- $	- $	- $	- $	- $
2.02	**Secteur emballage**	0 m²										- $	- $		- $	- $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.03	**Secteur Hewitt**	0 m²										- $	- $		- $	- $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.04	**Secteur Soucy**	0 m²										- $	- $		- $	- $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.05	**Secteur Camp**	0 m²										- $	- $		- $	- $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.06	**Secteur GSC**	0 m²										- $	- $		- $	- $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.07	**Secteur entreposage remorques**	0 m²										- $	- $		- $	- $	- $	- $	- $
	4 Remorques 53' et 1 conteneur											14 542,00 $	- $		- $	14 542,00 $	- $	- $	- $
2.08	**Guérite**											- $	- $		- $	- $	- $	- $	- $
W-046-01	Guérite	34 m²	2 m	34 m²	42 m²	0 m²	0 t	7 m³	0 m³	5 000 $	1 900 $	3 475,00 $	3 230,00 $		- $	- $	- $	- $	245,00 $
W-046-02	Bâtisse des valves (Roulotte)	15 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³	8 000 $	800 $	- $	- $		- $	- $			- $
												- $	- $		- $	- $	- $	- $	- $
2.09	**Secteur Mégadome AMEM**											- $	- $		- $	- $	- $	- $	- $
	Mégadome, conteneurs et matériel entreposé											87 000,00 $	80 000,00 $		5 000,00 $	2 000,00 $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.10	**Bureaux Oconnel et Carothèque**											- $	- $		- $	- $	- $	- $	- $
W-053-00	Bureaux Oconnel (Agencement de 4 roulottes)	197 m²		0 m²	0 m²	0 m²	0 t	0 m³	96 m³	15 000 $	10 700 $	24 644,00 $	- $		- $	24 644,00 $	- $	- $	- $
W-053-01	Dépendance 1 (Remise)	18 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³	3 000 $	1 000 $	1 710,00 $	- $	6,3	1 710,00 $	- $	- $	- $	- $
W-053-02	Dépendance 2 (Roulotte)	58 m²		0 m²	0 m²	0 m²	0 t	0 m³	6 m³	5 000 $	3 100 $	7 051,50 $	180,00 $	20,3	710,50 $	6 161,00 $	- $	- $	- $
	Dépendance 2 (fondation en béton)											1 250,00 $	- $	0	- $	- $	- $	- $	1 250,00 $
												- $	- $				- $	- $	- $
2.11	**Sous-station électrique**											- $	- $				- $	- $	- $
	Sous-station électrique											27 504,50 $	22 000,00 $	0	- $	5 250,00 $	65,75 $	188,75 $	- $
W-054-00	Bâtiment d'isolation 34,5 kV	23 m²	3 m	23 m²	144 m²	0 m²	1 t	4 m³	0 m³	5 000 $	1 300 $	7 621,75 $	7 200,00 $	8,05	281,75 $	- $	- $	- $	140,00 $
												- $	- $			- $	- $	- $	- $
2.12	**Poste Normand**											- $	- $			- $	- $	- $	- $
												- $	- $			- $	- $	- $	- $
2.13	**Secteur entreposage près du Poste Normand**											1 527,00 $	- $			- $	394,50 $	1 132,50 $	- $
W-031-00	Entrepôt (près du poste Normand)	414 m²	4 m	414 m²	815 m²	0 m²	6 t	0 m³	16 m³	135 000 $	22 400 $	28 799,50 $	23 728,00 $	144,9	5 071,50 $	- $	- $	- $	- $
	Entrepôt SNC	400										29 900,00 $	25 000,00 $	140	4 900,00 $	- $	- $	- $	- $
	Conteneurs (6)											20 916,00 $	- $		- $	20 916,00 $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.14	**Secteur Mégadome Descimco, ancienne guérite et garage des spirales**											- $	- $		- $	- $	- $	- $	- $
	Garage des spirales	250										28 062,50 $	25 000,00 $	87,5	3 062,50 $	- $	- $	- $	- $
	Ancienne guérite	47										5 575,75 $	5 000,00 $	16,45	575,75 $	- $	- $	- $	- $
	Mégadome Descimco											30 000,00 $	27 000,00 $		3 000,00 $	- $	- $	- $	- $
	Entreposage matériels	200										17 450,00 $	15 000,00 $	70	2 450,00 $	- $	- $	- $	- $
												- $	- $			- $	- $	- $	- $
2.15	**Secteur Station de surpression**											4 326,50 $	- $			- $	1 117,75 $	3 208,75 $	- $
W-055-00	Station de surpression	326 m²	9 m	326 m²	1 062 m²	338 m²	17 t	58 m³	6 m³	25 000 $	20 800 $	43 457,50 $	37 434,00 $	114,1	3 993,50 $	- $	- $	- $	2 030,00 $
	Station de surpression	275 m²						43 m³				37 373,75 $	32 500,00 $	96,25	3 368,75 $	- $	- $	- $	1 505,00 $
	Roulottes AMEC-Parc à résidus											24 644,00 $	- $		- $	24 644,00 $	- $	- $	- $
	Roulottes et conteneurs --Pratique sécurité incendie											6 161,00 $	- $		- $	6 161,00 $	- $	- $	- $
	Pad avec conteneurs, pneus, équipements et matériels											5 000,00 $	- $		- $	5 000,00 $	- $	- $	- $
	Pad avec conteneur, tuyaux et équipements											4 000,00 $	- $		- $	4 000,00 $	- $	- $	- $
	Pad avec conteneurs, réservoir et matériels divers											3 486,00 $	- $		- $	3 486,00 $	- $	- $	- $
												- $	- $			- $	- $	- $	- $
2.16	**Secteur à l'ouest du concentrateur**											- $	- $			- $	- $	- $	- $
												- $	- $			- $	- $	- $	- $
2.17	**Secteur garage Oconnel**											763,50 $	- $			- $	197,25 $	566,25 $	- $
W-049-00	Garage Oconnel	223 m²	4 m	223 m²	466 m²	0 m²	3 t	21 m³	256 m³	8 000 $	12 400 $	25 014,75 $	21 548,00 $	78,05	2 731,75 $	- $	- $	- $	735,00 $
W-049-01	Roulotte Oconnel	36 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³		2 000 $	6 161,00 $	- $		- $	6 161,00 $	- $	- $	- $
	Parc à déchets dangereux (près du garage Oconnel)											17 050,00 $							
													- $		- $	17 050,00 $	- $	- $	- $
	Mégadome											80 000,00 $	75 000,00 $		5 000,00 $	- $	- $	- $	- $
	Mégadomes PETIT (4)											60 000,00 $	55 000,00 $		5 000,00 $	- $	- $	- $	- $
	Conteneurs (10) et remorques 53'(4)											45 916,00 $	- $		- $	45 916,00 $	- $	- $	- $
												- $	- $			- $	- $	- $	- $
2.18	**Secteur de la Gare**											3 054,00 $	- $			- $	789,00 $	2 265,00 $	- $
W-022-00	Gare	484 m²	3 m	484 m²	786 m²	0 m²	12 t	13 m³	0 m³	45 000 $	26 300 $	33 181,50 $	26 034,00 $	169,4	5 929,00 $	- $	197,25 $	566,25 $	455,00 $
W-024-00	Entrepôt de la gare	97 m²	3 m	97 m²	457 m²	0 m²	3 t	24 m³	0 m³	85 000 $	5 400 $	16 111,75 $	12 302,00 $	33,95	1 188,25 $	- $	460,25 $	1 321,25 $	840,00 $
W-050-00	Entrepôt	505 m²	4 m	505 m²	921 m²	0 m²	7 t	0 m³	0 m³	5 000 $	27 300 $	32 976,25 $	26 790,00 $	176,75	6 186,25 $	- $	- $	- $	- $
W-050-01	Dépendance 1 (Remise)	16 m²		16 m²	0 m²	0 m²	0 t	0 m³	11 m³		800 $	718,00 $	522,00 $	5,6	196,00 $	- $	- $	- $	- $
W-050-02	Dépendance 2 (Remise)	32 m²		32 m²	0 m²	0 m²	0 t	0 m³	0 m³		1 700 $	3 066,50 $	384,00 $	11,2	392,00 $	- $	591,75 $	1 698,75 $	- $
W-023-00	Abri pour grue de secours	246 m²	9 m	246 m²	802 m²	0 m²	9 t	0 m³	0 m³	55 000 $	13 600 $	24 975,50 $	21 962,00 $	86,1	3 013,50 $	- $	- $	- $	- $
												- $	- $			- $	- $	- $	- $
2.19	**Secteur parc pétrolier**											763,50 $	- $			- $	197,25 $	566,25 $	- $
W-029-00	Parc pétrolier (bâtiment des pompes)	78 m²	3 m	78 m²	187 m²	6 m²	3 t	32 m³	0 m³	45 000 $	4 500 $	9 157,50 $	7 082,00 $	27,3	955,50 $	- $	- $	- $	1 120,00 $
W-029-01	Réservoirs acier, 3.96mØ x 11.06m haut (2)	12 m²	11 m	0 m²	0 m²	0 m²	0 t	0 m³	0 m³	10 000 $	700 $	12 500,00 $	10 000,00 $		- $	2 500,00 $	- $	- $	- $
W-029-02	Réservoirs acier, 18.29mØ x 12.19m haut (2)	263 m²	12 m	0 m²	0 m²	0 m²	0 t	0 m³	0 m³	75 000 $	14 100 $	85 000,00 $	77 500,00 $			7 500,00 $	- $	- $	- $
W-029-03	Dépendances (2)	4 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³	15 000 $	200 $	20 000,00 $	15 000,00 $		5 000,00 $		- $	- $	- $
	Quai de chargement essence et diesel											10 000,00 $	7 000,00 $		- $	3 000,00 $	- $	- $	- $
W-074-01	Unité de filtration (Remorque) (1)	0 m²			0 m²	0 m²	0 t	0 m³	0 m³	3 000 $		2 764,00 $	- $		- $	2 764,00 $	- $	- $	- $
W-074-02	Unité de filtration (Conteneur) (1)	0 m²			0 m²	0 m²	0 t	0 m³	0 m³	3 000 $		3 486,00 $	- $		- $	3 486,00 $	- $	- $	- $
W-074-03	Traitement des sols (Remise)	5 m²			0 m²	0 m²	0 t	0 m³	67 m³	1 500 $	300 $	2 071,25 $	2 010,00 $	1,75	61,25 $	- $	- $	- $	- $
												- $	- $			- $	- $	- $	- $

Estimation des coûts de démantèlement des installations de Mont-Wright

	Désignation des installations et des différents secteurs	Dimension		Quantité						EDI 2007	EDI 2012	EDI 2017	Coût de démantèlement (2017)	Volume de rebus projetté (estimé en fct de l'emprise)	Coût transport au LET (halde 6)	Transport ammeublement et roulottes/ conteneurs à Port-Cartier	Coût transport acier à Contrecoeur		Coût concassage du béton
		Emprise bâtiment	Hauteur	Toiture	Enveloppe	Plancher	Acier	Béton	Mat.sec								Manutention	Transport	
2.20	**Secteur Forage CCL**											1 272,50 $	- $						
W-068-00	Forage CCL (garage)	439 m²	5 m	439 m²	1 575 m²	0 m²	5 t	0 m³	0 m³	13 500 $	24 000 $	43 795,75 $	38 418,00 $	153,65	5 377,75 $	- $	- $	- $	- $
W-068-01	Dépendance 1 (Remise)	15 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³	2 000 $	800 $	683,75 $	500,00 $	5,25	183,75 $	- $	- $	- $	- $
W-068-02	Dépendance 2 (Remise)	13 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³		700 $	659,25 $	500,00 $	4,55	159,25 $	- $	- $	- $	- $
W-068-03	Dépendance 3 (Conteneur)(2)	65 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³		3 500 $	7 481,00 $	- $		- $	6 972,00 $	131,50 $	377,50 $	- $
W-069-00	Forage CCL (entrepôt)	150 m²	4 m	150 m²	612 m²	0 m²	2 t	0 m³	434 m³	3 000 $	8 400 $	29 557,50 $	27 720,00 $	52,5	1 837,50 $	- $	- $	- $	- $
W-070-00	Forage CCL (roulotte)(1)	57 m²			0 m²	0 m²	0 t	0 m³	110 m³	5 000 $	3 100 $	9 461,00 $	3 300,00 $		- $	6 161,00 $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.21	**Secteur MYK**											- $	- $		- $	- $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
												- $	- $		- $	- $	- $	- $	- $
2.22	**Secteur Concentrateur**											2 706 607,50 $	- $		- $	- $	699 251,25 $	2 007 356,25 $	- $
W-011-00	Concentrateur	16 908 m²	30 m	16 908 m²	33 102 m²	75 714 m²	10 635 t	7 993 m³	55 m³	510 000 $	2 352 900 $	4 975 613,00 $	4 450 560,00 $	5917,8	207 123,00 $	- $	9 862,50 $	28 312,50 $	279 755,00 $
W-011-01	Silos (6)	2 270 m²	25 m	2 270 m²	0 m²	2 270 m²	150 t	13 190 m³	0 m³	750 000 $	1 056 300 $	1 149 453,50 $	657 960,00 $	794,5	27 807,50 $	- $	526,00 $	1 510,00 $	461 650,00 $
W-012-01	Annexe au concentrateur (entrée)	106 m²	9 m	106 m²	729 m²	212 m²	8 t	81 m³	0 m³		9 300 $	30 607,50 $	24 438,00 $	37,1	1 298,50 $	- $	526,00 $	1 510,00 $	2 835,00 $
W-012-02	Annexe au concentrateur (salle électrique)	254 m²	6 m	254 m²	591 m²	507 m²	8 t	91 m³	0 m³		16 600 $	227 130,50 $	27 414,00 $	88,9	3 111,50 $	- $	49 970,00 $	143 450,00 $	3 185,00 $
W-013-00	Bâtiment au-dessus des silos	1 803 m²	17 m	1 803 m²	7 978 m²	6 231 m²	760 t	415 m³	106 m³		140 800 $	785 789,75 $	443 778,00 $	631,05	22 086,75 $	- $	78 900,00 $	226 500,00 $	14 525,00 $
W-100-01	Concentrateur de l'expansion	11 200 m²	30 m	11 200 m²	15 000 m²	25 000 m²	1 200 t	2 500 m³	375 m³		1 155 100 $	1 619 300,00 $	1 114 650,00 $	3920	137 200,00 $	- $	72 325,00 $	207 625,00 $	87 500,00 $
W-100-02	Silos de l'expansion	1 500 m²	30 m	1 500 m²	0 m²	1 500 m²	1 100 t	4 300 m³	0 m³		537 900 $	693 390,50 $	458 600,00 $	525	18 375,00 $	- $	17 029,25 $	48 886,25 $	150 500,00 $
W-014-00	Centrale thermique	1 830 m²	18 m	1 830 m²	4 951 m²	2 455 m²	259 t	191 m³	0 m³	435 000 $	118 500 $	273 798,00 $	243 932,00 $	640,5	22 417,50 $	- $	197,25 $	566,25 $	6 685,00 $
W-015-00	Entrée électrique (côté centrale thermique)	138 m²	4 m	138 m²	94 m²	138 m²	3 t	19 m³	0 m³		7 700 $	91 284,50 $	6 980,00 $	48,3	1 690,50 $	- $	21 171,50 $	60 777,50 $	665,00 $
W-016-01	Chargement des wagons (galeries et tunnels)	719 m²	5 m	719 m²	10 250 m²	6 429 m²	322 t	352 m³	0 m³		54 900 $	445 927,25 $	411 820,00 $	251,65	8 807,75 $	- $	3 353,25 $	9 626,25 $	12 320,00 $
W-016-02	Chargement des wagons (tour de transfert #1)	272 m²	13 m	291 m²	1 563 m²	872 m²	51 t	62 m³	0 m³	125 000 $	18 800 $	109 345,00 $	64 650,00 $	95,2	3 332,00 $	- $	10 125,50 $	29 067,50 $	2 170,00 $
W-016-03	Chargement des wagons (tour de transfert #3)	236 m²	45 m	236 m²	3 314 m²	1 651 m²	154 t	105 m³	0 m³	75 000 $	34 000 $	189 404,00 $	144 154,00 $	82,6	2 891,00 $	- $	9 994,00 $	28 690,00 $	3 675,00 $
W-017-00	Chargement des wagons (bât. au-dessus du silo)	345 m²	66 m	345 m²	5 026 m²	2 173 m²	152 t	164 m³	24 m³	75 000 $	62 300 $	202 542,25 $	188 504,00 $	120,75	4 226,25 $	- $	1 052,00 $	3 020,00 $	5 740,00 $
W-018-00	Chargement des wagons (chambre électrique)	331 m²	8 m	331 m²	557 m²	331 m²	16 t	49 m³	24 m³		20 200 $	38 001,75 $	27 142,00 $	115,85	4 054,75 $	- $	1 315,00 $	3 775,00 $	1 715,00 $
W-019-00	Chargement des wagons	323 m²	9 m	323 m²	1 247 m²	323 m²	20 t	34 m³	0 m³	110 000 $	19 700 $	57 319,25 $	40 720,00 $	113,05	3 956,75 $	- $	2 958,75 $	8 493,75 $	1 190,00 $
W-019-01	Silo de chargement	399 m²	60 m	399 m²	0 m²	734 m²	45 t	8 525 m³	0 m³	180 000 $	1 076 000 $	740 658,75 $	386 496,00 $	139,65	4 887,75 $	- $	13 150,00 $	37 750,00 $	298 375,00 $
W-100-03	Tour de transfert de minerai de l'expansion	400 m²	45 m	400 m²	700 m²	400 m²	200 t	200 m³	11 m³		53 700 $	390 180,00 $	98 330,00 $	140	4 900,00 $	- $	72 325,00 $	207 625,00 $	7 000,00 $
W-072-00	Clarificateurs (3 bassins de 76.20mØ)	6 837 m²	5 m	0 m²	0 m²	115 m²	1 100 t	770 m³	25 m³	225 000 $	376 600 $	387 427,75 $	276 470,00 $	2392,95	83 753,25 $	- $	65,75 $	188,75 $	26 950,00 $
W-072-01	Bâtisse des pompes aux clarificateurs	34 m²	5 m	34 m²	54 m²	47 m²	1 t	17 m³	2 m³	3 000 $	2 300 $	70 337,50 $	3 156,00 $	11,9	416,50 $	- $	17 095,00 $	49 075,00 $	595,00 $
	Deux clarificateurs pour la nouvelle ligne 7 (expansion)	1 709 m²	2 m	0 m²	0 m²	30 m²	260 t	200 m³	6 m³		2 300 $	116 378,25 $							
W-034-00	Entrepôt	653 m²	6 m	653 m²	1 321 m²	0 m²	24 t	20 m³	0 m³	25 000 $	0 $	- $	69 000,00 $	598,15	20 935,25 $		1 578,00 $	4 530,00 $	20 335,00 $
												- $							- $
2.23	**Secteur bureaux, entrepôts et garages**											- $	- $						- $
												- $	- $						- $
												- $	- $						- $
W-001-00	Bureaux de la mine	1 873 m²	7 m	1 873 m²	812 m²	2 049 m²	64 t	426 m³	430 m³	150 000 $	119 100 $	153 070,25 $	115 216,00 $	655,55	22 944,25 $	- $	- $	- $	14 910,00 $
W-001-01	Dépendance (passage couvert)	67 m²	2 m	67 m²	178 m²	67 m²			21 m³		3 700 $	16 544,25 $	5 798,00 $	23,45	820,75 $	- $	2 564,25 $	7 361,25 $	- $
W-042-00	Agrandissement bureaux de la mine	679 m²	8 m	679 m²	1 707 m²	1 394 m²	39 t	55 m³	38 m³		41 200 $	93 977,25 $	75 336,00 $	237,65	8 317,75 $	- $	2 169,75 $	6 228,75 $	1 925,00 $
W-076-00	Atelier électrique du mine dispatch	618 m²	0 m	618 m²	1 331 m²	1 274 m²	33 t	67 m³	0 m³		34 400 $	79 306,00 $	63 028,00 $	216,3	7 570,50 $	- $	1 643,75 $	4 718,75 $	2 345,00 $
W-027-00	Atelier électrique (Ancien)	781 m²	5 m	781 m²	1 829 m²	167 m²	25 t	0 m³	0 m³	125 000 $	42 300 $	- $	- $	273,35	- $	- $			- $
W-002-00	Station de carburant pour camions	430 m²	8 m	430 m²	119 m²	154 m²	35 t	48 m³	0 m³	45 000 $	25 500 $	29 901,50 $	22 954,00 $	150,5	5 267,50 $	- $	- $	- $	1 680,00 $
W-002-01	Dépendance 1 (remise sur la plateforme)	5 m²		5 m²	0 m²	5 m²					200 $	181,25 $	120,00 $	1,75	61,25 $	- $	- $	- $	- $
W-002-02	Dépendance 2 (remise)	25 m²		25 m²	0 m²	25 m²					1 400 $	906,25 $	600,00 $	8,75	306,25 $	- $	- $	- $	- $
W-002-03	Réservoir hors-terre, vertical en acier	0 m²		0 m²	0 m²	0 m²						17 308,50 $	875,00 $		- $	400,00 $	4 142,25 $	11 891,25 $	- $
W-035-00	Ancien atelier des pneus	1 070 m²	12 m	1 070 m²	4 202 m²	0 m²	63 t	10 m³	0 m³	65 000 $	59 600 $	131 547,50 $	118 090,00 $	374,5	13 107,50 $	- $	- $	- $	350,00 $
W-036-00	Ancien atelier des pneus (annexe)	135 m²	3 m	135 m²	244 m²	0 m²	0 t	0 m³	168 m³		7 400 $	15 993,25 $	11 540,00 $	47,25	1 653,75 $	- $	723,25 $	2 076,25 $	- $
W-038-00	Ancien atelier des pneus (entrepôt)	372 m²	4 m	372 m²	736 m²	0 m²	11 t	4 m³	0 m³	65 000 $	20 100 $	185 469,00 $	22 982,00 $	130,2	4 557,00 $	- $	40 765,00 $	117 025,00 $	140,00 $
W-006-00	Concasseur	1 665 m²	30 m	1 665 m²	5 622 m²	4 356 m²	620 t	555 m³	0 m³	1 150 000 $	166 900 $	384 778,25 $	344 957,00 $	582,75	20 396,25 $	- $	- $	- $	19 425,00 $
W-051-00	Salle à manger au concasseur	95 m²	4 m	0 m²	236 m²	95 m²	0 t	0 m³	0 m³	8 000 $	5 200 $	7 532,75 $	5 860,00 $	33,25	1 163,75 $	- $	131,50 $	377,50 $	- $
W-071-00	Vestiaire au concasseur	119 m²	3 m	119 m²	157 m²	119 m²	2 t	0 m³	25 m³		6 500 $	8 863,75 $	7 406,00 $	41,65	1 457,75 $	- $	- $	- $	- $
W-007-00	Tunnel de convoyeurs (100% sous terre)	1 482 m²		0 m²	0 m²	1 482 m²	0 t	0 m³	0 m³	475 000 $	79 700 $	471 448 $	452 784,00 $	518,7	18 154,50 $	- $	131,50 $	377,50 $	- $
W-008-00	Chambre de vulcanisation	76 m²	11 m	76 m²	355 m²	275 m²	2 t	10 m³	0 m³	35 000 $	4 800 $	47 776,00 $	12 392,00 $	26,6	931,00 $	- $	8 810,50 $	25 292,50 $	350,00 $
W-009-00	Station d'entraînement	1 029 m²	17 m	1 029 m²	2 982 m²	1 251 m²	134 t	546 m³	90 m³	185 000 $	86 900 $	339 231,25 $	156 852,00 $	360,15	12 605,25 $	- $	38 924,00 $	111 740,00 $	19 110,00 $
W-010-00	Galerie de convoyeurs aérien	1 988 m²	4 m	1 988 m²	5 743 m²	3 975 m²	592 t	252 m³	140 m³	225 000 $	112 100 $	340 260,00 $	331 440,00 $		- $	- $	- $	- $	8 820,00 $
W-033-00	Remise Environnement (ancienne guérite)	35 m²	5 m	35 m²	95 m²	15 m²	0 t	0 m³	0 m³	10 000 $	1 900 $	- $							- $
W-047-00	Abribus	69 m²	2 m	69 m²	104 m²	0 m²	0 t	0 m³	0 m³	5 000 $	3 700 $	3 753,25 $	2 908,00 $	24,15	845,25 $	- $	- $	- $	- $
W-047-01	Passage 1	59 m²	2 m	59 m²	0 m²	0 m²	0 t	0 m³	121 m³	7 500 $	3 300 $	5 060,75 $	4 338,00 $	20,65	722,75 $	- $	- $	- $	- $
W-047-02	Passage 2	33 m²	2 m	33 m²	0 m²	33 m²	0 t	0 m³	0 m³	5 000 $	1 800 $	70 674,75 $	792,00 $	11,55	404,25 $	- $	17 949,75 $	51 528,75 $	- $
W-005-00	Bureaux	1 263 m²	22 m	1 263 m²	2 030 m²	11 525 m²	273 t	1 410 m³	718 m³		193 500 $	429 982,25 $	364 906,00 $	442,05	15 471,75 $	- $	65,75 $	188,75 $	49 350,00 $
W-032-00	Parc des réservoirs à mazout (bâtiment)	92 m²	3 m	92 m²	347 m²	0 m²	1 t	24 m³	0 m³	75 000 $	5 100 $	10 222,00 $	9 382,00 $		- $	- $	- $	- $	840,00 $
W-032-01	Réservoir en acier 3843m³ (2)	0 m²	0 m	0 m²	0 m²	0 m²	0 t	0 m³	0 m³			1 118 897,50 $	29 000,00 $		- $	7 000,00 $	279 766,25 $	803 131,25 $	- $
W-003-00	Atelier d'entretien et entrepôt	22 444 m²	19 m	22 444 m²	19 658 m²	35 025 m²	4 255 t	2 584 m³	0 m³	1 175 000 $	1 598 000 $	2 501 193,50 $	2 127 416,00 $	7855,4	274 939,00 $	- $	2 169,75 $	6 228,75 $	90 440,00 $
W-025-00	Atelier de nettoyage à la vapeur/ salle lavage 240t	578 m²	13 m	578 m²	2 584 m²	0 m²	33 t	18 m³	0 m³		32 700 $	96 296,50 $	70 262,00 $	202,3	7 080,50 $	- $	4 734,00 $	13 590,00 $	630,00 $
W-043-00	Atelier des pneus	929 m²	15 m	929 m²	1 733 m²	1 052 m²	72 t	30 m³	0 m³		54 800 $	99 954,25 $	83 452,00 $	325,15	11 380,25 $	- $	1 052,00 $	3 020,00 $	1 050,00 $
W-004-00	Atelier des petits véhicules	447 m²	10 m	447 m²	1 023 m²	447 m²	16 t	49 m³	0 m³	85 000 $	27 500 $	45 716,75 $	38 526,00 $	156,45	5 475,75 $	- $	- $	- $	1 715,00 $
W-004-01	Dépendance 1 (Abri)	23 m²		23 m²	0 m²	23 m²	0 t	0 m³	0 m³		1 200 $	833,75 $	552,00 $	8,05	281,75 $	- $	- $	- $	- $
W-004-02	Dépendance 2 (Remise)	5 m²		5 m²	0 m²	5 m²	0 t	0 m³	0 m³		200 $	181,25 $	120,00 $	1,75	61,25 $	- $	- $	- $	- $
W-004-03	Dépendance 3 (Conteneur)	19 m²		19 m²	0 m²	19 m²	0 t	0 m³	0 m³		1 000 $	688,75 $	456,00 $	6,65	232,75 $	- $	- $	- $	- $
W-004-04	Dépendance 4 (Conteneur)	19 m²		19 m²	0 m²	19 m²	0 t	0 m³	0 m³		1 000 $	688,75 $	456,00 $	6,65	232,75 $	- $	- $	- $	- $
W-004-05	Réservoir (1) vertical en acier	0 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³			1 275,00 $	875,00 $		- $	400,00 $	- $	- $	- $
W-030-00	Parc des réservoirs d'huile et lubrifiant	42 m²	3 m	42 m²	0 m²	42 m²	0 t	43 m³	0 m³		2 600 $	16 319,00 $	2 814,00 $		12 000,00 $	- $	- $	- $	1 505,00 $
W-030-01	Réservoirs en acier (8)	25 m²	8 m	0 m²	0 m²	0 m²	0 t	0 m³	0 m³	28 000 $	1 300 $	29 600,00 $	24 350,00 $		- $	5 250,00 $	- $	- $	- $
W-075-01	Autres dépendances sur le site (Guérite)	19 m²	2 m	19 m²	42 m²	0 m²	0 t	0 m³	228 m³	2 000 $	1 200 $	- $	- $	6,65	- $	- $			- $
W-075-02	Autres dépendances sur le site (Remise)	8 m²	0 m	0 m²	0 m²	0 m²	0 t	0 m³	228 m³	2 500 $	600 $	6 938,00 $	6 840,00 $	2,8	98,00 $	- $	- $	- $	- $
W-075-03	Autres dépendances sur le site (Remise Troubleshooting)	6 m²		6 m²	0 m²	6 m²	0 t	0 m³	0 m³		300 $	306 043,50 $	570,00 $	2,1	73,50 $	- $	78 900,00 $	226 500,00 $	- $
W-100-04	Garages entretien 400 tonnes (expansion)	9 200 m²	35 m	9 200 m²	27 800 m²	9 200 m²	1 200 t	3 680 m³	417 m³		1 153 100 $	1 452 424,00 $	1 207 870,00 $	3220	112 700,00 $	- $	789,00 $	2 265,00 $	128 800,00 $
W-021-00	Caserne (ancien bâtiment d'alum)	201 m²	7 m	201 m²	771 m²	201 m²	12 t	11 m³	0 m³	75 000 $	11 600 $	27 513,25 $	24 666,00 $	70,35	2 462,25 $	- $	- $	- $	385,00 $
W-044-00	Parc des réservoirs journaliers (améliorations)	0 m²		0 m²	0 m²	0 m²	0 t	18 m³	0 m³			3 130,00 $	2 000,00 $		500,00 $	- $	- $	- $	630,00 $
W-044-01	Réservoirs des huiles usées (3)	0 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³			1 275,00 $	775,00 $		500,00 $	- $	- $	- $	- $
W-044-02	Réservoir à bunker (1)	0 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³			1 275,00 $	775,00 $		500,00 $	- $	- $	- $	- $
W-044-03	Réservoir diesel (1)	0 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³			1 275,00 $	775,00 $		500,00 $	- $	- $	- $	- $
W-044-04	Réservoir solvant usé (1)	0 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³			1 275,00 $	775,00 $		500,00 $	- $	- $	- $	- $
W-044-05	Dépendance 1 (Remise)	10 m²		10 m²	0 m²	0 m²	0 t	0 m³	0 m³		500 $	1 072,50 $	950,00 $	3,5	122,50 $	- $	- $	- $	- $
W-044-06	Dépendance 2 (Remise modulaire)	31 m²		31 m²	0 m²	0 m²	0 t	1 m³	137 m³	5 000 $	1 700 $	7 483,75 $	4 524,00 $	10,85	379,75 $	- $	657,50 $	1 887,50 $	35,00 $
W-048-00	Petit concasseur démantlé	36 m²		0 m²	0 m²	0 m²	10 t	0 m³	0 m³	5 000 $	1 900 $	20 750,00 $	3 300,00 $			17 450,00 $	- $	- $	- $
W-048-01	Dépendances (5 remises) au petit concasseur	44 m²		44 m²	0 m²	0 m²	0 t	0 m³	0 m³		2 400 $	- $	- $						- $

Estimation des coûts de démantèlement des installations de Mont-Wright

	Désignation des installations et des différents secteurs		Dimension		Quantité						EDI 2007	EDI 2012	EDI 2017	Coût de démantèlement (2017)	Volume de rebus projetté (estimé en fct de l'emprise)	Coût transport au LET (halde 6)	Transport ammeublement et roulottes/ conteneurs à Port-Cartier	Coût transport acier à Contrecoeur		Coût concassage du béton
			Emprise bâtiment	Hauteur	Toiture	Enveloppe	Plancher	Acier	Béton	Mat.sec								Manutention	Transport	
2.24	**Cantines**												- $	- $						- $
		Cantine #1 (Roulotte)(4)											24 644,00 $	- $		- $	24 644,00 $	- $	- $	- $
W-039-00		Cantine #2 (Roulotte)(4)	155 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³	15 000 $	8 300 $	24 644,00 $	- $		- $	24 644,00 $	- $	- $	- $
W-073-00		Cantine #3 (Roulotte)(4)	155 m²			0 m²	0 m²	0 t	0 m³	0 m³	8 000 $	8 300 $	24 644,00 $	- $		- $	24 644,00 $	- $	- $	- $
W-073-01		Dépendance 1 (Remise)	13 m²			0 m²	0 m²	0 t	0 m³	0 m³	2 000 $	700 $	1 394,25 $	1 235,00 $	4,55	159,25 $	- $	- $	- $	- $
W-073-02		Dépendance 2 (Remise)	9 m²			0 m²	0 m²	0 t	0 m³	5 m³		500 $	965,25 $	855,00 $	3,15	110,25 $	- $	- $	- $	- $
W-040-00		Cantine #4 (Roulotte)(2)	94 m²		0 m²	0 m²	0 m²	0 t	0 m³	116 m³	15 000 $	5 100 $	12 322,00 $	- $		- $	12 322,00 $	- $	- $	- $
W-040-01		Dépendance (garage)	56 m²	4 m	56 m²	161 m²	0 m²	0 t	0 m³	0 m³	5 000 $	3 000 $	6 006,00 $	5 320,00 $	19,6	686,00 $	- $	- $	- $	- $
		Cantine #5 (Roulotte)(1)											6 161,00 $	- $		- $	6 161,00 $	- $	- $	- $
													- $	- $				- $	- $	- $
2.25	**Secteur UTER**												- $	- $				- $	- $	- $
W-028-00		Traitement des eaux sanitaires (QUONSET)	223 m²	5 m	223 m²	431 m²	0 m²	0 t	0 m³	15 m³	45 000 $	12 100 $	15 495,75 $	11 746,00 $	78,05	2 731,75 $	- $	263,00 $	755,00 $	- $
W-045-00		Station de pompage des boues	66 m²	5 m	66 m²	300 m²	0 m²	4 t	10 m³	0 m³	5 000 $	3 600 $	10 963,00 $	8 532,00 $	23,1	808,50 $	- $	328,75 $	943,75 $	350,00 $
W-020-00		Usine de traitement des eaux rouges	177 m²	6 m	177 m²	616 m²	205 m²	5 t	8 m³	0 m³	35 000 $	10 100 $	24 646,75 $	18 890,00 $	61,95	2 168,25 $	- $	854,75 $	2 453,75 $	280,00 $
W-026-00		Station de pompage (Lac Hessé)	320 m²	7 m	320 m²	1 453 m²	57 m²	13 t	508 m³	0 m³	95 000 $	33 300 $	80 910,00 $	59 210,00 $	112	3 920,00 $	- $	- $	- $	17 780,00 $
		Bassin des boues											41 000,00 $	22 000,00 $		4 000,00 $	- $	- $	- $	15 000,00 $
		Balance à camion											10 000,00 $	10 000,00 $		- $	- $	- $	- $	- $
													- $	- $		- $	- $	- $	- $	- $
2.27	**Poste de mesure**												- $	- $		- $	- $	- $	- $	- $
		MS-5											2 000,00 $	2 000,00 $		- $	- $	- $	- $	- $
		HS-1											2 000,00 $	2 000,00 $		- $	- $	- $	- $	- $
		UTE MS-5 (2 conteneurs)											6 972,00 $	- $	0	- $	6 972,00 $	- $	- $	- $
2.26	**Secteur Orica**												- $	- $		- $	- $	- $	- $	- $
													- $	- $		- $	- $	- $	- $	- $
													5 344,50 $	- $		- $	- $	1 380,75 $	3 963,75 $	- $
W-056-00		Orica, Usine de fabrication B1	734 m²	5 m	734 m²	2 174 m²	120 m²	21 t	95 m³	11 m³	25 000 $	42 200 $	77 294,50 $	64 978,00 $	256,9	8 991,50 $	- $	- $	- $	3 325,00 $
W-056-01		Orica, Abri Puit d'eau fraiche	6 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³		300 $	73,50 $	- $	2,1	73,50 $	- $	- $	- $	- $
W-056-02		Dépendances (2 conteneurs)(2)	54 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³	3 000 $	2 900 $	15 523,00 $	- $	18,9	661,50 $	6 972,00 $	2 038,25 $	5 851,25 $	- $
W-057-00		Orica, Entrepôt des pièces E8	124 m²	4 m	124 m²	313 m²	0 m²	31 t	6 m³	0 m³	8 000 $	11 900 $	21 231,50 $	18 230,00 $	43,4	1 519,00 $	- $	328,75 $	943,75 $	210,00 $
W-058-00		Orica, Garage G2	144 m²	5 m	144 m²	591 m²	0 m²	5 t	0 m³	0 m³	8 000 $	7 900 $	22 561,00 $	15 198,00 $	50,4	1 764,00 $	- $	1 446,50 $	4 152,50 $	- $
W-059-00		Orica, Garage G4	518 m²	8 m	518 m²	1 612 m²	953 m²	22 t	171 m³	0 m³	35 000 $	35 500 $	77 428,00 $	64 334,00 $	181,3	6 345,50 $	- $	197,25 $	566,25 $	5 985,00 $
W-060-00		Orica, Garage G1	166 m²	7 m	166 m²	379 m²	0 m²	3 t	0 m³	0 m³	8 000 $	9 100 $	15 140,50 $	10 562,00 $	58,1	2 033,50 $	- $	657,50 $	1 887,50 $	- $
W-060-00		Orica, Garage G6	367 m²	3 m	367 m²	1 087 m²	60 m²	10 t	48 m³	6 m³	8 000 $	9 100 $	38 535,75 $	32 360,00 $	128,45	4 495,75 $	- $	- $	- $	1 680,00 $
W-062-00		Orica, Garage G5	152 m²	5 m	152 m²	306 m²	0 m²	0 t	0 m³	0 m³	5 000 $	8 300 $	9 806,00 $	7 944,00 $	53,2	1 862,00 $	- $	- $	- $	- $
W-063-00		Orica, Silo E9	0 m²		0 m²	0 m²	0 m²	0 t	0 m³	0 m³			11 000,00 $	7 500,00 $	0	- $	3 500,00 $	- $	- $	- $
W-063-00		Conteneur et réservoir	0 m²	0 m	0 m²	0 m²	0 m²	0 t	0 m³	0 m³	0 $	0 $	2 000,00 $	- $	0	- $	2 000,00 $	- $	- $	- $
W-063-01		Dépendance (Conteneur aménagé)	30 m²			0 m²	0 m²	0 t	0 m³	0 m³		1 600 $	5 640,00 $	- $	10,5	367,50 $	4 000,00 $	328,75 $	943,75 $	- $
W-064-00		Orica, garage G3	154 m²	5 m	154 m²	584 m²	0 m²	5 t	0 m³	118 m³		8 400 $	20 604,50 $	18 718,00 $	53,9	1 886,50 $	- $	- $	- $	- $
W-065-00		Orica, Roulotte	0 m²			0 m²	0 m²	0 t	0 m³	0 m³	0 $	0 $	2 800,00 $	- $	0	- $	2 800,00 $	- $	- $	- $
W-099-01		Améliorations, c. de fer (17691m + 25 aiguil.)	0 m²		0 m²	0 m²	0 m²	0 t	0 m³	19 m³			- $	- $						
W-099-02		Divers (acier et béton)	0 m²		0 m²	0 m²	0 m²	275 t	325 m³	19 m³			- $	- $						
Total								24 424 t	50 510 m³		7 431 000 $	11 474 000 $	25 571 135 $	16 025 209 $		1 272 877 $	367 473 $	1 581 156 $	4 539 060 $	1 785 360 $

ANNEXE

H-4 DÉTAIL DES COÛTS DE DÉMANTÈLEMENT DES ÉQUIPEMENTS FIXES

Estimation du coût de démantèlement équipements fixes : Mont-Wright

Actifs « Mont-Wright » *(Prix de rachat)*

Éval	Description	Masse	Prix 2007	Prix 2012	Prix 2017
SIS	2 CRUSHED ORE CONVEYORS	300 t	150 000 $	173 891 $	238 246 $
SIS	STATION POMPAGE PORTATIVE 500	1 t	500 $	580 $	794 $
SIS	SYST ,COLLECTION DE POUSSIERE				
SIS	INSONORISATION CONCENTRATEUR				
SIS	ANALYSEUR EN CONTINU BELTCON				
SIS	5 TON JIB CRANE	2 t	1 000 $	1 159 $	1 588 $
SIS	PONT ROULANT DESSUS BASSIN REC	100 t	50 000 $	57 964 $	79 415 $
SIS	OVER .TRAVEL CRANE CAP.IMPR.-#1	75 t	37 500 $	43 473 $	59 561 $
SIS	AUG.CAPACtTE PONT ROULANT				
SIS	LIGHT PLANT & LISTER 3.5 KV				
SIS	ENROULEUR DE CABLE/CHARGEUR960	2 t	1 000 $	1 159 $	1 588 $
SIS	WALK IN BAKE OVEN HEATEO	35 t	17 500 $	20 287 $	27 795 $
SIS	VENTIL. IMPROV.-WELOING SHOP				
SIS	EQUIPMEN STEAM SYSTEM	350 t	175 000 $	202 873 $	277 954 $
SIS	CHAUD.ELECT POMPE&CONT PNEUM.	75 t	37 500 $	43 473 $	59 561 $
SIS	TNSTE WATER SUPPLY SYST				
SIS	DOMESTIC WATER SYSTEM	120 t	60 000 $	69 556 $	95 298 $
SIS	BOUILLOIRE ELEC.330 KVA	35 t	17 500 $	20 287 $	27 795 $
SIS	CHAUDIERE ELECTRIQUE 24000KW	45 t	22 500 $	26 084 $	35 737 $
SIS	WASTE WATER MGT ·MW ·PHASE I				
SIS	WASTE WATER MGT-MW-PHASE II				
SIS	STEAM HEAT&LEV.MON. CRUOE ORE				
SIS	MINE ELCT OISTR -PHASE 1-1999				
SIS	ELECTR SYST DISTR MW MINE	100 t	50 000 $	57 964 $	79 415 $
SIS	ELECTRICAL DIST SYSTEM MW	100 t	50 000 $	57 964 $	79 415 $
SIS	TNSTE.POWER OIST STRE LIGHT				
SIS	POWER OIST STREET *T* PARK				
SIS	COMMUNIC & ALARM SYSTEM				
SIS	SYSTEME DE TELEVISION				
SIS	POSTE METEOROLOGIQUE				
SIS	FIRE PROTECTION SYSTEM MW	75 t	37 500 $	43 473 $	59 561 $
SIS	PROTECTION IMPR0.-1997-#3				
SIS	FIRE PROTECTION IMPR0.-1998-#4				
SIS	SEWER SYSTEM MT-WRIGHT				
SIS	TANK MILO STEEL 10000 GAL	10 t	5 000 $	5 796 $	7 942 $
SIS	TANK FARM MW	175 t	87 500 $	101 436 $	138 977 $
SIS	DIESEL PIPELINE REPLACEMENT				
SIS	GESTION EAUX USEES-PHASE Ill				
SIS	PETROLUM PROD MGMT PHASE IV				
SIS	WATER POLUT CONT SYST				
SIS	BASSIN RECUPERATION BOUE ROUGE				
SIS	BASSIN/DECANTATION/EAUX HUil.				
SIS	SYST .NETT.CENT HOFFMAN-CONC				
SIS	SEDIMENTATION DES RESIDUS M.VV.				
SIS	PARC DECHETS OANGER .ENVQ MW				
SIS	RES.50KL&BRUL .HUIL US ENVQ MW				
SIS	CIT 50KL&BRUL HUIL US ENVIQ MW				
SIS	CIT 50KL&BRUL HUIL US ENVQ MW				
SIS	INST -RESERVOIRS CAPTAGE-HUILE				
SIS	SITE TRAITEMENT SOLS CONTAMINE				
SIS	MINE DEWATERING PUMPHOUSE	25 t	12 500 $	14 491 $	19 854 $
SIS	MINE DEWATERING-MW	35 t	17 500 $	20 287 $	27 795 $
SIS	PUMPHOUSE-MW	25 t	12 500 $	14 491 $	19 854 $
SIS	MINE OEWATERING-2000	25 t	12 500 $	14 491 $	19 854 $
SIS	MINE DEWATERING	25 t	12 500 $	14 491 $	19 854 $
SIS	FILED MAINTENNCE SHOP REPLAC.				
SIS	MANGANESE FUME COLLECTION				
SIS	OETAILEO ENG.STUOY-MTCE FACIL.				
SIS	SALLE DE LAV.& EQUIP.AUX.				
SIS	ATELIER DE PETITS VEHICULES				
SIS	AJOUT CANONS (SIS) & PASSERELLES (RLA)	20 t	10 000 $	11 593 $	15 883 $
SIS	ABRI POUR CONTENEUR A DECHET	5 t	2 500 $	2 898 $	3 971 $
SIS	PORTE#19 ATELIER SOUDURE	0 t	500 $	580 $	794 $
SIS	MAINT.SHOP & WASHING FAC.IMPR.				
SIS	TOILETTES & SALLE DE REPOS				
SIS	CRUSHER HANOL STORAGE EQUIP	40 t	20 000 $	23 185 $	31 766 $
SIS	2 CRUSHERS	200 t	100 000 $	115 927 $	158 831 $
SIS	CRUSH & STOR TUNN&STRUCT MW	175 t	87 500 $	101 436 $	138 977 $
SIS	CRUSH & STOR HANOL FACIL MW	175 t	87 500 $	101 436 $	138 977 $

Estimation du coût de démantèlement équipements fixes : Mont-Wright

Actifs « Mont-Wright » *(Prix de rachat)*

Éval	Description	Masse	Prix 2007	Prix 2012	Prix 2017
SIS	CRUSH & HANDL PROC EQUIP MW	175 t	87 500 $	101 436 $	138 977 $
SIS	AGGREG .CRUSH.PLT .IMPROV.97-PHI				
SIS	SYSTEME DE DEPOUSSIERAGE				
SIS	VENT ATELIER DE CAOUTC.CONC.				
SIS	ATEL REP.PETIT VEHI .ENT-MW-CAR				
SIS	AMEL.VENT.-ATELEQPT AUX COMP.				
SIS	DEPOUSSIEREUR-CONVOYEUR NAVETT	25 t	75 000 $	86 946 $	119 123 $
SIS	AMEL.VENT -ATELIERS-MW				
SIS	MOD STRUCTURALES ATEL ELECT				
SIS	VENTILATION ATELIER-CONCENTRAT				
SIS	REMPLACEMENT DU DEPOUSSIEREUR				
SIS	CONCEN BLOG SERV FACIL M W				
SIS	CONCENTR AUTOG GRINDMILL MW				
SIS	CONCEN GRIND & SCREEN NO 2				
SIS	CONCE GRIND & SCREEN NO 3				
SIS	CONCENTR AUTOG GRINDMILL MW				
SIS	CONCENTR AUTOG GRINDMILL MW				
SIS	CONCENTR AUTOG GRINDMILL MW				
SIS	CONC SPIRAL LAUND&PIPING MW	1 000 t	500 000 $	579 637 $	794 153 $
SIS	CONC FILTER SYSTEM MW	150 t	75 000 $	86 946 $	119 123 $
SIS	CONC TAIL & WATER RECSYS MW	85 t	42 500 $	49 269 $	67 503 $
SIS	MT-WRIGHT FLOW SHEET MOD.				
SIS	TAILING PUMPING COMPLETE	0 t	35 000 $	40 575 $	55 591 $
SIS	ENVIRONMENTAL PROTECTION				
SIS	TA ILING PIPELINE	0 t	100 000 $	115 927 $	158 831 $
SIS	CHEMIN D'INSPECTION CANAL C" "				
SIS	CHAUF .DE L.EAU DE PROCEDE-CONG				
SIS	WAT SUPP HESS LK PUMPSTN MW				
SIS	WAT SUP SERV FACIL PUMP STN	20 t	10 000 $	11 593 $	15 883 $
SIS	PIPEL HESS L STN TO CONCENT	100 t	50 000 $	57 964 $	79 415 $
SIS	WAT CLAR SYST THICKN STRUCT	200 t	100 000 $	115 927 $	158 831 $
SIS	WAT SUP SERV FAC	35 t	17 500 $	20 287 $	27 795 $
SIS	COUVERCLES SUR EPAISSISSEURS				
SIS	WAT SUP THICKENERS 3	150 t	75 000 $	86 946 $	119 123 $
SIS	WAT SUP ALUM & JAGUAR SYST				
SIS	INSTRUMENT-CONTR CENTER SYS				
SIS	POMPE A VIS HELICOIDALE				
SIS	TUYAUT-ASSECHEM ,FOSSE				
SIS	POMPES -ASSECHEM FOSSE				
SIS	TAILINGS PIPELINE TO HESSE	0 t	75 000 $	86 946 $	119 123 $
SIS	AREA RUN-OFF DIVERSION DITCHES				
SIS	GRAVITY RETURN LINE (DAM 8)		75 000 $	86 946 $	119 123 $
SIS	BORROW PIT PREPARATION				
SIS	TAILINGS DISPOSAL SYSTEM				
SIS	BARRAGE LAC HESSE ET RESIDUS		750 000 $	869 456 $	1 191 229 $
SIS	BARAGE LAC HESSE-RESIDUS/SUITE				
SIS	BARAGE LAC HESSE-RESIDUS-SUITE				
SIS	BARRAGE LAC HESSE-RESIDU SUITE				
SIS	BARRAGE LAC HESSE RESIDUS 93				
RLA	MINE TAILING CONFINEMENT 91				
SIS	MINE TAILING CONFINEMENT 92				
SIS	ENERGY CONSUMPTION TAILINGS				
SIS	142139AILINGS CONFINEMENT 94				
SIS	MINE TAILINGS CONFINEMENT -95				
SIS	MINE TAILINGS CONFINEMENT 1996				
SIS	MINE TAILINGS CONF.-PROGR.1997				
SIS	MINE TAILINGS CONF-PROGRAM 98				
SIS	MINE TAILINGS CONF-PROGRAM 99				
SIS	MINE TAILINGS CONF.-PROG.2000				
SIS	CONFINEMENT RESIDUS MW 2001				
SIS	CONFINEMENT DES RESIDUS2002 MW				
SIS	CONFINEMENT DES RESIDUS 2003				
SIS	MINE TAILING CONFINMENT				
SIS	TRANSFORMER&SWITCHOUSE	75 t	37 500 $	43 473 $	59 561 $
SIS	TRANSFORMATEUR 15KVA	15 t	7 500 $	8 695 $	11 912 $
SIS	POSTE DE COMMMUTATION PORTATIF				
SIS	REGULATEUR DE PUISSANCE APPLEE				
SIS	DISJONCTEUR 15 KV				
SIS	TRANSFORMATEUR	12 t	6 000 $	6 956 $	9 530 $
SIS	NORMAND SUS STATION				

Estimation du coût de démantèlement équipements fixes : Mont-Wright

Actifs « Mont-Wright » *(Prix de rachat)*

Éval	Description	Masse	Prix 2007	Prix 2012	Prix 2017
SIS	DEVELOP DU SECTEUR B-MT-WRIGHT				
SIS	EXTEN.LIGNES ELECT.MINE				
SIS	ATELIERS DE LA MINE				
SIS	EXTEN LIGNE ELECT-MINE-SUITE				
SIS	EXTENS.LIGNE ELECT MINE SUITE				
SIS	EXTEN.LIGN.ELECT.7.2KV-1996				
SIS	EXTENSION LIGNES ELECT.-1997				
SIS	EXTENSION LIGNES ELECT .- 1998				
SIS	EXT.LIGNES ELECT .MW -2000				
SIS	EXT.LIGNE ELECT. MW 2002				
SIS	TRANSMISSION LINE				
SIS	PIPE LINE DIESEL & VAPEUR-SUIT				
SIS	BALANCE MINERAI BRUT	35 t	17 500 $	20 287 $	27 795 $
SIS	BALANCE POUR MINERAI BRUT	35 t	17 500 $	20 287 $	27 795 $
SIS	REMPL.LECTEURS CODE BARRES				
SIS	CB-03 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB-04 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB-05 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB-06 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB-07 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB-09 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB1-1 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB1-2 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB1-3 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB1-4 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB1-5 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB1-6 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB1 7 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB2-1 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB2·2 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB2-3 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB2-4 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB2-5 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB2-6 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB2-7 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB3-1 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB3-2 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB3-3 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB3-4 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CB3-5 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CB3-6 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB3-7 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB4·1CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB4-2 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB4-3 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB4-4 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB4-5 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB4-6 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB4-7 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CBS-1 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CBS-2 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CB5-3 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CB5-4 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CBS-5 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CBS-6 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CBS-7 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
RLA	CB6-1 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB6-2 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB6-3 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	C88-4 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB6-5 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB6-6 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CB6-7 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CS-01 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $
SIS	CS-02 CONVOYEUR	15 t	7 500 $	8 695 $	11 912 $

Estimation du coût de démantèlement équipements fixes : Mont-Wright

Actifs « Mont-Wright » *(Prix de rachat)*

Éval	Description	Masse	Prix 2007	Prix 2012	Prix 2017
SIS	BROYEUR DE CONCENTRE "A" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 Lables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallols, 1 réservoir 8x10	175 t	85 000 $	98 538 $	135 006 $
RLA	BROYEUR DE CONCENTRE "B" incluant 2 alimentaleurs, 2 broyeurs, 2 Lamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x11	175 t	85 000 $	98 538 $	135 006 $
RLA	BROYEUR DE CONCENTRE "C" incluant 2 alimentaleurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 Lables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallols, 1 réservoir 8x12	175 t	85 000 $	98 538 $	135 006 $
RLA	BROYEUR DE CONCENTRE "D" incluant 2 alimenlateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist Lertiaires, 176 dallots, 1 réservoir 8x13	175 t	85 000 $	98 538 $	135 006 $
RLA	BROYEUR DE CONCENTRE "E" incluant 2 alimenlateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallols, 1 réservoir 8x14	175 t	85 000 $	98 538 $	135 006 $
RLA	BROYEUR DE CONCENTRE "F" incluant 2 alimentaleurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallols, 1 réservoir 8x15	175 t	85 000 $	98 538 $	135 006 $
RLA	PONT ROULANT 3P 2 TONS	10 t	5 000 $	5 796 $	7 942 $
SIS	PONT ROULANT 2P 2 TONS 40'	20 t	10 000 $	11 593 $	15 883 $
SIS	PONT ROULANT 2P 125T ET 5 TONS	65 t	32 500 $	37 676 $	51 620 $
SIS	PONT ROULANT 2P 25 TONS 80-1OO	75 t	37 500 $	43 473 $	59 561 $
SIS	PONT ROULANT 15 TONS	25 t	12 500 $	14 491 $	19 854 $
SIS	5 TON STACKER CRANE	3 t	1 500 $	1 739 $	2 382 $
SIS	ECHANTILLONEUR AUTO .DES TRAINS		- $	- $	- $
RLA	BROYEUR DE CONCENTRE "E" incluant 2 alimentateurs, 2 broyeurs, 2 tamis primaires et 10 secondaires, 2 cyclone d'eau circulé, 2 tables de filtration, 4 cyclones de résidus, 3 réservoirs 15' x 18', 24 dist tertiaires, 176 dallots, 1 réservoir 8x14. (Expansion 2013)	525 t	255 000 $	295 615 $	405 018 $
SIS	CONVOYEURS (Expansion 2013)	105 t	52 500 $	60 862 $	83 386 $
SIS	BALANCE MINERAI BRUT (Expansion 2013)	70 t	35 000 $	40 575 $	55 591 $
SIS	PONT ROULANT 2P 25 TONS 80-100 (Expansion 2013)	75 t	37 500 $	43 473 $	59 561 $
SIS	CONVOYEUR TRANSFERT (Expansion 2013)	15 t	7 500 $	8 695 $	11 912 $

Masse	2007	2012	2017
7 250 t	**4 700 500 $**	**5 449 168 $**	**7 465 832 $**

Coût de rachat par tonne (2017) :	**1 030 $/t**

Répartion des côuts de gestion pour une tonne :

Démantèlement :	80%	**824 $/t**
Transport vers le port :	20%	**206 $/t**