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PHILLIPS RIVER PROJECT

FEASIBILITY GEOTECHNICAL ASSESSMENT

TRILOGY DEPOSIT

REPORT 0748E

Prepared for:

Tectonic Resources NL
Phillips River Project
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EXECUTIVE SUMMARY

Purpose of Report

This report presents the findings and recommendations of a feasibility level geotechnical assessment of ground conditions influencing the stability of future open pit slopes and underground workings at the Trilogy Deposit (Trilogy) at Tectonic Resources NL (Tectonic), Phillips River Project (Phillips River), located near Hopetoun, Western Australia.

Findings

Ground Conditions

Important characteristics of the Trilogy rock mass are that:

- The depth of rock weathering is reasonably uniform over the deposit, with the top of fresh rock (TOFR) located at a depth of ~ 40m below surface (mbs).
- With the exception of the siliceous siltstones, the rock mass within the proposed open pit mining domain is characterised by strong fracturing which will be detrimental for berm and batter stability. Fracturing within the laminated siltstones significantly decreases as the rock becomes fresher with depth below surface. The siliceous siltstones are moderately fractured within the open pit and underground mining domains.
- The compressive strengths of **weathered laminated siltstones** typically range from ~ 1 MPa to 25 MPa. No weathered siliceous siltstones were intersected in the geotechnically logged intervals of borehole core, however, it is expected that the strength of these weathered rocks would also range from ~ 1 MPa to 25 MPa.
- For **fresh laminated siltstones**, UCS values of 160 MPa and 50 MPa are considered to represent the *best* case (highest) and *worst* case rock strength values respectively.
- There appears to be only minor variation in the mean rock strength (~ 50 MPa difference) between laminated siltstones within the orebodies and those in the surrounding country rocks.
- **Siliceous siltstones** are consistently *very strong* even where rock defects such as veinlets are inferred to have detrimentally affected rock strength. UCS values of 258 MPa and 200 MPa are considered to represent the *best* and *worst* case siliceous siltstone strengths respectively.
- The standing groundwater table, as measured from exploration boreholes drilled within the deposit, is located at ~ 35m below surface.

Open Pit Mining

On the basis of the geotechnical assessments, design parameters for a short to medium life open pit wall at Trilogy are:

Base case hangingwall & endwall design parameters (inferred likely rock mass conditions)

Rock Type Domain	Depth Below Surface	Batter Angle	Berm Width	Bench Height	Inter-ramp angle
Weathered Laminated Siltstones	0 to 40m	60°	4m	5m	36°
Slightly Weathered to Fresh Laminated Siltstones	40m to ~ 150m	60°	8m	15m	42°

Base case footwall design parameters (wall striking sub-parallel to bedding)

Rock Type Domain	Depth Below Surface	Batter Angle	Berm Width	Bench Height	Inter-ramp angle
Weathered Laminated Siltstones and Siliceous Siltstones	0 to 40m	60°	4m	5m	36°
Slightly Weathered to Fresh Laminated Siltstones	35m to ~ 150m	60°	8m	15m	42°
Slightly Weathered to Fresh Siliceous Siltstones	35m to ~ 150m	64°	6m	15m	48°

Underground Mining

From a geotechnical viewpoint the strong siliceous siltstone unit at Trilogy is considered to be favourable for implementation of more productive and lower cost longhole open stoping.

The potential for instability will, however, increase if the lower strength laminated siltstones intersect or are located in close proximity (say within 3m) of stope hangingwalls. If stope designs and/ or rock reinforcement are unable to manage this risk, then bench stoping should be adopted as exposure of the laminated siltstone can be reduced by the placement of rock fill.

Based on the results of the Modified Stability Graph Method assessments, initial stope designs should be based on Hydraulic Radius (HR) values as follows:

$$HR_{Walls} \leq 11.1m$$
$$HR_{Backs} \leq 15.5m$$

Where non-recoverable rib and sill pillars are left to assist in maintaining stope wall stability these should be designed to have ‘aspect ratios’ ≥ 1:1 to remain stable within the low stress environment expected at Trilogy. If there is an intention to recover pillars towards the end of mine life it would be advisable to design pillars with aspect ratios ≥ 1.5:1 to (aim to) ensure *good* conditions for re-entry development, drilling and charging.

Infrastructure

For preliminary planning purposes it is recommended that the decline is positioned ≥ 30m from potential stoping areas.

Ventilation shafts raisebored at diameters up to ~ 3m are expected to be self-supporting. Alternatively, if the shafts are developed by handheld mining methods, the shaft sidewalls will need to be systematically rock bolted and meshed as they are exposed.

The ventilation drive(s) and associated portal can be supported with weld mesh and friction bolts.

Ground Support and Reinforcement

- The batter surrounding the underground mines Portal should be systematically supported with fibrecrete and full-column cement grouted rock bolts.
- An appropriate minimum ground support standard for standard size development would be to install ≥ 2.4m long friction bolts and weld mesh over the backs and shoulders of the development to within ~ 3m of floor level.
- Where wide spans (≥ 6m) are formed, the backs should be reinforced with 6m long twin bulbed strand cable bolts installed on a 2.0m to 2.5m grid, in addition to the standard support (friction bolts and mesh already installed).
- In an effort to improve stope wall stability, it is recommended that the hangingwall rock mass immediately opposite ore drives be reinforced using 2m to 2.5m spaced rings of ≥ 6m long twin bulbed strand cable bolts, with each ring containing two (3) plated and post-tensioned cable bolts.

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This report presents the findings and recommendations of a feasibility level geotechnical assessment of ground conditions influencing the stability of proposed open pit slopes and underground mining areas at the Trilogy Deposit (Trilogy) at Tectonic Resources NL (Tectonic) Phillips River Project (Phillips River), located near Hopetoun, Western Australia.

Mine design parameters for the proposed open pit and underground mine are provided. Requirements for future and ongoing pit wall monitoring and geotechnical assessment are discussed.

The work was carried out at the request of Mr Bruce Armstrong, Senior Project Geologist for Tectonic.

1.1 Sources of Information

Findings and recommendations are based on:

- Discussions (and correspondence) conducted variously and severally with Messrs Steven Norregaard, Managing Director; Andy Czerw, Operations Director and Bruce Armstrong, Senior Project Geologist of Tectonic; and Geoffrey Davidson, Principal Mining Engineer of Mining and Cost Engineering Pty Ltd (M&C Engineering) Mining Consultants to Tectonic.
- Consideration of the findings and recommendations of previous geotechnical assessments [1→3] of ground conditions at Trilogy. The geotechnical data collected from these previous assessments by Peter O'Bryan & Associates (POB) and Tectonic were combined into a series of Microsoft EXCEL spreadsheets.
- Assessments of ground conditions based on:
  - Summary geotechnical logging of selected portions of surface exploration and geotechnical boreholes (Appendix A).
  - Review of photographs of the above-mentioned borehole cores (supplied by Tectonic).
  - EXCEL spreadsheets (supplied by Tectonic) containing rock quality designation (RQD) and fracture frequency records.
- A representative selection of cross-sections at 1:500 scale provided by Tectonic showing:
  - Borehole traces with plots showing variation in Rock Quality Designation (RQD), fracture frequency, and estimated rock strength along the traces (using data collected by Tectonic).
  - Outlines of the interpreted orebodies and the top of fresh rock (TOFR).
- Stereographic analysis of rock defect orientation data collected by Tectonic. Analysis was performed using the Rocscience *Dips* [4] program.
- Results of laboratory-based rock property testing [5, 6] of representative core samples selected from some of the geotechnically logged boreholes. Testing was conducted by Fenixx Australia Pty Ltd, Perth.
- Empirical assessments, based on borehole cores, of rock mass quality and competence using the:
  - The Rock Mass Rating [7] (RMR) and the Mining Rock Mass Rating Scheme [8] (MRMR) to characterise ground within proposed open pit walls. A method [9] based on the MRMR scheme was used to check derived *base case* wall design parameters.
  - Q System developed by the Norwegian Geotechnical Institute [10, 11]. The Modified Stability Graph Method [12], which utilises a modified Q-Value, was used to make a preliminary estimate of potential stable stope spans.
- Two-dimensional limit equilibrium and finite element analyses were conducted to assess the likely stability conditions against circular failure through the rock mass. Limit equilibrium analyses used the Rocscience program *Slide* [13], while finite element analysis used the Rocscience program *Phase²* [14].

- Review of structural and hydrological reports [15→17] prepared by external consultants for Tectonic concerning the Trilogy deposit.
- Consideration of operational experience gained at other Australian mines in the design of open pit slopes and underground opening within similar geological and geotechnical settings to those found at Trilogy.

2.0 Background Information

2.1 Geology

The geological description of the Trilogy Deposit provided in this section, and illustrated in Figure 1, is based on two geological reports prepared by Dr Roger Majoribanks [15, 16], Geological Consultant to Tectonic.

Stratigraphy at Trilogy comprises (hangingwall to footwall):

Ribbon Banded Siltstone

This sedimentary unit is characterised by a well developed lithological banding (bedding) defined by alternating pale-grey phyllitic siltstone (~ 60 to 90%) and minor dark-grey graphitic siltstone. The banding is generally ~ 3mm to 10mm thick although some siltstone bands are up to several centimetres thick.

Laminated Graphitic Siltstone

This unit is strongly laminated and contains abundant graphite. The transition from Ribbon Banded Siltstone to Laminated Graphitic Siltstone is gradational over several metres, which makes delineation of the contact a matter for interpretation.

The unit is intruded by numerous quartz and quartz sulphide veins both parallel to and cross-cutting bedding. These quartz sulphide veins are associated with the gold and base metals mineralisation at Trilogy.

Polymict Breccia

This sedimentary breccia is typically a massive rock that contains angular to sub-angular clasts (≤ 5cm diameter) of mudstone and felsic volcanic rock that occur in a matrix of silt and sand.

The unit has been intruded by numerous quartz veins and is also locally strongly silicified (as described below).

Silica Alteration Zones

The silica alteration zones are predominantly confined to the Polymict breccia. The zones appear to have developed by pervasive silicification of the breccia. A weakly developed banding may be present.

Quartz Sulphide Mineralised Zones

The quartz-sulphide rich zones that form the Trilogy Lodes occur within the Laminated Graphitic Siltstone unit. The A and B Lodes occur immediately above the Polymict breccia unit and they have been interpreted to be genetically related to the unit.

Major Structures

The most significant structure within the mine area is the steep (~ 75°) north-east dipping Trilogy Fault that separates the A and B Lodes.

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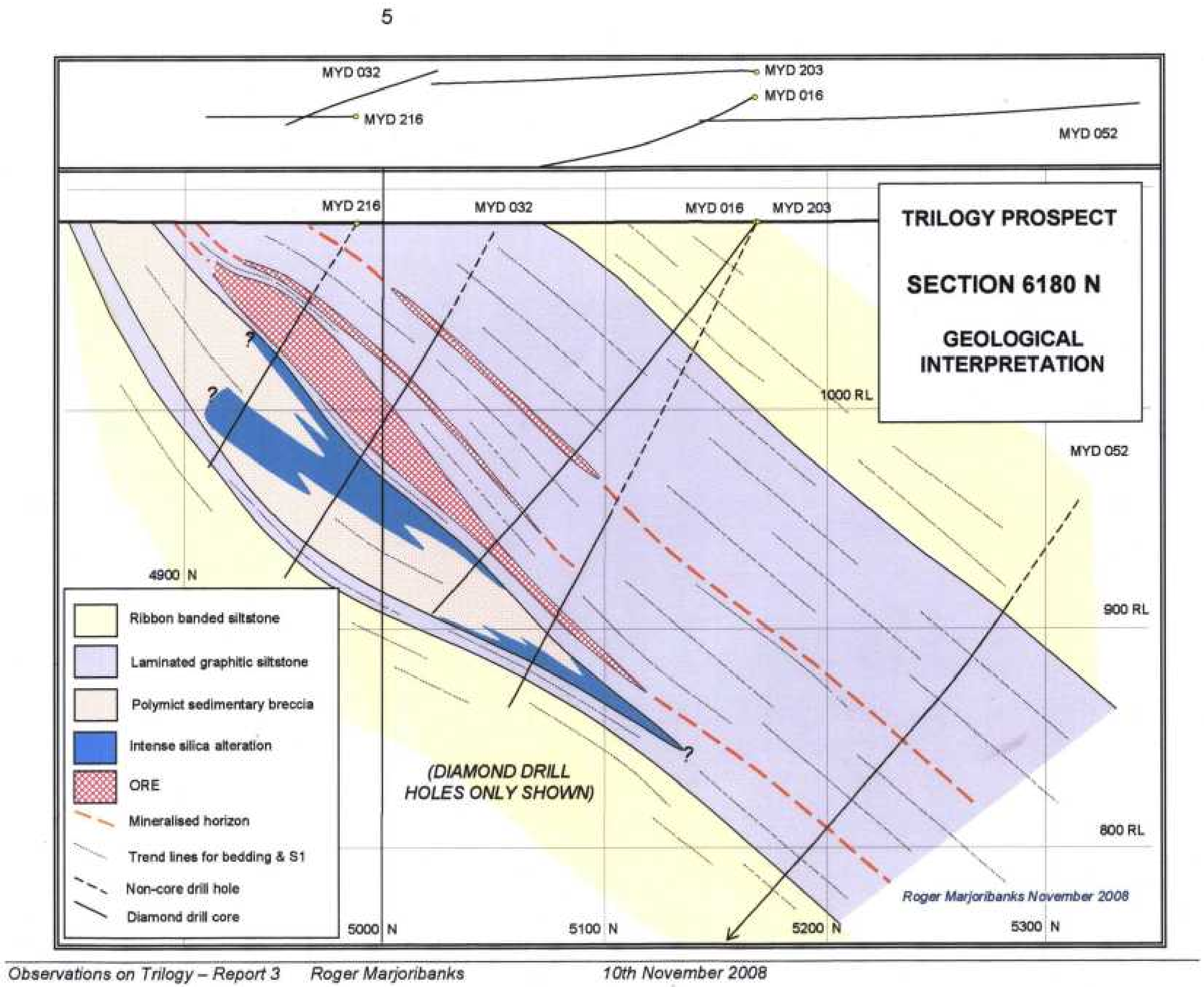

Figure 1 **Geology Cross Section through Trilogy Deposit on 6180 Northing** (after Majoribanks [16])

2.2 Proposed Mining

2.2.1 Open Pit Mining

Tectonic is planning to extract the majority of the Trilogy Deposit via conventional open pit mining techniques. The open pit will be mined in three stages (Figure 2) with the eventual pit (Figures 3 & 4) having a quasi-circular footprint ~ 500m in diameter, with an "offset" final floor.

The eastern wall will essentially follow the relatively shallow dipping footwall of the deposit. Maximum wall height will be ~ 140m.

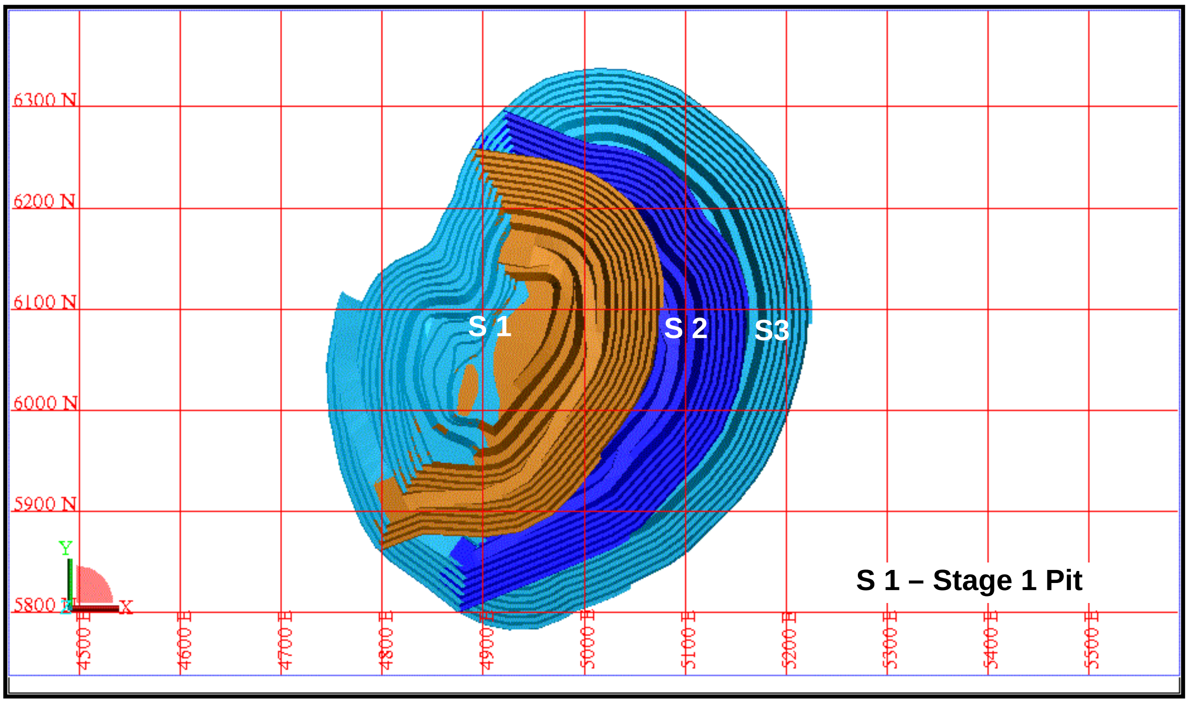

Figure 2 Plan View Showing the 3 Stages of Trilogy Open Pit Mining

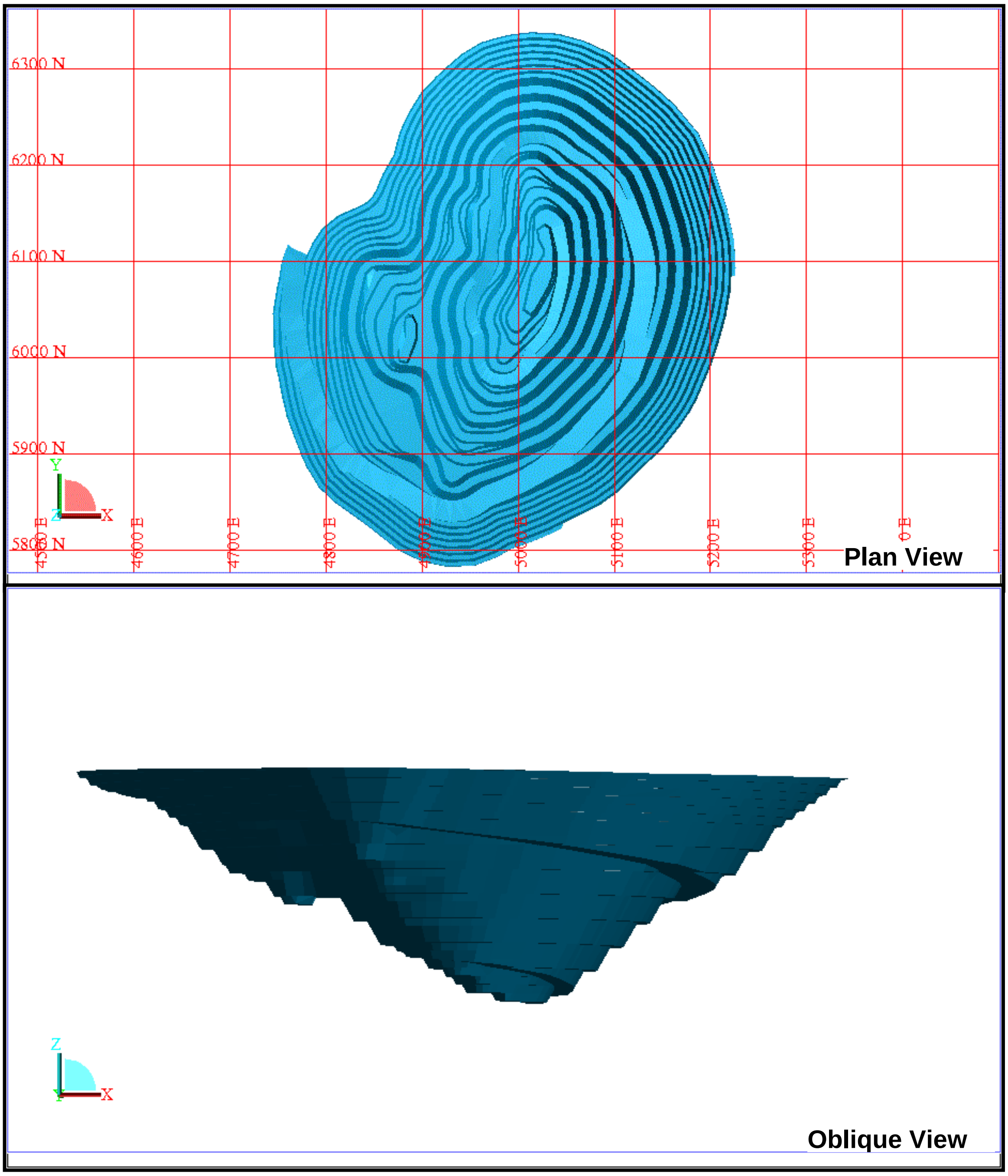

Figure 3 Plan and Oblique Views Showing Final Pit Walls at Trilogy

2.2.2 Underground Mining

Additional to the open pit resource, three (3) stope blocks (Figures 3 to 5) have been delineated below the proposed open pit as being potentially amenable to extraction by mechanised underground mining methods.

The potential stope blocks have the following dimensions:

Stope Block No.	Length x Height x Width
1.	130m x 60m x 5-15m
2.	55m x 40m x 3-10m
3.	55m x 60m x 5-20m

The above stope block numbers also correspond with the proposed stope extraction sequence.

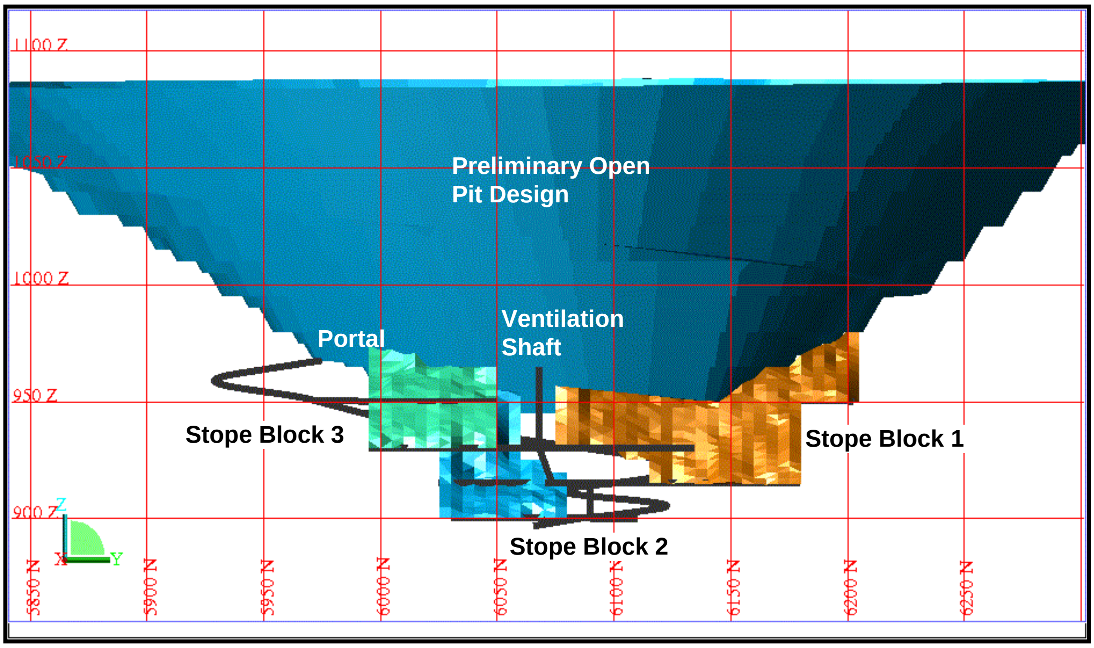

Figure 4 Longitudinal Section Showing Potential Stope Blocks at Trilogy

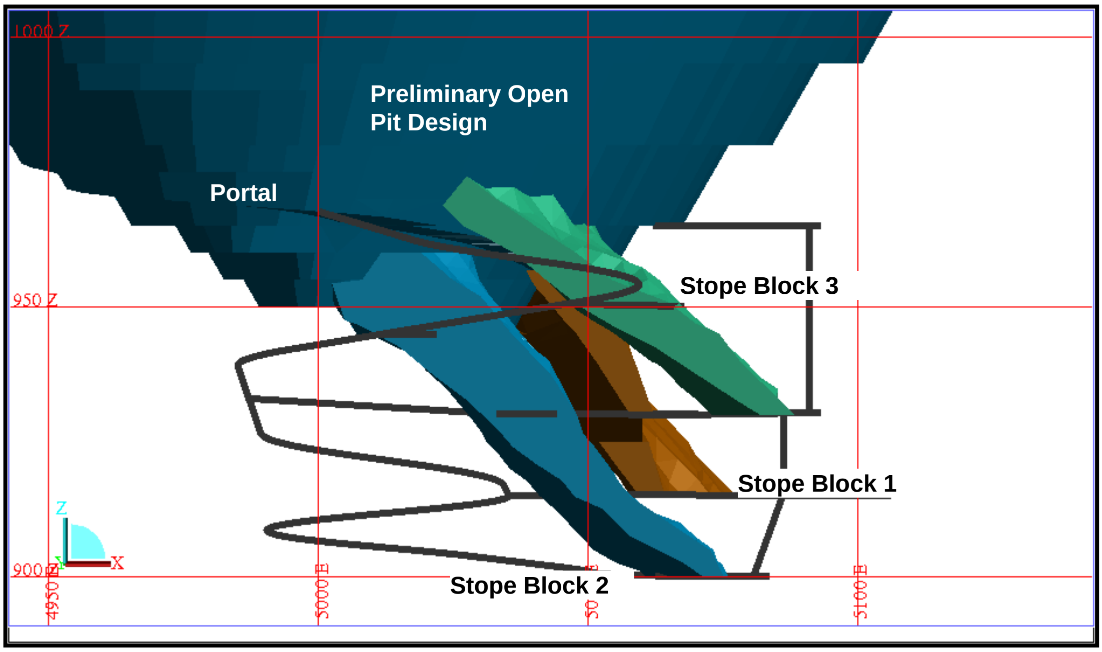

Figure 5 Oblique Section Showing Potential Stope Blocks at Trilogy

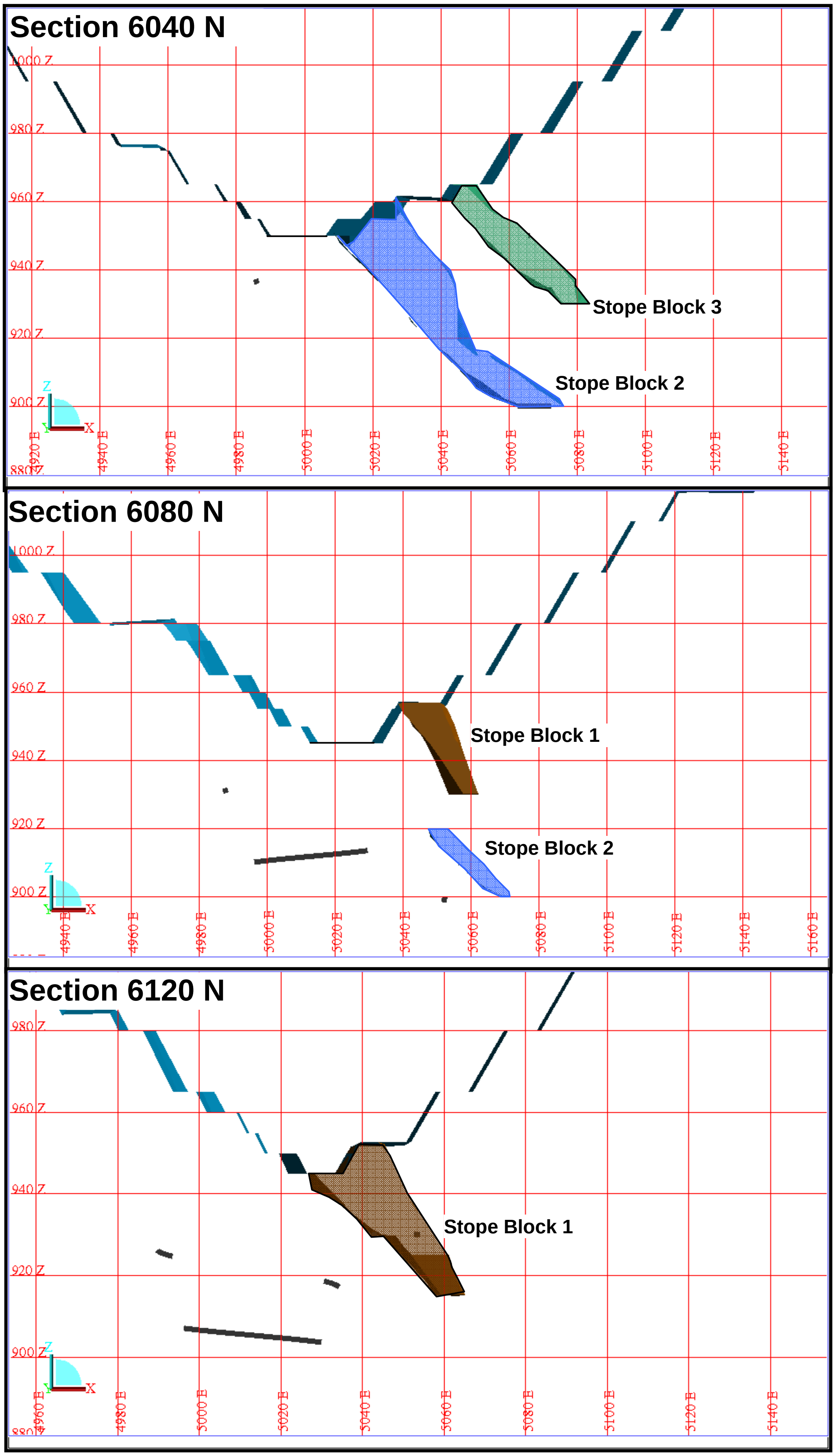

Figure 6 Cross Sections Showing Ore Blocks at Trilogy

The proposed underground will be accessed via a Portal developed into the 970-980mRL batter in the south-eastern corner of the Trilogy Open Pit. The decline will be located within the footwall sequence opposite Stope Block 2.

On each of the 15m or 20m vertically spaced sub-levelss, ore drives will be developed along the designed stope hangingwalls for production drilling and stope reinforcement purposes.

Tectonic's preference is to use longhole open stoping methods to extract the stope blocks, with voids backfilled either progressively (that is, benching) or immediately following mass blasting of secondary stopes.

Mine air is currently planned to be exhausted via a series of shaft/ rises (15-35m long) developed between sub-levels and a sub-horizontal ventilation drive that will intersect the open pit east wall in the 965– 985mRL batter.

3.0 Geotechnical Conditions

3.1 Geotechnical Investigations

Assessment of Trilogy Deposit ground conditions entailed review of borehole core intervals shown in Table 1.

Table 1 Borehole Intervals Reviewed & Estimated Ore Intersection

Method	Borehole No.	Mine	Interval (m)
Geotechnical logging.	MYCD 159	OC	30 – 80
	MYCD 171	OC	11 - 138
	MYCD 190	OC / UG	0 – 240
	MYCD 203	UG / OC	0 – 231
	MYCD 215	OC	0 - 184
	MYCD 216	OC	39 - 130
	MYCD 217	OC	42 – 151
	MYCD 218	OC	60 - 140
Check geotechnical logging of cut core and review of core photographs	MYCD 004	UG	170 – 250
	MYCD 016	UG	180 – 250
	MYCD 033	UG	180 – 275
Review core photographs	MYCD 185	UG	128 - 170
	MYCD 186	UG	133 - 195
	MYCD 189	UG	127 – 173

Important aspects of the review are that:

- For the open pit wall stability assessment whole core was geotechnically logged. The borehole cores used came from exploratory and geotechnical drilling programs.
- The underground assessment utilised exploration borehole cores, the majority of which had been disturbed by to varying degrees due to core cutting and assaying. To improve the reliability of the assessments, core photographs of the core taken prior to sampling were also reviewed.

3.2 Rock Weathering

The rock weathering profile within the expected open pit area varies as follows:

- The depth of rock weathering is reasonably uniform over the deposit, with the top of fresh rock (TOFR) located at a depth of ~ 40m below surface (mbs).
- More penetrative rock weathering has occurred, and the weathering profile is slightly depressed (~ 5 to 10m deeper) where the orebodies and major shear zones come within close proximity of surface.

Appendix A contains summary of rock weathering for individual boreholes.

3.3 Rock Quality

For this assessment Tectonic supplied EXCEL spreadsheets containing Rock Quality Designation (RQD) and fracture counts per metre of core from the assessed boreholes.

RQD and fracture frequency results for individual boreholes are presented in Appendix A. Where the intensity of fracturing exceeded 25 fractures per metre (f/m), Tectonic geologists recorded the fracture frequency as > 5 f/m, hence this is the maximum fracture frequency shown on the plots.

Table 2 Fracture Frequency & RQD Ranges According to Domains

Mining Domain	Rock Mass Domain	Fracture Frequency (f/m)		RQD (%)	
		1st Quartile (Worst)	4th Quartile (Best)	1st Quartile (Worst)	4th Quartile (Best)
Open Pit	Highly Weathered to Moderately Weathered	25	12	0	80
	Laminated Siltstones (Slightly Weathered to Fresh)	25	8	0	100
	Siliceous Siltstones (Slightly Weathered to Fresh)	25	4	60	100
Underground	Laminated Siltstones (Fresh)	25	5	55	100
	Siliceous Siltstones (Fresh)	25	4	67	100

The results show that:

- With the exception of the siliceous siltstones, the rock mass within the proposed open pit mining domain is characterised by strong fracturing which will be detrimental for berm and batter stability.
- Within the open pit and underground mining domains the siliceous siltstones have similar levels of moderate fracture development.
- Fracturing within the laminated siltstones decreases significantly as the rock becomes fresher with depth.

3.4 Rock Properties

Manual index testing, according to the International Society of Rock Mechanics (ISRM) guidelines, was undertaken during geotechnical logging to estimate intact rock strength. The results of this testing are presented in Appendix A for (each 1m interval along) the eight boreholes logged.

Two programs [5, 6] of rock property testing were undertaken on representative samples of borehole core selected from the geotechnically logged boreholes. Testing was performed by Fenixx Australia Pty Ltd, Perth and test results are summarised in Table 3.

Table 3 Summary of Rock Property Results for Trilogy

Rock Type	UCS (MPa) A+C			UCS (MPa) Total		
	Mean	Std Dev	No Samples	Mean	Std	No Samples
Laminated Siltstone	160	-	1	50	40	18
Siliceous Siltstone	258	78	5	200	120	10

Notes-
UCS = Uniaxial Compressive Strength normalised for 50mm core diameter
UCS_{A+C} = Uniaxial Compressive Strength data from core that failed either due to axial splitting (A) or multiple cracking (C)
UCS_{TOTAL} = Total Uniaxial Compressive Strength data including shear failure

Based on the results of the manual index testing and laboratory based Uniaxial Compressive Strength (UCS) results it is inferred that:

- The compressive strengths of **weathered laminated siltstones** typically range from ~ 1 MPa to 25 MPa. No weathered siliceous siltstones were intersected in the geotechnically logged intervals of borehole core, however, it is expected that the strength of these weathered rocks would also range from ~ 1 MPa to 25 MPa.
- For **fresh laminated siltstones**, UCS values of 160 MPa and 50 MPa are considered to represent the *best* case (highest) and *worst* case rock strength values respectively.
- There appears to be only minor variation in the mean rock strength (~ 50 MPa difference) between laminated siltstones occurring within the orebodies and those within the surrounding country rocks.
- **Siliceous siltstones** are consistently *very strong* even when rock defects such as veinlets are inferred to have detrimentally affected rock strength. UCS values of 258 MPa and 200 MPa are considered to represent the *best* and *worst* case rock strengths respectively.

In this assessment of ground conditions, mean rock strength values were assumed for consideration of likely *worst* case conditions. It is considered that adoption of the lowest values would not reflect accurately on the distribution of rock strengths within the deposit.

3.5 Rock Structure

Major faults and broken zones identified during the logging of the borehole core were drafted onto a set of drillhole based geological cross-sections (provided by Tectonic and included in Appendix B). Data shown on these cross-sections indicate that the majority of the faults and associated broken zones at Trilogy are oriented sub-parallel to primary bedding.

The width of individual structures is highly variable both along strike and down dip. Appendix B also provides a summary of the major structures and broken zones identified during the geotechnical borehole logging.

Tectonic provided logged rock defect data (in EXCEL format) for assessment in the *Dips* [4] program. Table 4 summarises the major defect sets identified from these data. Defect pole and major plane plots are presented in Appendix C.

Table 4 Major Defect Sets at Trilogy

Defect Set No.	Orientation Dip/DipDirection (°)	Type
1	47° / 092°	Well developed primary bedding and joints
2	49° / 137°	Moderately developed foliation and joints
3	62° / 286°	Moderately developed faults and joints
4	39° / 036°	Minor developed foliation, joints and faults
5	7° / 103°	Minor developed foliation and joints

Open pit wall stability is expected to be predominantly controlled by geological structures. Based on the major defect sets delineated (Table 4) the assessed potential wall failure modes (should walls be mined at too steep an angle for prevailing ground conditions) are provided in Table 5.

Table 5 Potential Modes of Wall Failure at Trilogy

Wall Location	Mode of Failure	Defect Set	Comments
North Wall	Sliding	2	Sliding on moderate south-east dipping defects.
	Toppling	4	Toppling on moderate north-east dipping defects.
South Wall	Sliding	4	Sliding on moderate north-east dipping defects.
	Toppling	2	Toppling on moderate south-east dipping defects.
East Wall	Toppling	1 2 &4	Toppling on moderate east dipping defects. Potential toppling on moderate north-east and south-west dipping defects.
West Wall	Sliding	1 2 &4	Planar sliding on moderate east dipping defects with release on defect 3. Potential sliding on south-east and north-east dipping defects with release on defect 3
	Toppling	3	Possible toppling on steep west dipping defects

Within slightly weathered to fresh rock the highest potential for open pit wall stability will be from Defect Sets 1 and 2 which are respectively bedding and foliation planes. These defect sets are well developed, within the Trilogy laminated shale domain and are typically coated with graphite. These defects are less well developed within the Siliceous Shale domain.

3.6 Hydrogeology

A hydrogeological investigation of the Trilogy deposit was carried out by Rockwater Pty Ltd [17]. Fundamental findings derived from this report are that:

- The standing groundwater table, as measured from exploration boreholes drilled within the deposit, is located at ~ 35m below surface.
- Airlift yields from the exploration holes ranged from < 20m^3/day up to ~ 240m^3/day, although only two holes had air lifts > 50m^3/day. Groundwater is interpreted to be contained within fractures, joints and vugs in the silicified shales of the ore lenses and in the overlying supergene zone.

Groundwater within the mineralised zone and underlying footwall rocks has a salinity of ~ 18,000 mg/l (TDS) and a pH of ~ 2.8.

3.7 Mining Rock Mass Rating Scheme

The Mining Rock Mass Rating (MRMR) [8] classification was introduced as a development of the CSIR Geomechanics Classification System (RMR) [7] with the aim of predicting how the rock mass will behave in a mining environment. The system is based on adjustments to the RMR for weathering, mining induced stresses, joint orientation, and blasting effects:

$$\text{MRMR} = \text{RMR x Adjust Factors}_{\text{(Weathering x Joints x Blasting x Stress)}}$$

The Mining Rock Mass Rating (MRMR) classification originally developed by Laubscher [8] and subsequently adapted by Haines and Terbrugge [9] to assess suitable overall wall angles that could reasonably be mined within wall rocks exhibiting variable degrees of weathering and competence.

The relationship between MRMR values and stable pit walls is empirically based, but has been shown by experience in Africa, Australia and South America to provide a realistic assessment of maximum wall angles that may be safely mined in rock masses of variable quality [9].

Input into the MRMR classifications comprised intact rock strengths, fracture frequency (FF) values, and defect characteristics for the different rock mass domains at Trilogy. ‘Damp’ ground conditions were assumed, as were the presence of at least three (3) inclined defect sets within all parts of the rock mass. Good, conventional blasting practices were assumed to be successfully maintained at all times.

A summary of the results obtained from the MRMR rock mass classification and derived slope angles is provided in Table 6, with associated calculations shown in Appendix D.

Note that this empirical method of slope stability assessment is unable to account for the possible influence of major (or pervasive) geological structures (such as unfavourably oriented faults).

Table 6 Summary of Mining Rock Mass Rating Assessment of Trilogy Open Pit Walls

Domain	Case	IRS Value	FF Value	JRC Parameters				JRC Value	Adjustment Parameters			MRMR	Slope Angle
				A	B	C	D	(40 X A x B x C)	Weathering	Joints	Blasting		
Moderate to Highly Weathered Rock	Best	4	11	0.8	0.75	1.0	0.2	4.8	0.88	0.8	0.94	13	36°
	Worst	1	4	0.7	0.55	1.0	0.2	3.1	0.88	0.8	0.94	5	33°
Slightly Weathered to Fresh Laminated Siltstone	Best	16	13	0.75	0.65	1.0	0.45	8.8	1.0	0.8	0.94	28	44°
	Worst	6	4	0.70	0.55	1.0	0.2	3.2	1.0	0.8	0.94	10	35°
Slightly Weathered to Fresh Siliceous Siltstone	Best	20	20	0.80	0.75	1.0	0.65	15.6	1.0	0.8	0.94	42	51°
	Worst	20	4	0.7	0.65	1.0	0.45	8.2	1.0	0.8	0.94	24	42°

3.8 Slope Stability Analyses

Two-dimensional limit equilibrium and finite element analyses were conducted to assess likely stability conditions against circular failure through the rock mass forming a 150m high Trilogy pit highwall/endwall. Limit equilibrium analyses used the Rocscience program **Slide** [13], while finite element analysis used the Rocscience program **Phase²** [14].

The cross-section modelled in both cases is shown in Figure 3. The slope comprises an upper highly weathered to completely weathered zone with a slope angle of ~ 36°, overlying slightly weathered to fresh rock in which the slope angle is 44°. The shear strengths used were based on calculated average RMR values: *very poor* quality rock in the upper zone and *fair* quality rock in the lower zone [1].

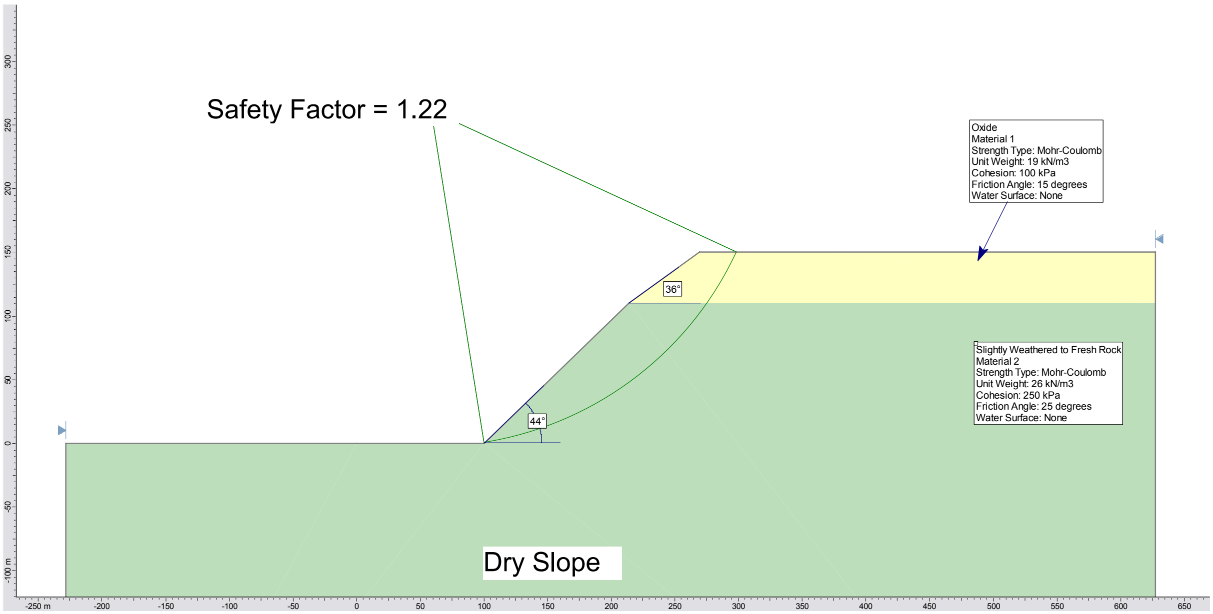

Figure 7 Cross-section for limit equilibrium & finite element analyses

Analyses were conducted using both limit equilibrium and finite element methods for:

- Dry slope conditions
- Partially saturated lower zone conditions.
- Fully saturated lower zone conditions.

Results from the analyses are summarised in Table 7. Graphic output from these analyses (showing critical failure surfaces (for Slide analyses) and zones of maximum shear strain (Phase² analyses) is presented in Appendix E.

Table 7 Results Summary: Limit Equilibrium & Finite Element Slope Stability Analyses

Slope Condition	Limit Equilibrium Factor of Safety (FS)	Finite Element Stress Reduction Factor (SRF)	Comment
Dry	1.22	1.30	Slope inferred STABLE
Groundwater 1: Partially saturated lower zone	1.07	1.13	FS & SRF inadequate for mining
Groundwater 2: Fully saturated lower zone	0.90	0.95	Slope UNSTABLE

Factor of Safety (FS) and Stress Reduction Factor (SRF) are both measures of the ratio of available strength to the gravity-induced load demand from the slope. Their values should be approximately equal. As well as a check on obtained result, the finite element assessment is used to confirm that the user-defined failure surface in the limit equilibrium calculation is reasonable.

The results indicate that:

⇨ Stability conditions would be *adequate* for mining in a *perfectly dry* rock mass.

⇨ Stability conditions would be *marginal for partially saturated conditions*. Local adverse influence, for example, due to unfavourable geological structural conditions (even locally) could cause slope failure.

⇨ *Under fully saturated lower zone conditions the slope would be unstable*.

The FS/SRF values calculated in the analyses apply to the completed pit configuration.

Notwithstanding the possible influence of geological structure and assuming groundwater levels can be drawn down, "better" slope stability conditions (greater FS/SRF) should apply during excavation. Nevertheless, it remains necessary to moderate slope angles (from those of the analysed cross-section) when deriving *base case* wall design parameters. Reductions in the overall angles of slope segment of up to ~ 2° are necessary.

3.9 Q-System Classification

The updated Norwegian Geological Institute (NGI) Q-System [10, 11] an empirical rock mass classification scheme, was used to characterise the laminated siltstone and siliceous siltstone domains within the proposed underground mining domain.

Q-System parameters are defined below:

$$Q = \frac{RQD}{Jn} \; x \; \frac{Jr}{Ja} \; x \; \frac{Jw}{SRF}$$

RQD	=	Rock Quality Designation
Jn	=	Joint set number
Jr	=	Joint roughness
Ja	=	Joint alteration
Jw	=	Joint water reduction factor
SRF	=	Stress reduction factor

Since Q-Values are non-linear, conventional measures of dispersion (such as standard deviation) are inappropriate. Accordingly, Q and Modified Q Values has been described using quartile values. To obtain a general understanding of ground conditions within the potential Trilogy Underground quartiles were calculated for the two rock type domains. Results are summarised in Table 8.

Table 8 Summary of Quartile Q' and Q-Values for Trilogy Rock Type Domains

Domain	Quartile	Q'-Value	Q-Value	Rock Class
Laminated Siltstone	1st	7.1	6.8	***Fair***
	2nd	15.2	15.2	***Good***
	3rd	36.0	36.3	***Good***
	4th	100.0	100.0	***Very Good***
Siliceous Siltstone	1st	17.6	17.3	***Good***
	2nd	34.1	34.1	***Good***
	3rd	44.1	44.0	***Very Good***
	4th	100.0	100.0	***Very Good***

Considering Q-System rock class divisions the Trilogy rock type domains are classified as:

Laminated Siltstones	***Fair* – *Very Good***
Siliceous Siltstones	***Good* – *Very Good***

Modified Stability Graph Method

The Modified Stability Graph Method [12] was used to make preliminary assessments of stable stope spans. The key input parameters and formulae for determining the stability of a stope is summarised below:

Modified Q:

$$Q' = \frac{RQD}{Jn} \times \frac{Jr}{Ja}$$

Modified Stability Number, N ':

$$N' = Q' \times A \times B \times C$$

A - Factor relating to rock strength and induced stresses.

B - Measure of relative orientation of dominant jointing to excavation surface.

C - Measure of influence of gravity on the stability of the stope face.

Hydraulic Radius, HR:

HR (m) = Area (m^2) ÷ Perimeter (m)

The input parameters, calculations and the resulting Modified Stability Numbers, N ' are presented in Appendix F.

Table 9 summarises the *empirically assessed* achievable hydraulic radii for unsupported and supported stope hangingwalls and backs at Trilogy (according to the Potvin (1988) and Nickson (1992) stope performance databases).

Table 9 Summary of Modified Stability Graph Results for Trilogy

Rock Type	Stope Boundary	N'	Unsupported		Supported	
			HR (m)	(Dip Span x Length)	HR (m)	(Dip Span x Length)
Silicified Siltstone	Hangingwall	36.9	11.1	50m x 40m (2 sublevels)	14.0	50m x 64m (2 sublevels)
	Backs	109.1	15.5	40m x ≥50m	17.9	64m x ≥50m
Laminated Siltstone	Hangingwall	3.1	4.8	28m x 15m (1 sublevels)	8.2	28m x 40m (1 sublevels)
	Backs	14.6	7.5	15m x ≥50m	11.7	40m x ≥50m

It is important to note that HR values for supported stopes assume that the assessed stope walls and/ or backs can be uniformly reinforced over their full area, typically with cable bolts. At most mines, however, uniform installation/ coverage of stope reinforcement is difficult to achieve, and this is expected to be the case at Trilogy.

4.0 Open Pit Mining

On the basis of the foregoing assessments, design parameters for a short to medium life open pit wall at Trilogy are shown in Tables 10 & 11.

Table 10 Base case hangingwall & endwall design parameters (inferred likely rock mass conditions)

Rock Type Domain	Depth Below Surface	Batter Angle	Berm Width	Bench Height	Inter-ramp angle
Weathered Laminated Siltstones	0 to 40m	60°	4m	5m	36°
Slightly Weathered to Fresh Laminated Siltstones	40m to~ 150m	60°	8m	15m	42°

Table 11 Base case footwall design parameters (wall striking sub-parallel to bedding)

Rock Type Domain	Depth Below Surface	Batter Angle	Berm Width	Bench Height	Inter-ramp angle
Weathered Laminated Siltstones and Siliceous Siltstones	0 to 40m	60°	4m	5m	36°
Slightly Weathered to Fresh Laminated Siltstones	35m to ~ 150m	60°	8m	15m	42°
Slightly Weathered to Fresh Siliceous Siltstones	35m to ~ 150m	64°	6m	15m	48°

Important Comments on Wall Design

The following general comments are considered to be applicable to the recommended *base case* design parameters for proposed mining in the Trilogy pit:

- **The recommended parameters are not necessarily conservative.**
- The parameters are recommended with an expectation that initial mining will allow use of observational techniques to refine slope parameters for final walls. That is, assessment of interim slopes will permit confirmation and/or amendment of the parameters.
- **The design assumes that dry (largely depressurised) wall rock conditions are achieved.**
- It is recommended that dewatering be carried out in advance of mining.
- Since it is possible that pit dewatering measures will not adequately drain wall rocks, allowance should be made to drill an array of sub-horizontal depressurisation holes into the highwall and endwalls of the pit. Some depressurisation may also be required in the footwall.
- Specifications of dewatering arrays need to be based on actual observation/measurement of conditions; however, for evaluation purposes allowance should be made to install a depressurisation array of ~ 25m long (≥ 76mm diameter) holes drilled at ± 5° to horizontal at ~ 20m horizontal × ~ 20m vertical spacings, commencing from an elevation ≤ 20m belwo the pre-mining groundwater level.
- It is expected that access ramps will be best located on the footwall (± endwalls) of the pit.
- Mining to the recommended wall parameters is expected to be accompanied by some local batter scale wall failures. Careful slope monitoring will be required throughout all stages of mining.

- Successful use of appropriate mining techniques, particularly in development of final walls, will be critical to the achievement of the design and maintenance of wall stability.
- The recommended parameters assume that stable wall conditions are required for the estimated 2 to 3 year life of the open pit only. Further geotechnical assessment would be required if longer term pit access is required.
- Local adjustments to design parameters may be necessary to satisfy stability requirements. Few data are known regarding the persistence of geological structures which could contribute to instability. Flattened batters and/or wider berms may be necessary locally. Conversely, there may be opportunity for local wall steepening.
- Convex, unconfined slope sectors (bullnoses) must be expected to be prone to failure. While it is reasonable to include such shapes in pit plans, (rather than committing directly to remove large “additional” volumes of waste).
- No general use of artificial reinforcement is anticipated. However, rock reinforcement could be used locally in fresh rocks if required, for example, shear pins and/or cable bolts could be used to (aim to) prevent possible failure on a batter scale.

- ***Siliceous Siltstones***

  Wall stability is expected to be predominantly controlled by the presence, orientation and shear strength of geological structures exposed in or located close behind pit walls. In particular, achievable batter/ wall angles on the western wall will be governed the attitude of bedding and foliation planes.

  These defect sets are well developed within the Trilogy laminated siltstones and are typically coated with graphite. It is inferred that these defects are less well developed within the siliceous siltstones, hence there is some opportunity to increase slope angles within this rock type. The extent to which this will be possible will be dictated by the frequency of occurrence and persistence of bedding/ foliation defects.

  If during excavation of the open pit the siliceous siltstones are found to contain more bedding and foliation partings then it would be expected to be necessary to reduce slope/ (batter?) angles to the dip of the partings to maintain stability adequate for mining.

  Further refinement of slope design parameters for the moderate to highly weathered siliceous siltstones cannot be provided at this stage. Additional geotechnical investigations, including borehole logging and rock property testing would be required to characterise ground conditions within those zones of the siliceous siltstones which have higher rock weathering grades.

5.0 Underground Mining

5.1 Mining Methods

Based on the assessment of borehole cores and operational experience, two mining methods are considered to be geotechnically suitable for the Trilogy Deposit:

A. Long Hole Open Stoping (LHOS) with pillars

B. Bench Stoping (Benching) with rock fill.

Longhole Open Stoping

At Trilogy the lodes would be extracted in an underhand manner (top-down mining).

Since the potential stope blocks at Trilogy are of limited extent (in both strike and dip) and that widths are highly variable, a flexible approach to pillar layout is warranted. At this stage it is envisaged that rib and/ or sill pillars could be incorporated into mine designs to maintain hangingwall stability and maximise ore recovery.

Depending on the mine layout adopted, it may be possible to partially recover ore contained in rib pillars by mass blasting towards the end of the mine life. It would be expected that ore recovered from mass blasts would be at least moderately diluted by waste rock from stope hangingwall failures.

The principal advantage of longhole open stoping in favourable ground conditions is that it is highly productive and has lower costs than other mining methods utilising backfill.

Bench Stoping

In bench stoping the orebody would be mined in an overhand manner (up-dip) using longhole drill and blast methods. Benching production at Trilogy would preferably be based on down-hole drilling to limit exposure of personnel to wide stope brows. On completion each stope would be backfilled with loose rock (mullock). Bogging of ore from subsequent up dip benches would be carried out on top of the rock fill.

The principal advantages of the bench stoping method for Trilogy are that:

- The rock fill can be introduced as required to control potential wall instability associated with the laminated siltstones. The rock fill will reduce unsupported spans, thereby (aiming to) maintain planned recoveries and controlling dilution.
- Total or near total extraction of the orebody could likely be achieved.

The disadvantages of bench stoping in this instance are that:

- Access to the base of stope block would be required to allow commencement of stoping. The individual stope blocks are too small to enable establishment of multiple stoping panels to provide early production and greater flexibility.
- The logistics of material handling and storage issues associated with the use of rock fill within an underground mine. Placement of fill within wide stopes may need to be undertaken using remotely operated loaders.

5.2 Preferred Mining Methods

The strong siliceous siltstone unit at Trilogy is considered geotechnically favourable for implementation of the more productive and lower cost longhole open stoping. It is expected that stope hangingwalls would experience some degree of slabbing, particularly where the rock mass is less silica altered and foliation planes are more prevalent.

The potential for instability will increase if the lower strength laminated siltstones intersect or come within close proximity (say within 3m) of stope hangingwalls. If stope designs and/ or rock reinforcement are unable to manage this risk then bench stoping should be adopted as exposure of the laminated siltstone can be reduced by the placement of rock fill.

Based on the results of the Modified Stability Graph Method assessments stopes should initially be designed with HR values as follows:

$HR_{Walls} \leq 11.1m$

$HR_{Backs} \leq 15.5m$

Where non-recoverable rib and sill pillars are left to assist in maintaining stope wall stability these should be designed to have 'aspect ratios' ≥ 1:1 to remain stable within the low stress environment expected at Trilogy. If there is an intention to recover pillars toward the end of mine life then it would be advisable to design pillars with aspect ratios ≥ 1.5:1 to (aim to) ensure *good* conditions for re-entry purposes.

5.3 Mine Infrastructure

Main Decline

Decline and access development is expected to be located within footwall laminated siltstones and siliceous siltstones that are rated as ***fair*** to ***very good*** in rock quality. For preliminary planning purposes it is recommended that the decline is positioned ≥ 30m from potential stoping areas.

Ventilation Drive and Shafts

The rock mass within the currently proposed shaft location should be predominantly fresh. If the ventilation shafts are raisebored at a diameter up to ~3m, it is expected that the sidewalls would be self-supporting. However, if the shafts are developed by handheld mining methods there will be a requirement to systematically rock bolt and mesh the shaft sidewalls as they are exposed during development.

The ventilation drive/s and associated portal can be supported with weld mesh and friction bolts.

5.4 Ground Support and Reinforcement

Ground support designs recommended for proposed development are as follows:

Portal

The proposed underground will be accessed via a Portal developed into the 970-980mRL batter face located in the southeast corner of the Trilogy Open Pit.

Any loose rock scree that has accumulated on the batters and berms between the portal position and the overlying sector of the open pit ramp must be cleaned away before commencing any ground support activities.

A catch fence should be constructed along the crest of the 970-980mRL batter to prevent loose rock from overlying slope falling into the Portal entrance area. This fence should extend to ≥ 15m either side of the Portal.

The rock surrounding the immediate (within ~5m) Portal entrance should be systematically supported with a 75mm thick layer of fibrecrete and 3.0m long full-column grouted gewie bars.

Short (~ 2m) development cuts should be taken in the first 3 or 4 cuts. Ground support consisting of 2.4m long friction bolts and galvanised mesh should be installed to the face after each cut. The friction bolts within the Portal area will also require cement grouting to increase anchorage capacity (typically from ~ 4 tonnes/m to ≥ 10 tonnes/m) and improve corrosion resistance.

Having advanced ~ 10m, cable bolting of the Portal backs will be required. Cable bolt ring spacing should be 2.0m, with four, 6m length twin bulbed strand cables per ring.

Main Decline and Accesses

The stronger and less structured siliceous siltstones should be more favourable for development stability than the lower strength graphite bearing laminated siltstones.

The shallow dip of the laminated siltstones means that development sidewalls should be reasonably stable while the backs of development will be susceptible to slabbing type failures.

Drill and blast standards will need to be of a high standard to prevent the laminated siltstones being excessively damaged and necessitating installation of higher levels of ground support and reinforcement.

An appropriate minimum ground support standard would be to install, ≥ 2.4m long friction bolts and weld mesh over the backs and shoulders of the development to within ~ 3m of floor level.

Ore Drives

The mineralised siliceous siltstones have been assessed to be of ***good*** or better rock quality.

An appropriate minimum ground support standard would be to install, ≥ 2.4m long friction bolts and weld mesh over the backs and shoulders of the development to within ~ 3m of floor level.

Intersection Spans

Where wide spans (≥ 6m) are formed the backs should be reinforced with 6m long twin bulbed strand cable bolts installed on a 2.0m to 2.5m grid, in addition to the friction bolts and mesh already installed as standard minimum support.

Stopes Spans

In an effort to improve stope wall stability it is recommended that the hangingwall rock mass immediately opposite ore drives with 2-2.5m spaced rings of ≥6m long twin strand cable bolts, with each ring containing two (3) plated and tensioned cable bolts.

6.0 Ongoing Geotechnical Requirements

Observational methods of design assessment and adjustment will need to be employed during pit development. The fundamental components of *observational assessment* are discussed in the following sections.

6.1 Pit Wall Mapping

It is considered crucial that further structural defect/geotechnical data are gathered as mining proceeds. These data are required to confirm, refine or amend (as the case may be) the *base case* wall designs. The pit should be mapped (at least) at every berm level. Data collected should include:

- **Basic lithology**, degree of **weathering** and estimated **strength** (simple index tests)
- **Major structural features**: faults, shears, contacts, foliation fabric, joints (> 5m persistence or of high frequency), recording location, orientation, persistence, spacing (measured or estimated) shape, roughness, infill, and termination.
- **General comments**, for example, occurrence of groundwater or dampness.
- **Failure descriptions**: location, date of (even small localised) failure, features defining the failure, estimated volume, mechanism, break-out mechanism.

Plots of relevant data showing true location of geology and major structures, and stereographic plots of all structures are minimum requirements for ongoing assessment. Defect orientation and defect characteristics data are essential to identify potential failure mechanisms, and to assess the likely frequency and size of possible failures.

6.2 Pit Wall Stability Monitoring

Use of qualitative visual and quantitative electro-optical distance measurement (EDM) (and possibly extensometry) stability monitoring methods are recommended for ongoing assessment of pit wall slope stability conditions at Trilogy.

Frequent visual inspection of the pit walls, including walking over all safely accessible berms, must be regarded as an integral aspect of pit mining. Observations should be recorded in a written log, and regularly updated photographic record can provide assistance in qualitative assessment.

EDM prisms should be installed at ~ 100m intervals around the periphery of the pit on alternate berms, commencing with the first berm below the pit crest. Interim pit wall displacements should be quantitatively monitored.

The frequency of surveying these prisms after identification of movement trends immediately following installation should be based on measured displacement rates, but should not be less frequently than weekly.

Slope distance and horizontal and vertical angles should be recorded. Slope distance will often be adequate; however three-dimensional assessment may be necessary.

Displacement (slope distance and possibly changes in easting, northing and elevation) versus time plots should be updated with each reading (and generally displayed hardcopy plots updated at least fortnightly or according to specific/local requirements).

The performance of waste dump slopes and foundations should be monitored by checking for slumping and cracking on slopes and for ground heave around the toes of slopes.

6.3 Final Wall Blasting

Blast energy requirements will increase with depth and decreasing weathering grade, and hard rock blasting techniques will be necessary in fresh rocks.

Variations in conditions are expected to be experienced. Parties who may need specific, quantitative information with respect to excavation and/or drilling conditions are advised to obtain a range of suitably representative material for appropriate testing and analysis.

Great care must be exercised where blasting against, or in the vicinity of, pit limit walls. Appropriate perimeter blasting techniques **must** be employed to protect the integrity of the walls.

Predominant geological structures exposed in pit walls can strongly influence the efficiency of perimeter blasts. Pervasive weaknesses (for example cleavage fabric) will promote fracture, but will not necessarily result in breakage at the desired batter angle or face alignment. In areas where the rock mass is *blocky* or highly fractured, it will be susceptible to damage and/or disturbance from explosives gasses if adequate relief is not achieved.

In addition to maintaining strict control over limit blasts, it is strongly recommended that due care be taken to ensure that production blasts do not damage or unduly disturb the rocks in either existing or future walls. This includes adjustment of sub-drill depths in the vicinity of future berms and berm crests. Some difficulty may be experienced in achieving acceptable results from both production and limit blasts with increased depth and rock strengths.

Close observation and assessment of blasting conditions and results will be needed to design and adjust limit blasts. Trial blasts *on non-limit walls* are strongly recommended.

6.4 Groundwater Monitoring

Dissipation of groundwater pressures from wall rocks is expected to be a critical aspect of mining at Trilogy. Groundwater levels should be monitored at several locations around the pit and short open hole piezometers should be installed from the developing highwall to monitor water levels behind the face.

6.5 Ground Control Management Plan

It is recommended that a formal Ground Control Management Plans (GCMPs) be developed for proposed open pit and underground mining at Trilogy.

The GCMPs would describe the ground conditions encountered and/ or anticipated in the mine, and justify the slope parameters and stoping methods in use or proposed. It would identify likely failure mechanisms and the means by which these would/ could be precluded or avoided to permit safe development and production. The physical and management procedures to be used to ensure appropriate mine design and use of safe mining practices would also be described.

From a geotechnical perspective, the document **must** show nominal design sections and plans for the open pit and underground. In this respect the contents of this document can be used to form the basis of this part of the GCMP.

6.6 Geotechnical Review

Regular geotechnical review of open pit wall stability conditions during mining operations is recommended. Such reviews should be conducted at ≤ 20m vertical increments in pit development, depending on assessment of actual conditions by Tectonic mining personnel.

Similarly, underground development and stoping must be subject to regular external review (as has been standard practice at Tectonic's previous operations – Rav 8 and Burnakura)

7.0 Closure

We trust that the information provided in this report is adequate for your current requirements. We stress the need for ongoing geotechnical assessment and review of actual mining conditions.

Please contact this office if there is any need for clarification or further information.

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APPENDIX A

SUMMARY BOREHOLE LOGS

TRILOGY DEPOSITS

Appendix A

Borehole	From (m)	To (m)	RQD (%)	Fracture Frequency (Fractures/metre)	Weathering	Hardness
MYCD 004	170	171	70	10	1	4
MYCD 004	171	172	90	5	1	4
MYCD 004	172	173	67	9	1	4
MYCD 004	173	174	95	10	1	4
MYCD 004	174	175	65	14	1	4
MYCD 004	175	176	49	16	1	4
MYCD 004	176	177	100	6	1	4
MYCD 004	177	178	86	9	1	4
MYCD 004	178	179	54	8	1	4
MYCD 004	179	180	85	12	1	4
MYCD 004	180	181	70	9	1	4
MYCD 004	181	182	55	14	1	4
MYCD 004	182	183	84	10	1	5
MYCD 004	183	184	92	4	1	5
MYCD 004	184	185	100	4	1	5
MYCD 004	185	186	100	2	1	5
MYCD 004	186	187	92	5	1	5
MYCD 004	187	188	100	3	1	5
MYCD 004	188	189	100	4	1	5
MYCD 004	189	190	91	6	1	5
MYCD 004	190	191	87	7	1	5
MYCD 004	191	192	100	4	1	5
MYCD 004	192	193	100	2	1	5
MYCD 004	193	194	100	2	1	5
MYCD 004	194	195	100	2	1	5
MYCD 004	195	196	65	7	1	5
MYCD 004	196	197	100	5	1	5
MYCD 004	197	198	80	7	1	5
MYCD 004	198	199	55	12	1	5
MYCD 004	199	200	60	5	1	5
MYCD 004	200	201	94	4	1	5
MYCD 004	201	202	75	5	1	5
MYCD 004	202	203	90	4	1	5
MYCD 004	203	204	100	2	1	5
MYCD 004	204	205	46	7	1	5
MYCD 004	205	206	48	25	1	3
MYCD 004	206	207	100	18	1	3
MYCD 004	207	208	100	4	1	5
MYCD 004	208	209	92	2	1	5
MYCD 004	209	210	90	5	1	5
MYCD 004	210	211	90	8	1	5
MYCD 004	211	212	100	3	1	5
MYCD 004	212	213	100	3	1	5
MYCD 004	213	214	100	1	1	5
MYCD 004	214	215	93	5	1	5
MYCD 004	215	216	100	4	1	5
MYCD 004	216	217	100	5	1	5
MYCD 004	217	218	100	2	1	5
MYCD 004	218	219	94	5	1	5

Appendix A

MYCD 004	219	220	100	1	1	5
MYCD 004	220	221	100	2	1	5
MYCD 004	221	222	86	3	1	5
MYCD 004	222	223	100	4	1	5
MYCD 004	223	224	86	6	1	5
MYCD 004	224	225	94	6	1	5
MYCD 004	225	226	85	6	1	5
MYCD 004	226	227	76	9	1	5
MYCD 004	227	228	45	15	1	5
MYCD 004	228	229	63	11	1	5
MYCD 004	229	230	82	9	1	5
MYCD 004	230	231	95	10	1	5
MYCD 004	231	232	81	11	1	5
MYCD 004	232	233	53	11	1	5
MYCD 004	233	234	35	18	1	5
MYCD 004	234	235	31	20	1	5
MYCD 004	235	236	36	5	1	5
MYCD 004	236	237	70	11	1	5
MYCD 004	237	238	65	10	1	5
MYCD 004	238	239	90	8	1	5
MYCD 004	239	240	10	25	1	5
MYCD 004	240	241	56	14	1	5
MYCD 004	241	242	90	4	1	5
MYCD 004	242	243	90	5	1	5
MYCD 004	243	244	100	6	1	5
MYCD 004	244	245	96	5	1	5
MYCD 004	245	246	86	5	1	5
MYCD 004	246	247	88	6	1	5
MYCD 004	247	248	84	5	1	5
MYCD 004	248	249	100	5	1	5
MYCD 004	249	250	85	7	1	5
MYCD 016	180	181	40	23	1	5
MYCD 016	181	182	60	13	1	5
MYCD 016	182	183	40	3	1	5
MYCD 016	183	184	60	7	1	5
MYCD 016	184	185	80	9	1	5
MYCD 016	185	186	60	18	1	5
MYCD 016	186	187	60	18	1	5
MYCD 016	187	188	100	19	1	5
MYCD 016	188	189	100	19	1	5
MYCD 016	189	190	100	19	1	5
MYCD 016	190	191	100	5	1	5
MYCD 016	191	192	78	5	1	5
MYCD 016	192	193	86	5	1	5
MYCD 016	193	194	82	5	1	5
MYCD 016	194	195	100	5	1	5
MYCD 016	195	196	83	5	1	5
MYCD 016	196	197	66	26	1	5
MYCD 016	197	198	10	26	1	5
MYCD 016	198	199	36	30	1	5
MYCD 016	199	200	10	30	1	5
MYCD 016	200	201	10	22	1	5

Appendix A

MYCD 016	201	202	78	4	1	5
MYCD 016	202	203	73	7	1	5
MYCD 016	203	204	81	9	1	5
MYCD 016	204	205	71	8	1	5
MYCD 016	205	206	10	14	1	5
MYCD 016	206	207	73	11	1	5
MYCD 016	207	208	88	4	1	5
MYCD 016	208	209	95	5	1	5
MYCD 016	209	210	85	6	1	5
MYCD 016	210	211	38	10	1	5
MYCD 016	211	212	15	5	1	5
MYCD 016	212	213	100	5	1	5
MYCD 016	213	214	93	4	1	5
MYCD 016	214	215	100	1	1	5
MYCD 016	215	216	100	1	1	5
MYCD 016	216	217	100	1	1	5
MYCD 016	217	218	100	0	1	5
MYCD 016	218	219	91	4	1	5
MYCD 016	219	220	85	4	1	5
MYCD 016	220	221	87	9	1	5
MYCD 016	221	222	100	4	1	5
MYCD 016	222	223	94	4	1	5
MYCD 016	223	224	100	4	1	5
MYCD 016	224	225	100	2	1	5
MYCD 016	225	226	95	4	1	5
MYCD 016	226	227	91	4	1	5
MYCD 016	227	228	70	4	1	5
MYCD 016	228	229	100	7	1	5
MYCD 016	229	230	87	15	1	5
MYCD 016	230	231	80	3	1	5
MYCD 016	231	232	60	3	1	5
MYCD 016	232	233	80	3	1	5
MYCD 016	233	234	100	2	1	5
MYCD 016	234	235	60	2	1	5
MYCD 016	235	236	60	16	1	5
MYCD 016	236	237	80	6	1	5
MYCD 016	237	238	40	5	1	5
MYCD 016	238	239	10	9	1	5
MYCD 016	239	240	40	8	1	5
MYCD 016	240	241	100	8	1	5
MYCD 016	241	242	80	14	1	5
MYCD 016	242	243	10	30	1	5
MYCD 016	243	244	80	12	1	5
MYCD 016	244	245	40	15	1	5
MYCD 016	245	246	80	9	1	5
MYCD 016	246	247	120	3	1	5
MYCD 016	247	248	100	2	1	5
MYCD 016	248	249	100	4	1	5
MYCD 016	249	250	80	5	1	5
MYCD 033	180	181	100	6	1	5
MYCD 033	181	182	86	6	1	5
MYCD 033	182	183	82	10	1	5

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MYCD 033	183	184	92	5	1	5
MYCD 033	184	185	92	4	1	5
MYCD 033	185	186	100	4	1	5
MYCD 033	186	187	95	6	1	5
MYCD 033	187	188	81	7	1	5
MYCD 033	188	189	92	5	1	5
MYCD 033	189	190	62	12	1	5
MYCD 033	190	191	36	16	1	5
MYCD 033	191	192	56	10	1	5
MYCD 033	192	193	71	10	1	5
MYCD 033	193	194	70	9	1	5
MYCD 033	194	195	84	7	1	5
MYCD 033	195	196	74	8	1	5
MYCD 033	196	197	70	70	1	5
MYCD 033	197	198	61	11	1	5
MYCD 033	198	199	74	9	1	5
MYCD 033	199	200	94	3	1	5
MYCD 033	200	201	94	7	1	5
MYCD 033	201	202	16	25	1	5
MYCD 033	202	203	24	25	1	5
MYCD 033	203	204	57	13	1	5
MYCD 033	204	205	60	13	1	5
MYCD 033	205	206	65	11	1	5
MYCD 033	206	207	74	9	1	5
MYCD 033	207	208	61	8	1	5
MYCD 033	208	209	51	20	1	5
MYCD 033	209	210	100	6	1	5
MYCD 033	210	211	91	6	1	5
MYCD 033	211	212	80	12	1	5
MYCD 033	212	213	80	12	1	5
MYCD 033	213	214	88	7	1	5
MYCD 033	214	215	93	4	1	5
MYCD 033	215	216	92	5	1	5
MYCD 033	216	217	92	5	1	5
MYCD 033	217	218	91	4	1	5
MYCD 033	218	219	73	8	1	5
MYCD 033	219	220	97	4	1	5
MYCD 033	220	221	84	5	1	5
MYCD 033	221	222	75	8	1	5
MYCD 033	222	223	83	15	1	5
MYCD 033	223	224	25	14	1	5
MYCD 033	224	225	59	10	1	5
MYCD 033	225	226	61	12	1	5
MYCD 033	226	227	53	12	1	5
MYCD 033	227	228	56	12	1	5
MYCD 033	228	229	59	17	1	5
MYCD 033	229	230	89	6	1	5
MYCD 033	230	231	100	2	1	5
MYCD 033	231	232	99	3	1	5
MYCD 033	232	233	68	16	1	5
MYCD 033	233	234	86	6	1	5
MYCD 033	234	235	92	5	1	5

Appendix A

MYCD 033	235	236	100	4	1	5
MYCD 033	236	237	100	2	1	5
MYCD 033	237	238	100	2	1	5
MYCD 033	238	239	85	5	1	5
MYCD 033	239	240	94	3	1	5
MYCD 033	240	241	100	3	1	5
MYCD 033	241	242	100	2	1	5
MYCD 033	242	243	100	4	1	5
MYCD 033	243	244	65	10	1	5
MYCD 033	244	245	100	2	1	5
MYCD 033	245	246	83	6	1	5
MYCD 033	246	247	36	22	1	5
MYCD 033	247	248	38	19	1	5
MYCD 033	248	249	73	11	1	5
MYCD 033	249	250	73	7	1	5
MYCD 033	250	251	73	8	1	5
MYCD 033	251	252	81	10	1	5
MYCD 033	252	253	75	10	1	5
MYCD 033	253	254	97	7	1	5
MYCD 033	254	255	74	6	1	5
MYCD 033	255	256	58	25	1	5
MYCD 033	256	257	48	18	1	5
MYCD 033	257	258	40	13	1	5
MYCD 033	258	259	92	4	1	5
MYCD 033	259	260	82	9	1	5
MYCD 033	260	261	11	25	1	5
MYCD 033	261	262	55	20	1	5
MYCD 033	262	263	69	12	1	5
MYCD 033	263	264	35	25	1	5
MYCD 033	264	265	92	9	1	5
MYCD 033	265	266	100	3	1	5
MYCD 033	266	267	74	9	1	5
MYCD 033	267	268	65	9	1	5
MYCD 033	268	269	86	7	1	5
MYCD 033	269	270	93	5	1	5
MYCD 033	270	271	88	6	1	5
MYCD 033	271	272	85	12	1	5
MYCD 033	272	273	91	3	1	5
MYCD 033	273	274	80	9	1	5
MYCD 033	274	275	60	12	1	5
MYCD 159	30	31	0	20	5	1
MYCD 159	31	32	0	20	5	1
MYCD 159	32	33	0	20	5	2
MYCD 159	33	34	0	20	5	2
MYCD 159	34	35	0	20	5	2
MYCD 159	35	36	0	20	5	2
MYCD 159	36	37	0	20	5	2
MYCD 159	37	38	0	20	5	2
MYCD 159	38	39	0	8	5	2
MYCD 159	39	40	0	14	1	2
MYCD 159	40	41	0	13	1	4
MYCD 159	41	42	23	13	1	4

Appendix A

MYCD 159	42	43	47	11	1	4
MYCD 159	43	44	33	15	1	4
MYCD 159	44	45	0	15	1	4
MYCD 159	45	46	14	20	1	4
MYCD 159	46	47	50	10	1	4
MYCD 159	47	48	27	17	1	4
MYCD 159	48	49	0	20	1	4
MYCD 159	49	50	0	20	1	4
MYCD 159	50	51	0	19	1	3
MYCD 159	51	52	0	20	1	3
MYCD 159	52	53	0	10	1	3
MYCD 159	53	54	0	17	1	3
MYCD 159	54	55	0	8	1	3
MYCD 159	55	56	13	6	1	3
MYCD 159	56	57	0	20	1	3
MYCD 159	57	58	0	20	1	3
MYCD 159	58	59	0	20	1	3
MYCD 159	59	60	0	20	1	3
MYCD 159	60	61	0	20	1	4
MYCD 159	61	62	84	8	1	4
MYCD 159	62	63	0	20	1	4
MYCD 159	63	64	60	7	1	4
MYCD 159	64	65	0	17	1	4
MYCD 159	65	66	0	20	1	3
MYCD 159	66	67	25	15	1	3
MYCD 159	67	68	0	16	1	3
MYCD 159	68	69	45	17	1	4
MYCD 159	69	70	14	20	1	4
MYCD 159	70	71	0	20	1	4
MYCD 159	71	72	27	11	1	4
MYCD 159	72	73	42	18	1	3
MYCD 159	73	74	0	20	1	3
MYCD 159	74	75	22	20	1	3
MYCD 159	75	76	22	20	1	3
MYCD 159	76	77	0	20	1	3
MYCD 159	77	78	45	20	1	5
MYCD 159	78	79	68	10	1	5
MYCD 159	79	80	35	8	1	5
MYCD 171	11	12	0	20	4	2
MYCD 171	12	13	0	20	4	2
MYCD 171	13	14	0	20	4	2
MYCD 171	14	15	0	20	4	2
MYCD 171	15	16	0	20	4	2
MYCD 171	16	17	0	20	4	2
MYCD 171	17	18	0	20	4	2
MYCD 171	18	19	12	20	4	2
MYCD 171	19	20	0	20	4	2
MYCD 171	20	21	0	20	4	2
MYCD 171	21	22	0	20	4	2
MYCD 171	22	23	0	20	4	2
MYCD 171	23	24	0	20	4	2
MYCD 171	24	25	0	20	4	2

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MYCD 171	25	26	0	20	4	2
MYCD 171	26	27	20	20	3	2
MYCD 171	27	28	0	20	3	2
MYCD 171	28	29	0	20	3	2
MYCD 171	29	30	0	20	3	2
MYCD 171	30	31	0	20	3	2
MYCD 171	31	32	0	20	3	2
MYCD 171	32	33	0	20	3	2
MYCD 171	33	34	0	20	3	2
MYCD 171	34	35	0	20	3	2
MYCD 171	35	36	0	20	3	2
MYCD 171	36	37	0	20	3	2
MYCD 171	37	38	10	20	2	4
MYCD 171	38	39	20	20	2	4
MYCD 171	39	40	0	20	2	4
MYCD 171	40	41	0	20	2	4
MYCD 171	41	42	0	20	2	4
MYCD 171	42	43	0	20	2	4
MYCD 171	43	44	0	20	2	4
MYCD 171	44	45	12	17	2	4
MYCD 171	45	46	60	13	2	4
MYCD 171	46	47	30	16	2	4
MYCD 171	47	48	30	11	1	4
MYCD 171	48	49	20	12	1	4
MYCD 171	49	50	10	20	1	4
MYCD 171	50	51	0	20	1	4
MYCD 171	51	52	0	20	1	4
MYCD 171	52	53	0	20	1	4
MYCD 171	53	54	0	20	1	4
MYCD 171	54	55	0	20	1	4
MYCD 171	55	56	0	20	1	4
MYCD 171	56	57	0	20	1	4
MYCD 171	57	58	0	20	1	4
MYCD 171	58	59	0	20	1	4
MYCD 171	59	60	0	20	1	4
MYCD 171	60	61	0	20	1	4
MYCD 171	61	62	0	20	1	4
MYCD 171	62	63	0	20	1	4
MYCD 171	63	64	0	20	1	4
MYCD 171	64	65	0	20	1	3
MYCD 171	65	66	0	20	1	3
MYCD 171	66	67	0	20	1	3
MYCD 171	67	68	0	20	1	3
MYCD 171	68	69	14	12	1	3
MYCD 171	69	70	20	15	1	4
MYCD 171	70	71	12	17	1	4
MYCD 171	71	72	15	18	1	4
MYCD 171	72	73	0	20	1	4
MYCD 171	73	74	32	13	1	4
MYCD 171	74	75	10	10	1	4
MYCD 171	75	76	40	20	1	4
MYCD 171	76	77	14	6	1	4

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MYCD 171	77	78	15	20	1	4
MYCD 171	78	79	23	20	1	4
MYCD 171	79	80	0	8	1	4
MYCD 171	80	81	14	20	1	4
MYCD 171	81	82	0	20	1	4
MYCD 171	82	83	0	20	1	4
MYCD 171	83	84	31	10	1	5
MYCD 171	84	85	100	4	1	5
MYCD 171	85	86	65	8	1	5
MYCD 171	86	87	80	7	1	5
MYCD 171	87	88	70	6	1	5
MYCD 171	88	89	94	5	1	5
MYCD 171	89	90	70	6	1	5
MYCD 171	90	91	92	4	1	4
MYCD 171	91	92	32	6	1	4
MYCD 171	92	93	30	8	1	4
MYCD 171	93	94	60	14	1	4
MYCD 171	94	95	0	20	1	3
MYCD 171	95	96	41	14	1	3
MYCD 171	96	97	60	10	1	5
MYCD 171	97	98	91	4	1	5
MYCD 171	98	99	70	6	1	5
MYCD 171	99	100	100	3	1	5
MYCD 171	100	101	90	2	1	5
MYCD 171	101	102	46	6	1	5
MYCD 171	102	103	86	5	1	5
MYCD 171	103	104	37	16	1	4
MYCD 171	104	105	43	9	1	4
MYCD 171	105	106	80	4	1	4
MYCD 171	106	107	50	13	1	4
MYCD 171	107	108	45	6	1	4
MYCD 171	108	109	60	4	1	5
MYCD 171	109	110	83	6	1	5
MYCD 171	110	111	100	1	1	5
MYCD 171	111	112	100	3	1	5
MYCD 171	112	113	50	6	1	5
MYCD 171	113	114	15	10	1	5
MYCD 171	114	115	72	4	1	5
MYCD 171	115	116	82	9	1	4
MYCD 171	116	117	78	9	1	4
MYCD 171	117	118	75	6	1	4
MYCD 171	118	119	80	9	1	4
MYCD 171	119	120	90	8	1	5
MYCD 171	120	121	90	2	1	5
MYCD 171	121	122	100	3	1	5
MYCD 171	122	123	77	8	1	5
MYCD 171	123	124	100	3	1	5
MYCD 171	124	125	90	6	1	5
MYCD 171	125	126	67	13	1	5
MYCD 171	126	127	87	10	1	5
MYCD 171	127	128	61	6	1	5
MYCD 171	128	129	60	4	1	5

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MYCD 171	129	130	80	4	1	5
MYCD 171	130	131	34	11	1	5
MYCD 171	131	132	53	7	1	5
MYCD 171	132	133	32	11	1	5
MYCD 171	133	134	82	4	1	5
MYCD 171	134	135	97	5	1	5
MYCD 171	135	136	90	5	1	5
MYCD 171	136	137	73	9	1	5
MYCD 171	137	138	40	10	1	5
MYCD 185	128	129	10			
MYCD 185	129	130	20			
MYCD 185	130	131	30			
MYCD 185	131	132	70			
MYCD 185	132	133	70			
MYCD 185	133	134	80			
MYCD 185	134	135	90			
MYCD 185	135	136	100			
MYCD 185	136	137	82			
MYCD 185	137	138	82			
MYCD 185	138	139	100			
MYCD 185	139	140	97			
MYCD 185	140	141	100			
MYCD 185	141	142	96			
MYCD 185	142	143	85			
MYCD 185	143	144	100			
MYCD 185	144	145	100			
MYCD 185	145	146	100			
MYCD 185	146	147	93			
MYCD 185	147	148	80			
MYCD 185	148	149	80			
MYCD 185	149	150	33			
MYCD 185	150	151	94			
MYCD 185	151	152	49			
MYCD 185	152	153	59			
MYCD 185	153	154	70			
MYCD 185	154	155	81			
MYCD 185	155	156	43			
MYCD 185	156	157	72			
MYCD 185	157	158	65			
MYCD 185	158	159	52			
MYCD 185	159	160	47			
MYCD 185	160	161	79			
MYCD 185	161	162	93			
MYCD 185	162	163	92			
MYCD 185	163	164	58			
MYCD 185	164	165	58			
MYCD 185	165	166	53			
MYCD 185	166	167	56			
MYCD 185	167	168	54			
MYCD 185	168	169	47			
MYCD 185	169	170	74			
MYCD 186	133	134	70			

Appendix A

MYCD 186	134	135	63			
MYCD 186	135	136	76			
MYCD 186	136	137	73			
MYCD 186	137	138	77			
MYCD 186	138	139	80			
MYCD 186	139	140	85			
MYCD 186	140	141	10			
MYCD 186	141	142	30			
MYCD 186	142	143	21			
MYCD 186	143	144	26			
MYCD 186	144	145	96			
MYCD 186	145	146	100			
MYCD 186	146	147	70			
MYCD 186	147	148	30			
MYCD 186	148	149	70			
MYCD 186	149	150	79			
MYCD 186	150	151	84			
MYCD 186	151	152	72			
MYCD 186	152	153	50			
MYCD 186	153	154	80			
MYCD 186	154	155	72			
MYCD 186	155	156	44			
MYCD 186	156	157	12			
MYCD 186	157	158	31			
MYCD 186	158	159	100			
MYCD 186	159	160	89			
MYCD 186	160	161	87			
MYCD 186	161	162	86			
MYCD 186	162	163	49			
MYCD 186	163	164	82			
MYCD 186	164	165	93			
MYCD 186	165	166	93			
MYCD 186	166	167	83			
MYCD 186	167	168	100			
MYCD 186	168	169	54			
MYCD 186	169	170	100			
MYCD 186	170	171	92			
MYCD 186	171	172	83			
MYCD 186	172	173	60			
MYCD 186	173	174	78			
MYCD 186	174	175	74			
MYCD 186	175	176	74			
MYCD 186	176	177	67			
MYCD 186	177	178	80			
MYCD 186	178	179	43			
MYCD 186	179	180	33			
MYCD 186	180	181	81			
MYCD 186	181	182	87			
MYCD 186	182	183	77			
MYCD 186	183	184	87			
MYCD 186	184	185	70			
MYCD 186	185	186	67			

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MYCD 186	186	187	88			
MYCD 186	187	188	70			
MYCD 186	188	189	100			
MYCD 186	189	190	86			
MYCD 186	190	191	100			
MYCD 186	191	192	100			
MYCD 186	192	193	68			
MYCD 186	193	194	57			
MYCD 186	194	195	42			
MYCD 189	127	128	14			
MYCD 189	128	129	75			
MYCD 189	129	130	84			
MYCD 189	130	131	82			
MYCD 189	131	132	80			
MYCD 189	132	133	30			
MYCD 189	133	134	37			
MYCD 189	134	135	45			
MYCD 189	135	136	38			
MYCD 189	136	137	77			
MYCD 189	137	138	82			
MYCD 189	138	139	100			
MYCD 189	139	140	69			
MYCD 189	140	141	89			
MYCD 189	141	142	52			
MYCD 189	142	143	62			
MYCD 189	143	144	60			
MYCD 189	144	145	34			
MYCD 189	145	146	85			
MYCD 189	146	147	88			
MYCD 189	147	148	58			
MYCD 189	148	149	78			
MYCD 189	149	150	90			
MYCD 189	150	151	68			
MYCD 189	151	152	61			
MYCD 189	152	153	40			
MYCD 189	153	154	67			
MYCD 189	154	155	97			
MYCD 189	155	156	86			
MYCD 189	156	157	86			
MYCD 189	157	158	40			
MYCD 189	158	159	27			
MYCD 189	159	160	40			
MYCD 189	160	161	63			
MYCD 189	161	162	74			
MYCD 189	162	163	54			
MYCD 189	163	164	30			
MYCD 189	164	165	66			
MYCD 189	165	166	67			
MYCD 189	166	167	38			
MYCD 189	167	168	73			
MYCD 189	168	169	97			
MYCD 189	169	170	93			

Appendix A

MYCD 189	170	171	88			
MYCD 189	171	172	13			
MYCD 189	172	173	100			
MYCD 190	0	1	0	25	6	1
MYCD 190	1	2	0	25	5	1
MYCD 190	2	3	0	25	5	1
MYCD 190	3	4	0	25	5	1
MYCD 190	4	5	0	25	4	1
MYCD 190	5	6	0	25	4	1
MYCD 190	6	7	0	25	4	1
MYCD 190	7	8	0	25	4	1
MYCD 190	8	9	0	25	4	1
MYCD 190	9	10	0	25	4	1
MYCD 190	10	11	0	19	4	1
MYCD 190	11	12	0	25	4	1
MYCD 190	12	13	0	25	4	1
MYCD 190	13	14	0	17	4	1
MYCD 190	14	15	0	25	4	1
MYCD 190	15	16	0	25	4	2
MYCD 190	16	17	20	17	4	2
MYCD 190	17	18	0	25	4	2
MYCD 190	18	19	0	25	4	2
MYCD 190	19	20	0	25	4	2
MYCD 190	20	21	0	25	4	2
MYCD 190	21	22	11	25	4	2
MYCD 190	22	23	18	25	4	2
MYCD 190	23	24	0	25	4	2
MYCD 190	24	25	0	25	3	2
MYCD 190	25	26	0	25	3	2
MYCD 190	26	27	0	25	3	2
MYCD 190	27	28	0	25	3	2
MYCD 190	28	29	0	25	3	2
MYCD 190	29	30	23	25	3	2
MYCD 190	30	31	29	13	3	2
MYCD 190	31	32	32	25	3	2
MYCD 190	32	33	45	10	3	2
MYCD 190	33	34	56	16	3	2
MYCD 190	34	35	30	15	3	2
MYCD 190	35	36	33	25	3	2
MYCD 190	36	37	40	20	3	2
MYCD 190	37	38	0	20	3	2
MYCD 190	38	39	0	25	3	2
MYCD 190	39	40	14	25	3	2
MYCD 190	40	41	12	25	3	2
MYCD 190	41	42	25	25	3	2
MYCD 190	42	43	38	12	2	3
MYCD 190	43	44	30	16	2	3
MYCD 190	44	45	16	21	2	3
MYCD 190	45	46	32	16	2	3
MYCD 190	46	47	10	21	2	3
MYCD 190	47	48	31	19	2	3
MYCD 190	48	49	65	14	1	3

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MYCD 190	49	50	26	22	1	3
MYCD 190	50	51	10	25	1	3
MYCD 190	51	52	0	25	1	3
MYCD 190	52	53	26	17	1	3
MYCD 190	53	54	20	25	1	3
MYCD 190	54	55	70	8	1	3
MYCD 190	55	56	91	7	1	3
MYCD 190	56	57	86	10	1	3
MYCD 190	57	58	73	9	1	3
MYCD 190	58	59	55	13	1	3
MYCD 190	59	60	11	23	1	3
MYCD 190	60	61	33	25	1	2
MYCD 190	61	62	20	25	1	2
MYCD 190	62	63	57	13	1	2
MYCD 190	63	64	61	8	1	3
MYCD 190	64	65	46	16	1	3
MYCD 190	65	66	58	16	1	3
MYCD 190	66	67	48	15	1	3
MYCD 190	67	68	46	12	1	3
MYCD 190	68	69	57	10	1	3
MYCD 190	69	70	44	13	1	3
MYCD 190	70	71	87	8	1	3
MYCD 190	71	72	64	8	1	3
MYCD 190	72	73	100	4	1	3
MYCD 190	73	74	77	10	1	3
MYCD 190	74	75	80	8	1	3
MYCD 190	75	76	80	6	1	3
MYCD 190	76	77	64	12	1	3
MYCD 190	77	78	10	15	1	3
MYCD 190	78	79	60	12	1	3
MYCD 190	79	80	87	6	1	3
MYCD 190	80	81	99	2	1	3
MYCD 190	81	82	65	9	1	3
MYCD 190	82	83	15	24	1	3
MYCD 190	83	84	22	20	1	3
MYCD 190	84	85	0	25	1	3
MYCD 190	85	86	10	25	1	3
MYCD 190	86	87	12	13	1	3
MYCD 190	87	88	22	16	1	3
MYCD 190	88	89	20	25	1	3
MYCD 190	89	90	23	18	1	3
MYCD 190	90	91	60	7	1	3
MYCD 190	91	92	30	9	1	3
MYCD 190	92	93	36	10	1	3
MYCD 190	93	94	20	22	1	3
MYCD 190	94	95	30	11	1	3
MYCD 190	95	96	50	8	1	3
MYCD 190	96	97	50	8	1	3
MYCD 190	97	98	60	6	1	3
MYCD 190	98	99	30	20	1	3
MYCD 190	99	100	25	25	1	3
MYCD 190	100	101	0	18	1	3

Appendix A

MYCD 190	101	102	12	25	1	3
MYCD 190	102	103	0	25	1	3
MYCD 190	103	104	60	10	1	3
MYCD 190	104	105	100	1	1	3
MYCD 190	105	106	70	6	1	3
MYCD 190	106	107	55	10	1	3
MYCD 190	107	108	60	10	1	3
MYCD 190	108	109	35	17	1	3
MYCD 190	109	110	60	13	1	3
MYCD 190	110	111	10	19	1	3
MYCD 190	111	112	52	9	1	4
MYCD 190	112	113	95	2	1	4
MYCD 190	113	114	90	3	1	4
MYCD 190	114	115	96	5	1	4
MYCD 190	115	116	100	3	1	4
MYCD 190	116	117	100	3	1	4
MYCD 190	117	118	81	4	1	4
MYCD 190	118	119	90	5	1	4
MYCD 190	119	120	96	4	1	4
MYCD 190	120	121	100	6	1	4
MYCD 190	121	122	100	3	1	4
MYCD 190	122	123	86	5	1	4
MYCD 190	123	124	83	7	1	4
MYCD 190	124	125	91	3	1	4
MYCD 190	125	126	98	4	1	4
MYCD 190	126	127	79	6	1	4
MYCD 190	127	128	75	4	1	4
MYCD 190	128	129	79	5	1	4
MYCD 190	129	130	92	4	1	4
MYCD 190	130	131	100	1	1	4
MYCD 190	131	132	77	5	1	4
MYCD 190	132	133	51	9	1	4
MYCD 190	133	134	76	7	1	4
MYCD 190	134	135	83	9	1	4
MYCD 190	135	136	77	5	1	4
MYCD 190	136	137	88	5	1	4
MYCD 190	137	138	91	5	1	4
MYCD 190	138	139	96	4	1	4
MYCD 190	139	140	80	9	1	4
MYCD 190	140	141	67	8	1	4
MYCD 190	141	142	79	8	1	4
MYCD 190	142	143	70	11	1	4
MYCD 190	143	144	77	6	1	4
MYCD 190	144	145	64	13	1	4
MYCD 190	145	146	60	10	1	4
MYCD 190	146	147	29	10	1	4
MYCD 190	147	148	54	25	1	4
MYCD 190	148	149	70	6	1	4
MYCD 190	149	150	38	25	1	4
MYCD 190	150	151	18	11	1	4
MYCD 190	151	152	45	16	1	4
MYCD 190	152	153	80	17	1	4

Appendix A

MYCD 190	153	154	44	25	1	3
MYCD 190	154	155	42	25	1	3
MYCD 190	155	156	67	10	1	3
MYCD 190	156	157	30	25	1	3
MYCD 190	157	158	90	6	1	3
MYCD 190	158	159	50	15	1	4
MYCD 190	159	160	0	22	1	4
MYCD 190	160	161	0	25	1	4
MYCD 190	161	162	28	25	1	4
MYCD 190	162	163	72	14	1	3
MYCD 190	163	164	73	8	1	3
MYCD 190	164	165	100	4	1	3
MYCD 190	165	166	64	11	1	3
MYCD 190	166	167	86	5	1	3
MYCD 190	167	168	80	6	1	3
MYCD 190	168	169	95	4	1	3
MYCD 190	169	170	90	4	1	3
MYCD 190	170	171	96	6	1	3
MYCD 190	171	172	85	4	1	3
MYCD 190	172	173	57	20	1	3
MYCD 190	173	174	30	16	1	3
MYCD 190	174	175	70	16	1	3
MYCD 190	175	176	13	25	1	3
MYCD 190	176	177	30	11	1	3
MYCD 190	177	178	27	25	1	3
MYCD 190	178	179	90	4	1	4
MYCD 190	179	180	72	8	1	4
MYCD 190	180	181	76	5	1	4
MYCD 190	181	182	44	9	1	4
MYCD 190	182	183	15	25	1	4
MYCD 190	183	184	15	12	1	4
MYCD 190	184	185	69	7	1	4
MYCD 190	185	186	41	12	1	4
MYCD 190	186	187	80	7	1	5
MYCD 190	187	188	46	14	1	5
MYCD 190	188	189	58	8	1	5
MYCD 190	189	190	79	7	1	5
MYCD 190	190	191	85	5	1	5
MYCD 190	191	192	95	4	1	5
MYCD 190	192	193	90	4	1	5
MYCD 190	193	194	85	4	1	5
MYCD 190	194	195	92	3	1	5
MYCD 190	195	196	69	4	1	5
MYCD 190	196	197	97	5	1	5
MYCD 190	197	198	100	4	1	5
MYCD 190	198	199	95	5	1	5
MYCD 190	199	200	82	6	1	5
MYCD 190	200	201	61	10	1	5
MYCD 190	201	202	94	4	1	5
MYCD 190	202	203	93	7	1	5
MYCD 190	203	204	92	6	1	5
MYCD 190	204	205	64	8	1	4

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MYCD 190	205	206	76	6	1	4
MYCD 190	206	207	86	4	1	4
MYCD 190	207	208	100	1	1	4
MYCD 190	208	209	100	3	1	4
MYCD 190	209	210	83	4	1	4
MYCD 190	210	211	55	14	1	5
MYCD 190	211	212	42	13	1	5
MYCD 190	212	213	31	13	1	5
MYCD 190	213	214	85	6	1	5
MYCD 190	214	215	100	4	1	5
MYCD 190	215	216	93	6	1	5
MYCD 190	216	217	76	5	1	5
MYCD 190	217	218	69	8	1	5
MYCD 190	218	219	65	8	1	5
MYCD 190	219	220	100	3	1	5
MYCD 190	220	221	100	4	1	5
MYCD 190	221	222	5	25	1	4
MYCD 190	222	223	21	10	1	4
MYCD 190	223	224	39	11	1	4
MYCD 190	224	225	40	25	1	4
MYCD 190	225	226	28	25	1	4
MYCD 190	226	227	88	4	1	5
MYCD 190	227	228	76	4	1	5
MYCD 190	228	229	55	7	1	5
MYCD 190	229	230	95	5	1	5
MYCD 190	230	231	96	3	1	5
MYCD 190	231	232	92	6	1	5
MYCD 190	232	233	78	9	1	5
MYCD 190	233	234	72	9	1	5
MYCD 190	234	235	80	5	1	5
MYCD 190	235	236	100	3	1	5
MYCD 190	236	237	87	5	1	5
MYCD 190	237	238	100	3	1	5
MYCD 190	238	239	93	4	1	5
MYCD 190	239	240	90	5	1	5
MYCD 203	0	1	60	6	6	1
MYCD 203	1	2	60	5	5	1
MYCD 203	2	3	50	9	5	1
MYCD 203	3	4	20	13	5	1
MYCD 203	4	5	50	8	5	1
MYCD 203	5	6	55	7	4	1
MYCD 203	6	7	60	4	4	1
MYCD 203	7	8	30	12	4	1
MYCD 203	8	9	70	8	4	1
MYCD 203	9	10	40	16	4	1
MYCD 203	10	11	30	8	4	1
MYCD 203	11	12	70	8	4	1
MYCD 203	12	13	60	9	4	1
MYCD 203	13	14	20	12	4	1
MYCD 203	14	15	20	11	4	2
MYCD 203	15	16	20	13	4	2
MYCD 203	16	17	30	17	4	2

Appendix A

MYCD 203	17	18	10	15	3	2
MYCD 203	18	19	20	14	3	2
MYCD 203	19	20	60	12	3	2
MYCD 203	20	21	40	9	3	2
MYCD 203	21	22	50	9	3	2
MYCD 203	22	23	40	11	3	2
MYCD 203	23	24	50	5	3	2
MYCD 203	24	25	70	5	3	3
MYCD 203	25	26	50	4	3	3
MYCD 203	26	27	30	7	3	3
MYCD 203	27	28	20	9	3	3
MYCD 203	28	29	30	10	3	3
MYCD 203	29	30	40	12	3	3
MYCD 203	30	31	60	12	3	3
MYCD 203	31	32	50	16	3	3
MYCD 203	32	33	20	15	3	3
MYCD 203	33	34	40	13	3	3
MYCD 203	34	35	30	8	3	3
MYCD 203	35	36	50	11	3	3
MYCD 203	36	37	50	10	3	3
MYCD 203	37	38	60	12	3	3
MYCD 203	38	39	60	6	3	3
MYCD 203	39	40	60	11	3	3
MYCD 203	40	41	20	16	3	3
MYCD 203	41	42	30	16	3	3
MYCD 203	42	43	70	6	3	3
MYCD 203	43	44	20	15	3	3
MYCD 203	44	45	40	12	3	3
MYCD 203	45	46	10	14	3	3
MYCD 203	46	47	20	23	3	3
MYCD 203	47	48	20	14	3	3
MYCD 203	48	49	10	26	3	3
MYCD 203	49	50	20	14	2	3
MYCD 203	50	51	50	11	2	4
MYCD 203	51	52	50	13	2	4
MYCD 203	52	53	60	13	2	4
MYCD 203	53	54	70	7	2	4
MYCD 203	54	55	40	11	2	4
MYCD 203	55	56	30	11	2	4
MYCD 203	56	57	0	25	2	4
MYCD 203	57	58	0	25	2	4
MYCD 203	58	59	20	19	1	4
MYCD 203	59	60	20	25	1	3
MYCD 203	60	61	20	25	1	3
MYCD 203	61	62	0	25	1	3
MYCD 203	62	63	0	25	1	3
MYCD 203	63	64	30	25	1	4
MYCD 203	64	65	40	15	1	4
MYCD 203	65	66	30	12	1	4
MYCD 203	66	67	50	12	1	4
MYCD 203	67	68	50	5	1	4
MYCD 203	68	69	50	8	1	4

Appendix A

MYCD 203	69	70	60	8	1	4
MYCD 203	70	71	50	8	1	4
MYCD 203	71	72	60	10	1	4
MYCD 203	72	73	60	12	1	4
MYCD 203	73	74	100	4	1	4
MYCD 203	74	75	80	6	1	4
MYCD 203	75	76	70	5	1	4
MYCD 203	76	77	80	5	1	4
MYCD 203	77	78	70	6	1	4
MYCD 203	78	79	50	14	1	4
MYCD 203	79	80	80	8	1	4
MYCD 203	80	81	100	2	1	4
MYCD 203	81	82	40	9	1	4
MYCD 203	82	83	30	25	1	4
MYCD 203	83	84	30	15	1	4
MYCD 203	84	85	20	20	1	4
MYCD 203	85	86	40	15	1	4
MYCD 203	86	87	30	16	1	4
MYCD 203	87	88	10	25	1	3
MYCD 203	88	89	10	25	1	3
MYCD 203	89	90	10	25	1	3
MYCD 203	90	91	10	0	1	3
MYCD 203	91	92	10	0	1	3
MYCD 203	92	93	20	15	1	3
MYCD 203	93	94	50	16	1	3
MYCD 203	94	95	10	25	1	3
MYCD 203	95	96	20	19	1	3
MYCD 203	96	97	10	25	1	3
MYCD 203	97	98	70	9	1	4
MYCD 203	98	99	90	6	1	4
MYCD 203	99	100	90	2	1	4
MYCD 203	100	101	90	3	1	4
MYCD 203	101	102	80	11	1	4
MYCD 203	102	103	10	19	1	4
MYCD 203	103	104	80	9	1	4
MYCD 203	104	105	30	4	1	4
MYCD 203	105	106	20	25	1	4
MYCD 203	106	107	40	10	1	4
MYCD 203	107	108	50	7	1	4
MYCD 203	108	109	15	11	1	4
MYCD 203	109	110	30	25	1	4
MYCD 203	110	111	90	5	1	4
MYCD 203	111	112	20	18	1	4
MYCD 203	112	113	70	5	1	4
MYCD 203	113	114	35	10	1	4
MYCD 203	114	115	60	8	1	4
MYCD 203	115	116	60	5	1	4
MYCD 203	116	117	70	9	1	4
MYCD 203	117	118	70	6	1	4
MYCD 203	118	119	100	2	1	4
MYCD 203	119	120	100	2	1	4
MYCD 203	120	121	30	13	1	4

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MYCD 203	121	122	30	9	1	4
MYCD 203	122	123	90	6	1	4
MYCD 203	123	124	60	13	1	4
MYCD 203	124	125	90	3	1	4
MYCD 203	125	126	100	3	1	5
MYCD 203	126	127	100	3	1	5
MYCD 203	127	128	70	7	1	5
MYCD 203	128	129	90	4	1	5
MYCD 203	129	130	40	25	1	5
MYCD 203	130	131	40	25	1	5
MYCD 203	131	132	50	25	1	5
MYCD 203	132	133	70	5	1	5
MYCD 203	133	134	100	1	1	5
MYCD 203	134	135	100	0	1	5
MYCD 203	135	136	55	16	1	5
MYCD 203	136	137	70	7	1	5
MYCD 203	137	138	85	6	1	5
MYCD 203	138	139	65	10	1	4
MYCD 203	139	140	80	3	1	4
MYCD 203	140	141	80	7	1	4
MYCD 203	141	142	50	11	1	4
MYCD 203	142	143	65	10	1	4
MYCD 203	143	144	30	11	1	4
MYCD 203	144	145	35	11	1	4
MYCD 203	145	146	90	4	1	4
MYCD 203	146	147	40	17	1	4
MYCD 203	147	148	25	11	1	4
MYCD 203	148	149	0	25	1	4
MYCD 203	149	150	0	25	1	4
MYCD 203	150	151	20	19	1	4
MYCD 203	151	152	40	14	1	4
MYCD 203	152	153	20	15	1	4
MYCD 203	153	154	30	25	1	4
MYCD 203	154	155	0	23	1	4
MYCD 203	155	156	13	25	1	4
MYCD 203	156	157	0	25	1	4
MYCD 203	157	158	0	25	1	4
MYCD 203	158	159	0	12	1	4
MYCD 203	159	160	16	16	1	4
MYCD 203	160	161	30	11	1	4
MYCD 203	161	162	80	7	1	4
MYCD 203	162	163	30	12	1	4
MYCD 203	163	164	75	4	1	4
MYCD 203	164	165	95	3	1	4
MYCD 203	165	166	30	17	1	4
MYCD 203	166	167	20	25	1	4
MYCD 203	167	168	50	17	1	4
MYCD 203	168	169	50	12	1	4
MYCD 203	169	170	50	11	1	4
MYCD 203	170	171	60	9	1	4
MYCD 203	171	172	10	25	1	4
MYCD 203	172	173	30	25	1	4

Appendix A

MYCD 203	173	174	90	11	1	4
MYCD 203	174	175	100	3	1	5
MYCD 203	175	176	100	3	1	5
MYCD 203	176	177	80	1	1	5
MYCD 203	177	178	80	10	1	5
MYCD 203	178	179	90	5	1	5
MYCD 203	179	180	70	17	1	4
MYCD 203	180	181	35	10	1	4
MYCD 203	181	182	75	13	1	4
MYCD 203	182	183	30	11	1	4
MYCD 203	183	184	40	8	1	4
MYCD 203	184	185	80	11	1	4
MYCD 203	185	186	100	4	1	4
MYCD 203	186	187	90	6	1	4
MYCD 203	187	188	90	7	1	4
MYCD 203	188	189	80	4	1	4
MYCD 203	189	190	55	7	1	5
MYCD 203	190	191	70	7	1	5
MYCD 203	191	192	80	7	1	5
MYCD 203	192	193	90	6	1	5
MYCD 203	193	194	100	2	1	5
MYCD 203	194	195	70	11	1	5
MYCD 203	195	196	50	10	1	4
MYCD 203	196	197	70	3	1	4
MYCD 203	197	198	40	9	1	4
MYCD 203	198	199	75	10	1	5
MYCD 203	199	200	25	15	1	5
MYCD 203	200	201	30	16	1	5
MYCD 203	201	202	20	25	1	5
MYCD 203	202	203	30	15	1	5
MYCD 203	203	204	65	17	1	5
MYCD 203	204	205	80	6	1	5
MYCD 203	205	206	80	5	1	5
MYCD 203	206	207	95	4	1	5
MYCD 203	207	208	80	9	1	5
MYCD 203	208	209	60	13	1	5
MYCD 203	209	210	90	5	1	5
MYCD 203	210	211	95	5	1	5
MYCD 203	211	212	30	16	1	5
MYCD 203	212	213	83	5	1	5
MYCD 203	213	214	65	7	1	5
MYCD 203	214	215	100	5	1	5
MYCD 203	215	216	65	8	1	5
MYCD 203	216	217	90	4	1	5
MYCD 203	217	218	65	20	1	5
MYCD 203	218	219	81	6	1	5
MYCD 203	219	220	83	6	1	5
MYCD 203	220	221	30	13	1	5
MYCD 203	221	222	77	7	1	5
MYCD 203	222	223	68	8	1	5
MYCD 203	223	224	30	14	1	5
MYCD 203	224	225	70	12	1	5

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MYCD 203	225	226	70	5	1	5
MYCD 203	226	227	75	9	1	5
MYCD 203	227	228	70	9	1	5
MYCD 203	228	229	40	8	1	5
MYCD 203	229	230	79	5	1	5
MYCD 203	230	231	80	6	1	5
MYCD 203	231	231.3	30	0	1	5
MYCD 215	0	1	70	5	5	1
MYCD 215	1	2	80	4	5	1
MYCD 215	2	3	60	7	5	1
MYCD 215	3	4	50	11	4	2
MYCD 215	4	5	0	12	4	2
MYCD 215	5	6	20	12	4	2
MYCD 215	6	7	20	13	4	2
MYCD 215	7	8	25	8	4	2
MYCD 215	8	9	20	14	4	2
MYCD 215	9	10	12	20	4	2
MYCD 215	10	11	21	15	4	2
MYCD 215	11	12	0	15	4	2
MYCD 215	12	13	0	25	4	2
MYCD 215	13	14	0	16	4	2
MYCD 215	14	15	12	17	4	2
MYCD 215	15	16	0	25	4	2
MYCD 215	16	17	25	10	4	2
MYCD 215	17	18	0	25	4	2
MYCD 215	18	19	0	25	4	2
MYCD 215	19	20	0	25	4	2
MYCD 215	20	21	0	25	4	2
MYCD 215	21	22	20	14	4	2
MYCD 215	22	23	17	17	4	2
MYCD 215	23	24	12	7	4	2
MYCD 215	24	25	0	25	4	2
MYCD 215	25	26	0	14	4	2
MYCD 215	26	27	15	15	4	2
MYCD 215	27	28	0	25	4	2
MYCD 215	28	29	0	25	4	2
MYCD 215	29	30	0	25	4	2
MYCD 215	30	31	20	15	4	2
MYCD 215	31	32	0	25	3	2
MYCD 215	32	33	0	25	3	2
MYCD 215	33	34	0	25	3	2
MYCD 215	34	35	15	25	3	2
MYCD 215	35	36	0	25	3	2
MYCD 215	36	37	0	25	3	2
MYCD 215	37	38	0	25	3	2
MYCD 215	38	39	38	9	3	2
MYCD 215	39	40	12	25	3	2
MYCD 215	40	41	60	14	3	3
MYCD 215	41	42	34	13	3	3
MYCD 215	42	43	51	9	3	3
MYCD 215	43	44	53	7	3	3
MYCD 215	44	45	43	8	3	3

Appendix A

MYCD 215	45	46	11	25	3	3
MYCD 215	46	47	0	18	3	3
MYCD 215	47	48	0	25	3	3
MYCD 215	48	49	36	25	2	3
MYCD 215	49	50	20	25	2	3
MYCD 215	50	51	50	25	2	3
MYCD 215	51	52	40	13	2	3
MYCD 215	52	53	84	7	2	3
MYCD 215	53	54	95	5	2	3
MYCD 215	54	55	81	10	1	3
MYCD 215	55	56	72	9	1	3
MYCD 215	56	57	83	4	1	3
MYCD 215	57	58	57	9	1	3
MYCD 215	58	59	48	12	1	3
MYCD 215	59	60	0	25	1	3
MYCD 215	60	61	29	12	1	3
MYCD 215	61	62	23	25	1	3
MYCD 215	62	63	0	25	1	3
MYCD 215	63	64	80	25	1	3
MYCD 215	64	65	84	6	1	3
MYCD 215	65	66	75	9	1	3
MYCD 215	66	67	64	14	1	3
MYCD 215	67	68	45	16	1	3
MYCD 215	68	69	0	25	1	3
MYCD 215	69	70	46	15	1	3
MYCD 215	70	71	22	25	1	3
MYCD 215	71	72	15	25	1	3
MYCD 215	72	73	28	25	1	3
MYCD 215	73	74	19	25	1	3
MYCD 215	74	75	34	16	1	3
MYCD 215	75	76	25	25	1	3
MYCD 215	76	77	73	7	1	3
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MYCD 215	79	80	92	5	1	3
MYCD 215	80	81	92	4	1	3
MYCD 215	81	82	36	14	1	3
MYCD 215	82	83	45	8	1	3
MYCD 215	83	84	51	25	1	3
MYCD 215	84	85	18	13	1	3
MYCD 215	85	86	84	6	1	3
MYCD 215	86	87	48	9	1	3
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MYCD 215	88	89	73	11	1	3
MYCD 215	89	90	92	9	1	3
MYCD 215	90	91	75	7	1	3
MYCD 215	91	92	12	25	1	3
MYCD 215	92	93	57	18	1	3
MYCD 215	93	94	36	15	1	3
MYCD 215	94	95	40	21	1	3
MYCD 215	95	96	14	25	1	3
MYCD 215	96	97	30	14	1	3

Appendix A

MYCD 215	97	98	68	12	1	3
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MYCD 215	106	107	45	13	1	4
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MYCD 215	110	111	0	17	1	4
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MYCD 215	116	117	0	0	1	3
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MYCD 215	138	139	80	3	1	4
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MYCD 215	144	145	46	8	1	4
MYCD 215	145	146	72	14	1	4
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Appendix A

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MYCD 215	168	169	90	7	1	4
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MYCD 216	53	54	39	1	1	5
MYCD 216	54	55	35	15	1	5
MYCD 216	55	56	100	1	1	5

Appendix A

MYCD 216	56	57	60	15	1	5
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MYCD 216	105	106	80	3	1	5
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MYCD 216	107	108	100	3	1	5

Appendix A

MYCD 216	108	109	100	3	1	5
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Appendix A

MYCD 217	70	71	85	8		
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Appendix A

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Appendix A

MYCD 218	83	84	25	8	1	5
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MYCD 218	99	100	73	10	1	4
MYCD 218	100	101	11	16	1	4
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MYCD 218	132	133	85	7	1	4
MYCD 218	133	134	84	6	1	4
MYCD 218	134	135	69	8	1	4

Appendix A

MYCD 218	135	136	84	7	1	4
MYCD 218	136	137	80	7	1	4
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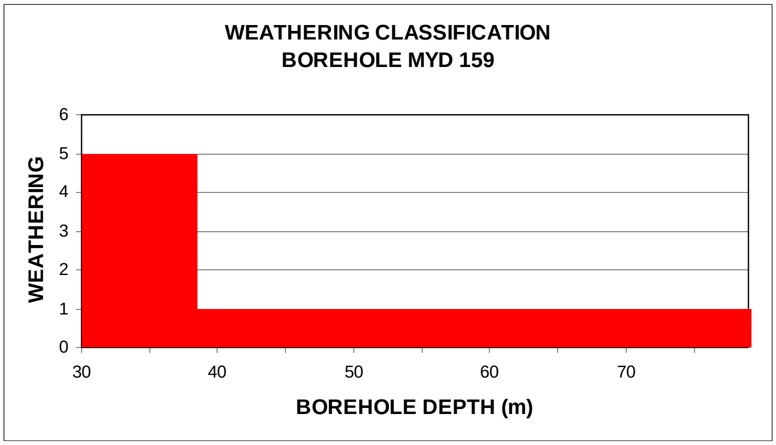
Appendix A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WEATHERING
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3
4
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30
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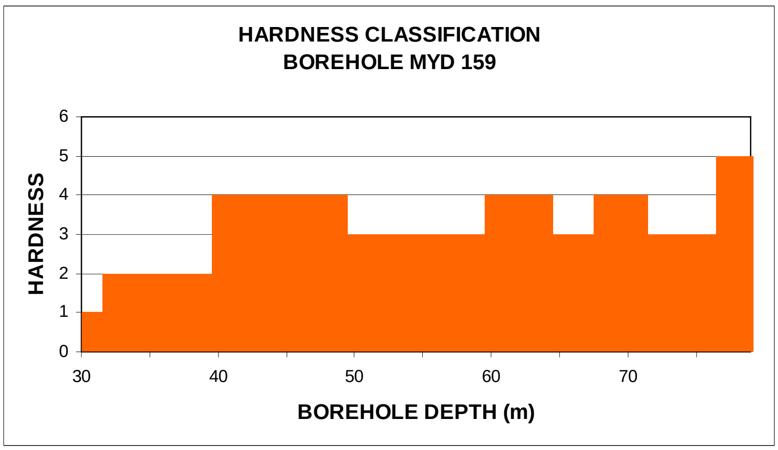
60
70
BOREHOLE DEPTH (m)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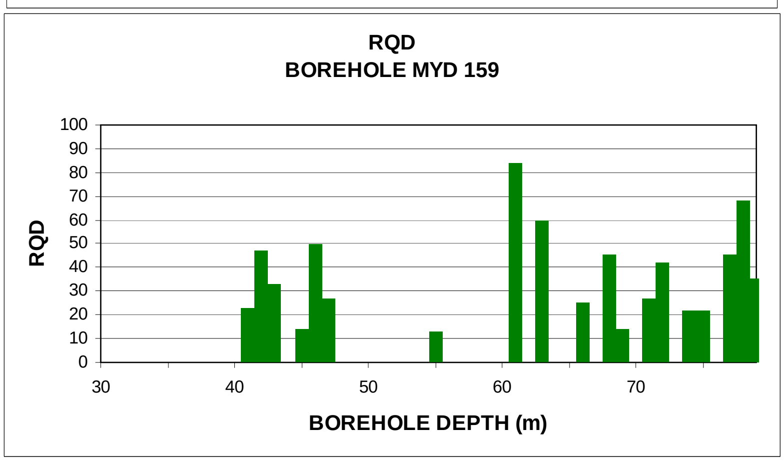
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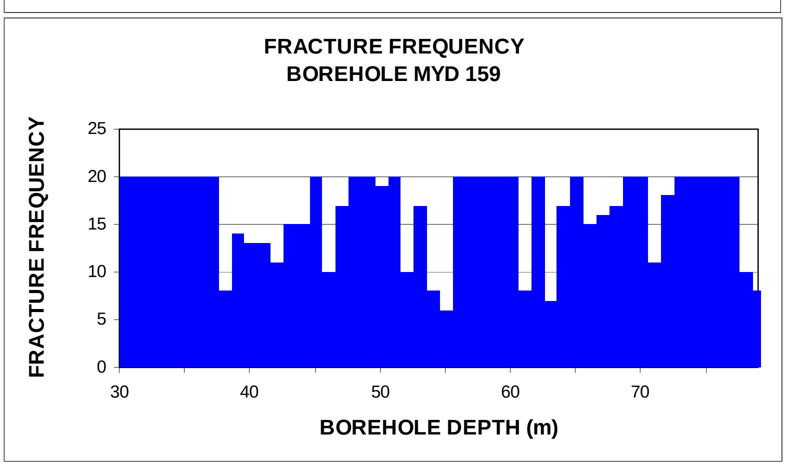
BOREHOLE DEPTH (m)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FRACTURE FREQUENCY
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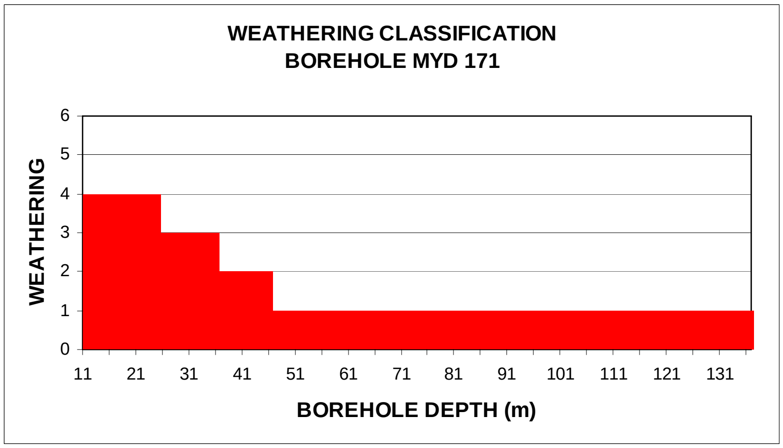
BOREHOLE DEPTH (m)

Appendix A



WEATHERING CLASSIFICATION
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WEATHERING
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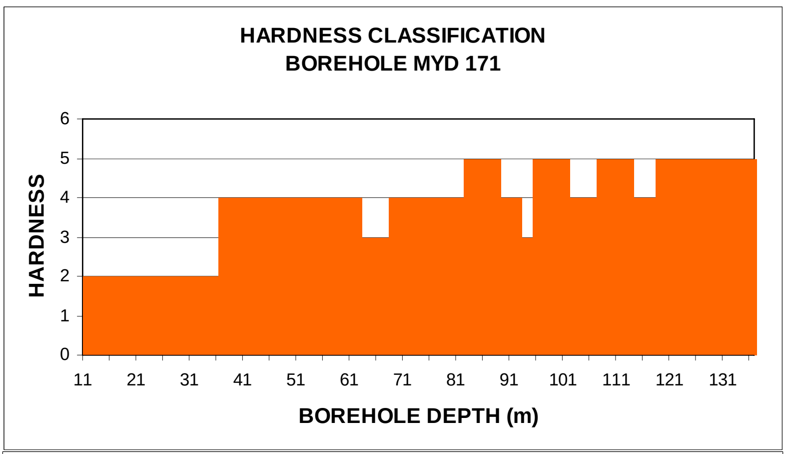
11 21 31 41 51 61 71 81 91 101 111 121 131
BOREHOLE DEPTH (m)



HARDNESS CLASSIFICATION
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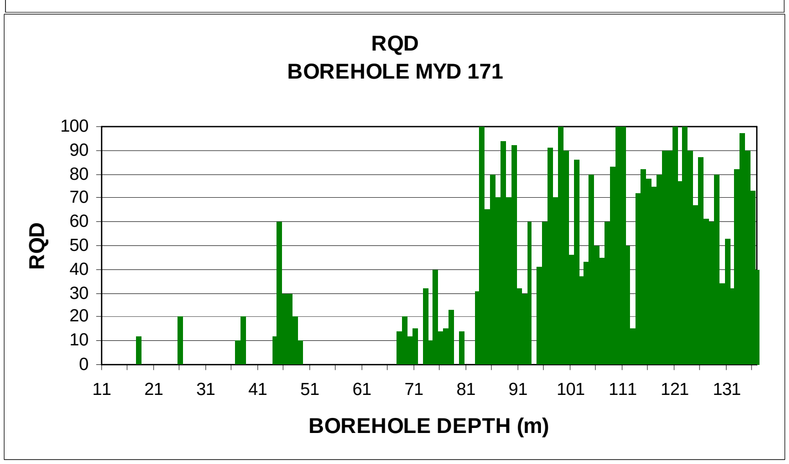
BOREHOLE DEPTH (m)



RQD
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RQD
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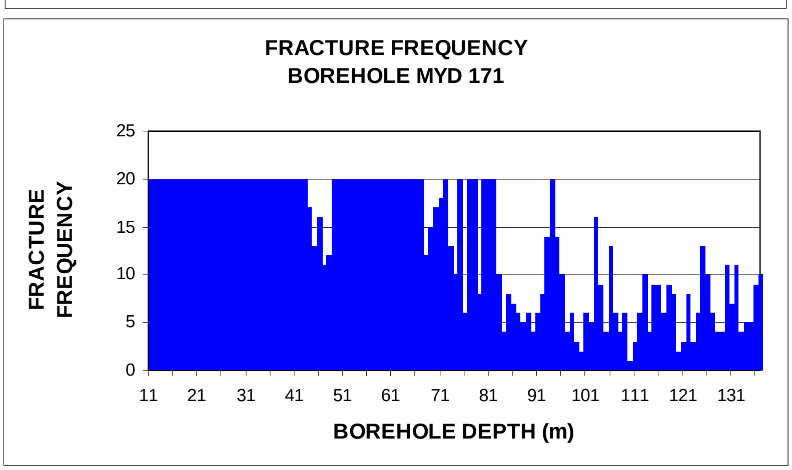
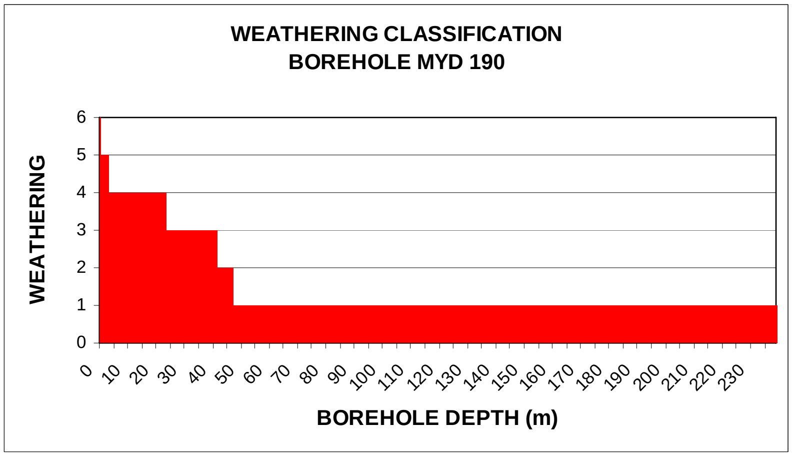
BOREHOLE DEPTH (m)

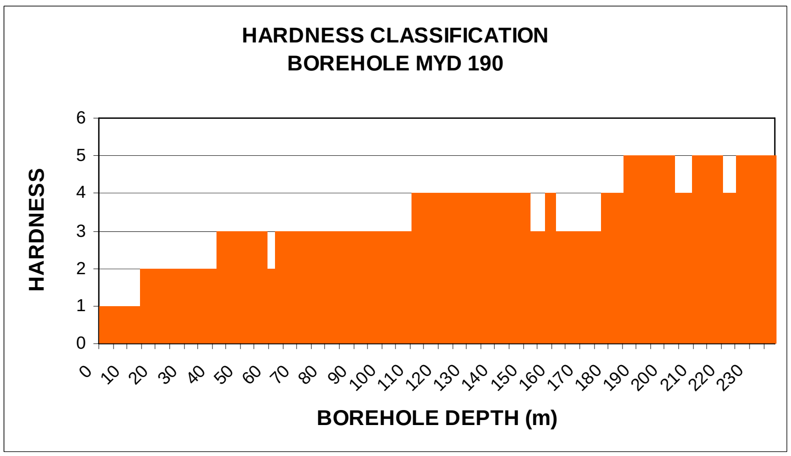


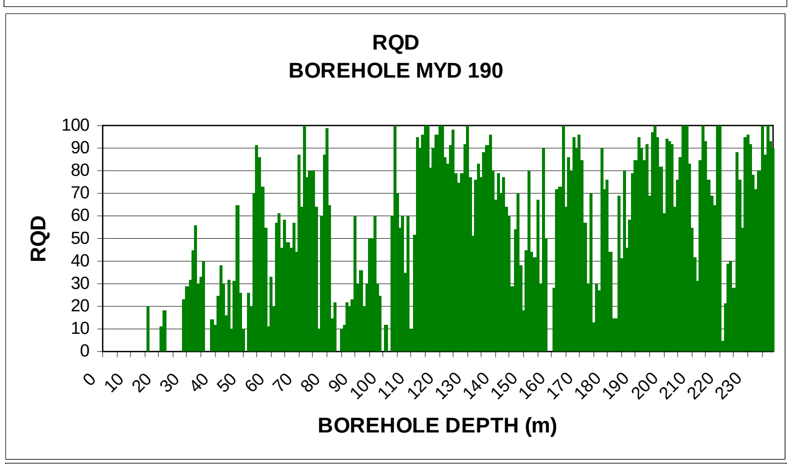
FRACTURE FREQUENCY
BOREHOLE MYD 171
FRACTURE FREQUENCY
0
5
10
15
20
25
11 21 31 41 51 61 71 81 91 101 111 121 131
BOREHOLE DEPTH (m)

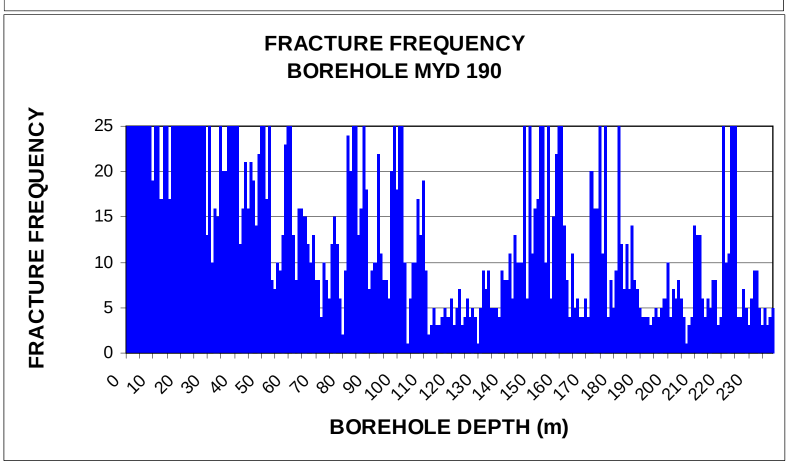
Appendix A

Appendix A

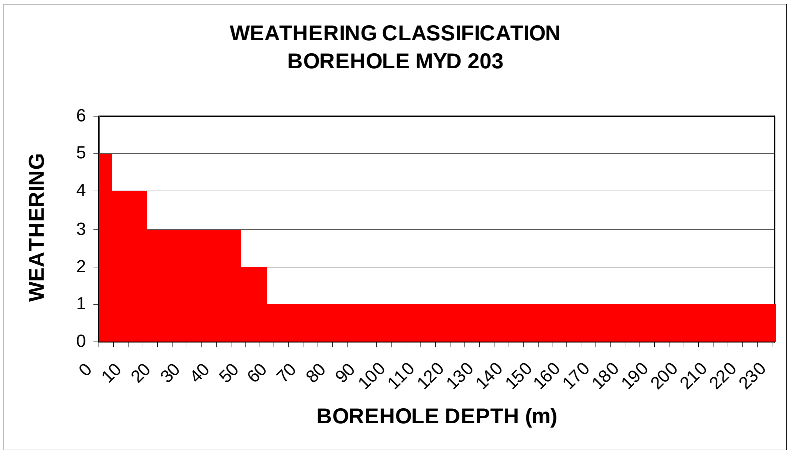

WEATHERING CLASSIFICATION
BOREHOLE MYD 190
WEATHERING
0
1
2
3
4
5
6
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
BOREHOLE DEPTH (m)


HARDNESS CLASSIFICATION
BOREHOLE MYD 190
HARDNESS
0
1
2
3
4
5
6
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
BOREHOLE DEPTH (m)

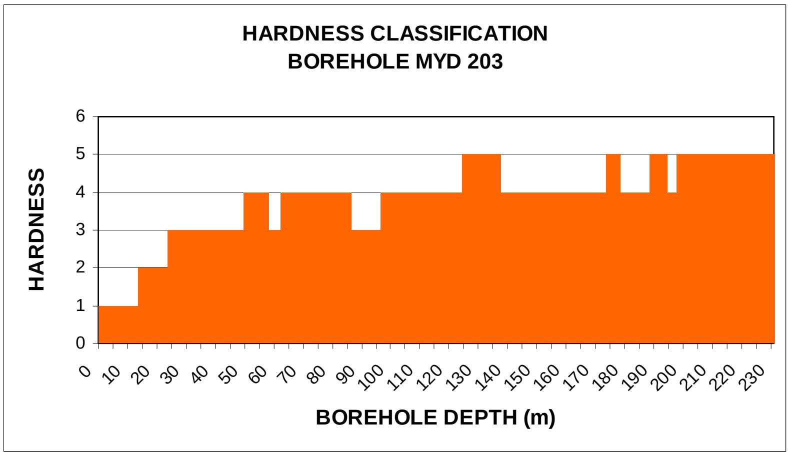

RQD
BOREHOLE MYD 190
RQD
0
10
20
30
40
50
60
70
80
90
100
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
BOREHOLE DEPTH (m)


FRACTURE FREQUENCY
BOREHOLE MYD 190
FRACTURE FREQUENCY
0
5
10
15
20
25
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
BOREHOLE DEPTH (m)

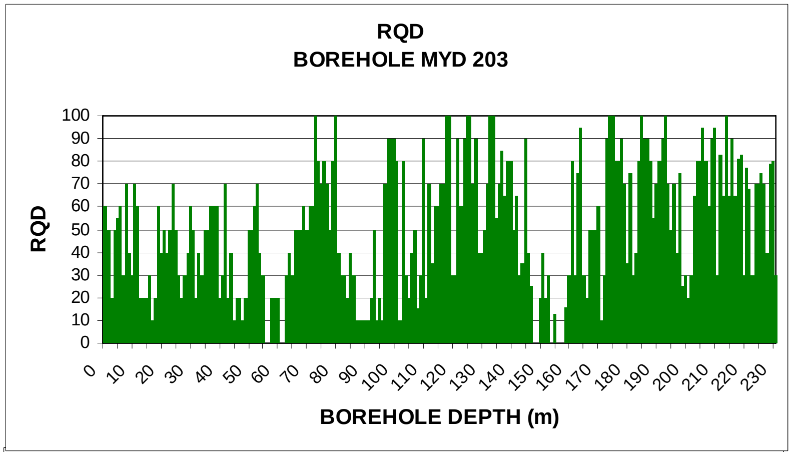
Appendix A



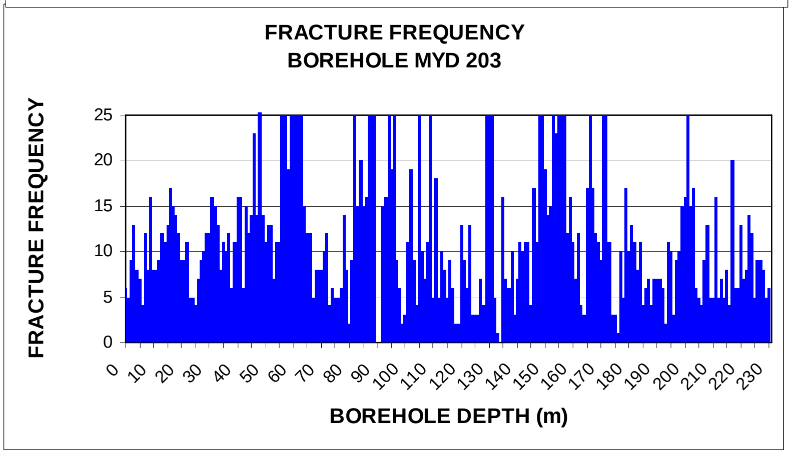
WEATHERING CLASSIFICATION
BOREHOLE MYD 203
WEATHERING
0 1 2 3 4 5 6
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
BOREHOLE DEPTH (m)



HARDNESS CLASSIFICATION
BOREHOLE MYD 203
HARDNESS
0 1 2 3 4 5 6
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
BOREHOLE DEPTH (m)

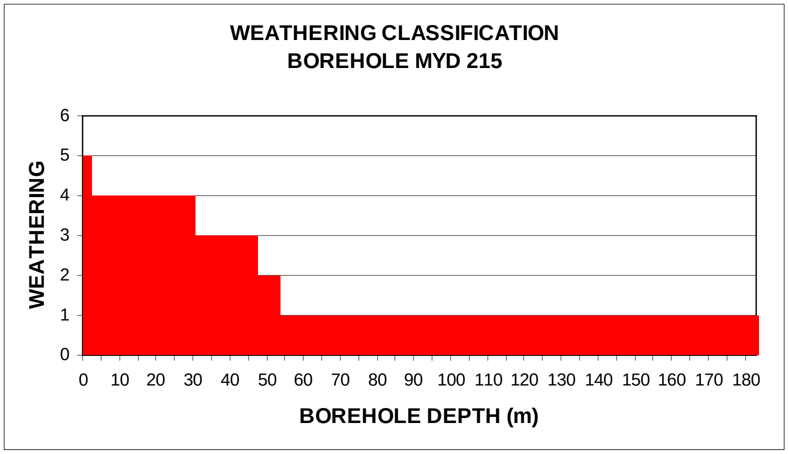


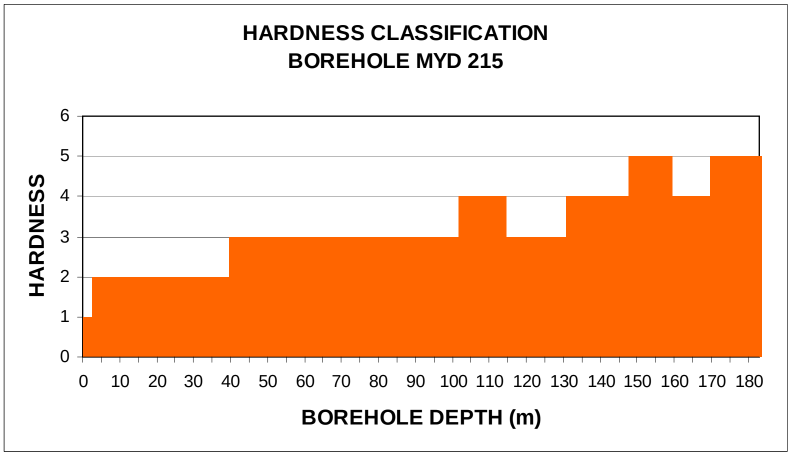
RQD
BOREHOLE MYD 203
RQD
0 10 20 30 40 50 60 70 80 90 100
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
BOREHOLE DEPTH (m)

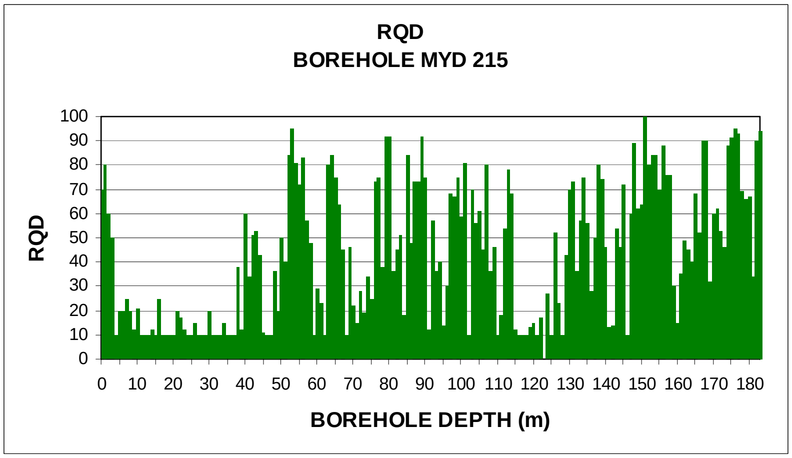


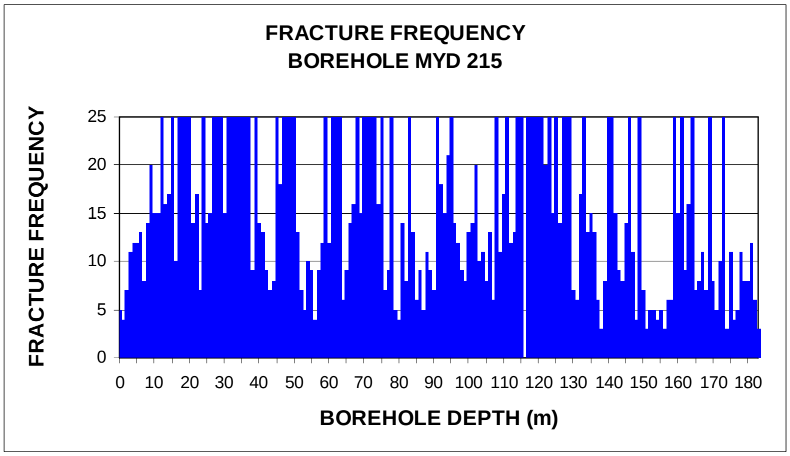
FRACTURE FREQUENCY
BOREHOLE MYD 203
FRACTURE FREQUENCY
0 5 10 15 20 25
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
BOREHOLE DEPTH (m)

Appendix A

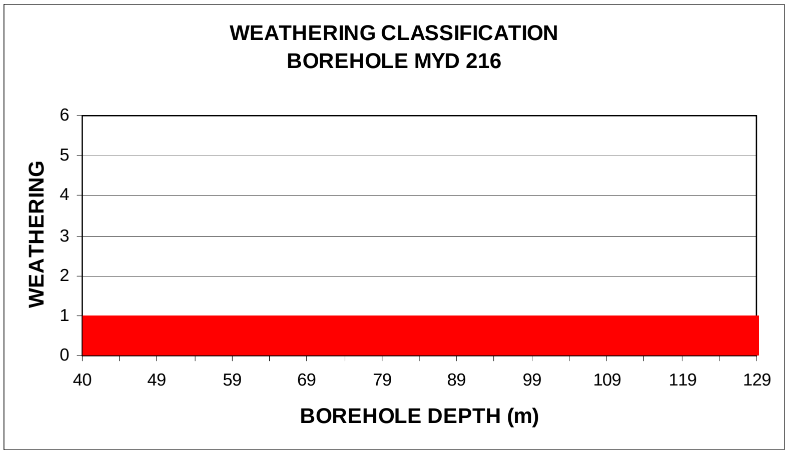

WEATHERING CLASSIFICATION
BOREHOLE MYD 215
WEATHERING
0
1
2
3
4
5
6
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
BOREHOLE DEPTH (m)

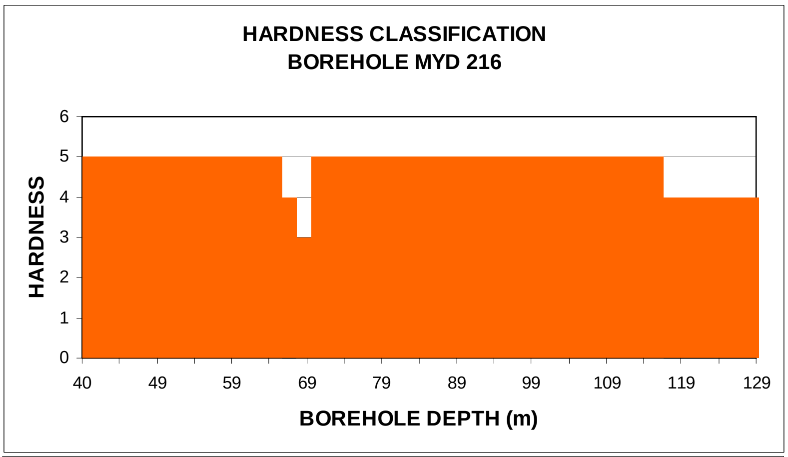

HARDNESS CLASSIFICATION
BOREHOLE MYD 215
HARDNESS
0
1
2
3
4
5
6
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
BOREHOLE DEPTH (m)

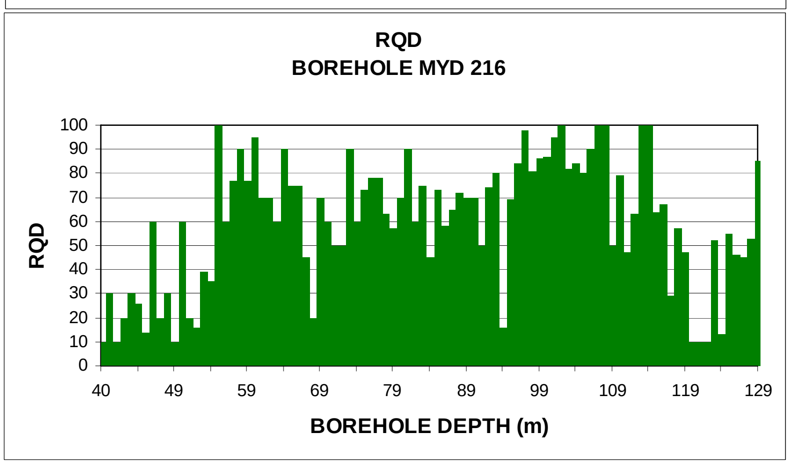

RQD
BOREHOLE MYD 215
RQD
0
10
20
30
40
50
60
70
80
90
100
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
BOREHOLE DEPTH (m)

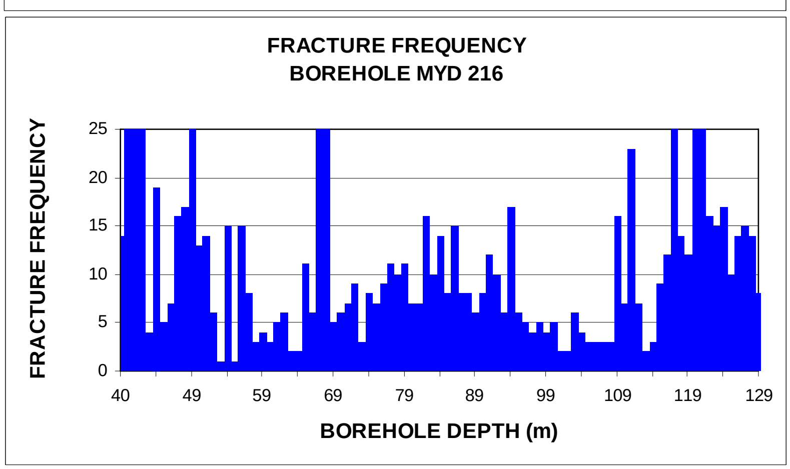

FRACTURE FREQUENCY
BOREHOLE MYD 215
FRACTURE FREQUENCY
0
5
10
15
20
25
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
BOREHOLE DEPTH (m)

Appendix A

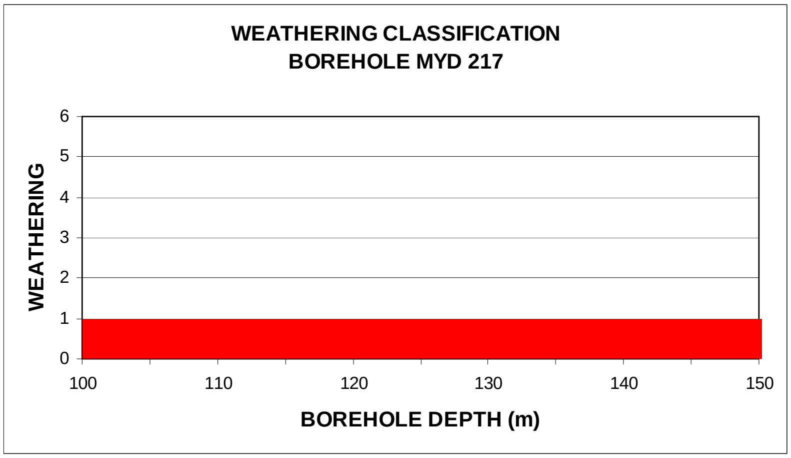

WEATHERING CLASSIFICATION
BOREHOLE MYD 216
WEATHERING
0
1
2
3
4
5
6
40
49
59
69
79
89
99
109
119
129
BOREHOLE DEPTH (m)


HARDNESS CLASSIFICATION
BOREHOLE MYD 216
HARDNESS
0
1
2
3
4
5
6
40
49
59
69
79
89
99
109
119
129
BOREHOLE DEPTH (m)

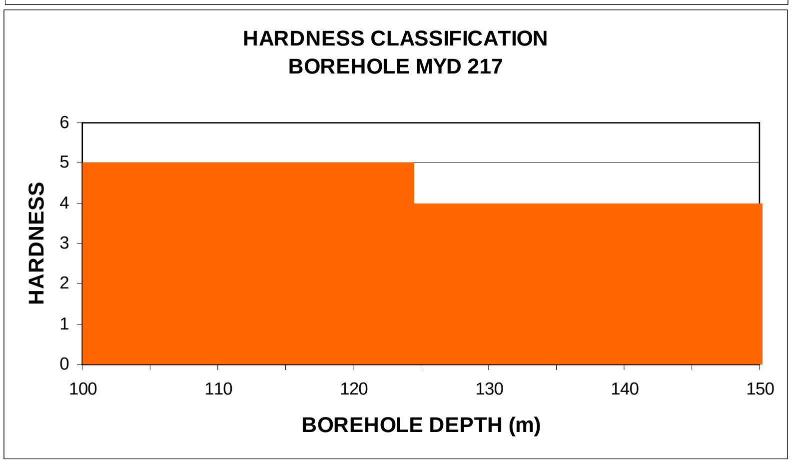

RQD
BOREHOLE MYD 216
RQD
0
10
20
30
40
50
60
70
80
90
100
40
49
59
69
79
89
99
109
119
129
BOREHOLE DEPTH (m)


FRACTURE FREQUENCY
BOREHOLE MYD 216
FRACTURE FREQUENCY
0
5
10
15
20
25
40
49
59
69
79
89
99
109
119
129
BOREHOLE DEPTH (m)

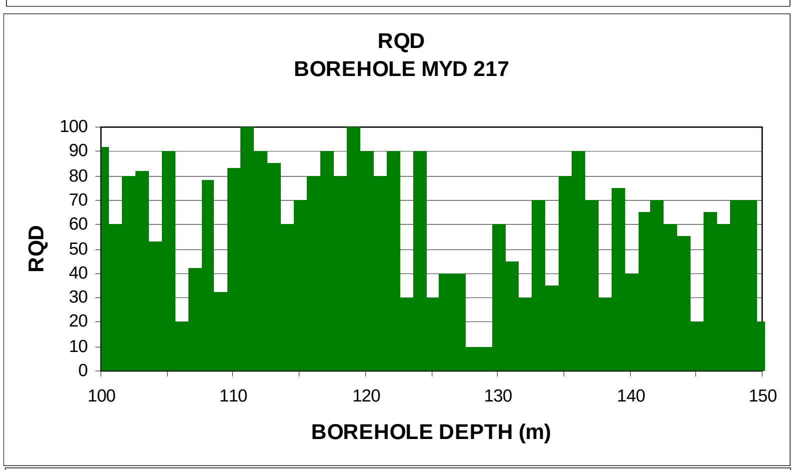
Appendix A



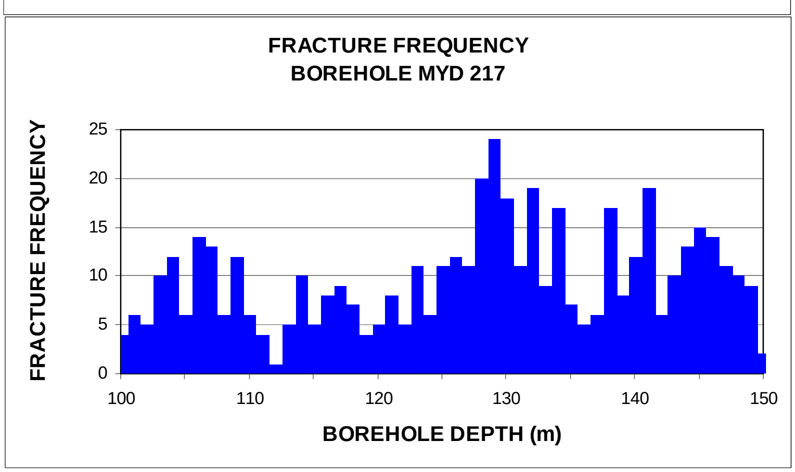
WEATHERING CLASSIFICATION
BOREHOLE MYD 217
WEATHERING
0
1
2
3
4
5
6
100
110
120
130
140
150
BOREHOLE DEPTH (m)



HARDNESS CLASSIFICATION
BOREHOLE MYD 217
HARDNESS
0
1
2
3
4
5
6
100
110
120
130
140
150
BOREHOLE DEPTH (m)

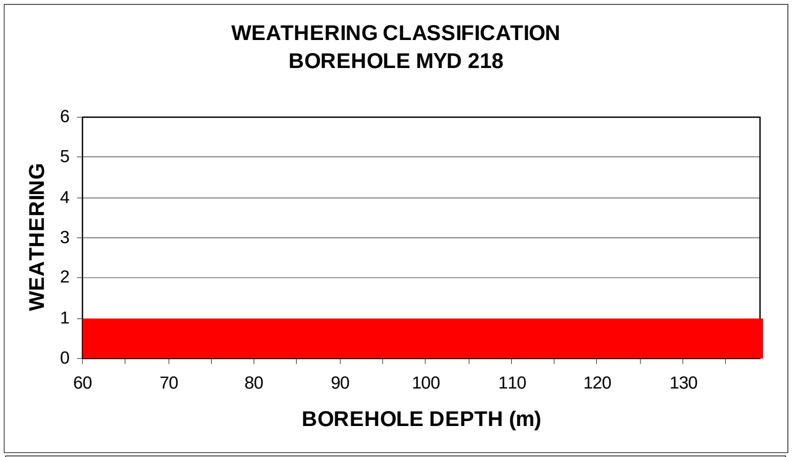


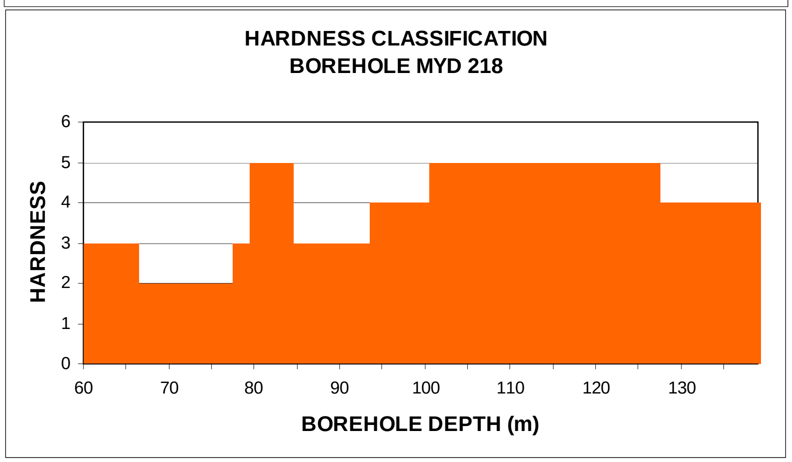
RQD
BOREHOLE MYD 217
RQD
0
10
20
30
40
50
60
70
80
90
100
100
110
120
130
140
150
BOREHOLE DEPTH (m)

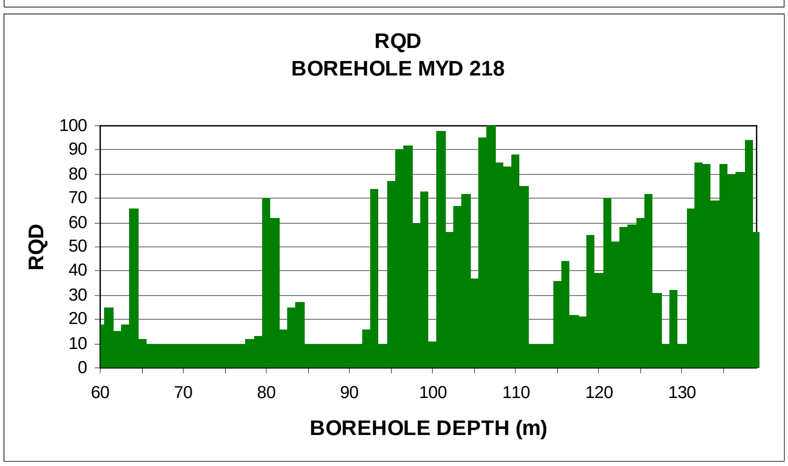


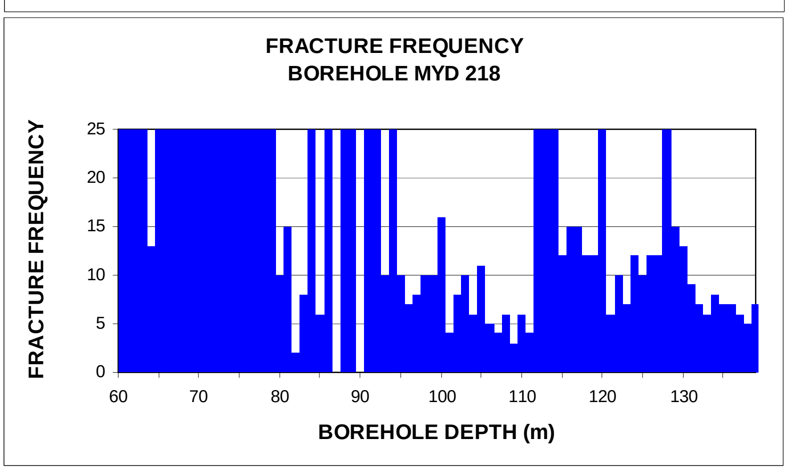
FRACTURE FREQUENCY
BOREHOLE MYD 217
FRACTURE FREQUENCY
0
5
10
15
20
25
100
110
120
130
140
150
BOREHOLE DEPTH (m)

Appendix A


WEATHERING CLASSIFICATION
BOREHOLE MYD 218
WEATHERING
0
1
2
3
4
5
6
60
70
80
90
100
110
120
130
BOREHOLE DEPTH (m)


HARDNESS CLASSIFICATION
BOREHOLE MYD 218
HARDNESS
0
1
2
3
4
5
6
60
70
80
90
100
110
120
130
BOREHOLE DEPTH (m)

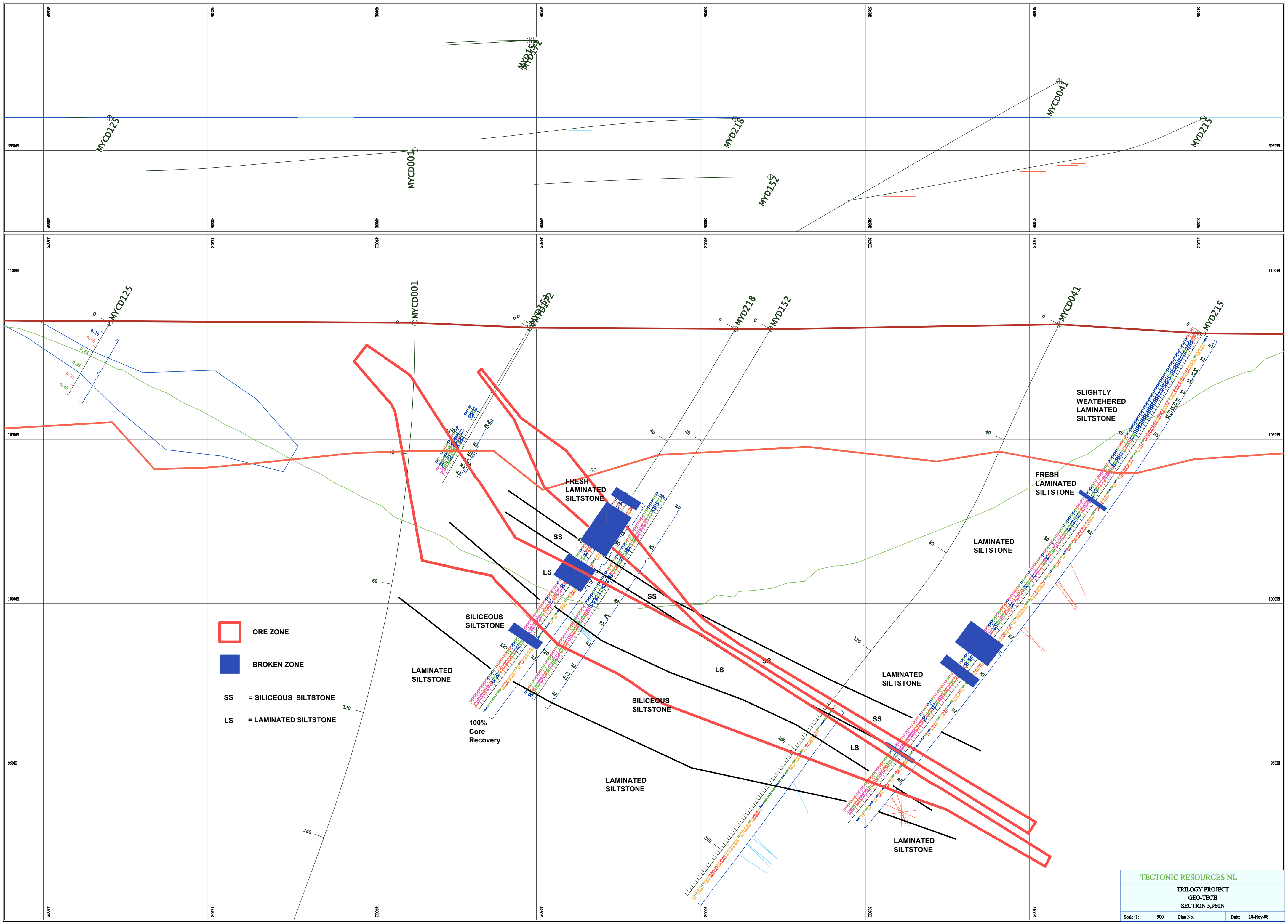

RQD
BOREHOLE MYD 218
RQD
0
10
20
30
40
50
60
70
80
90
100
60
70
80
90
100
110
120
130
BOREHOLE DEPTH (m)


FRACTURE FREQUENCY
BOREHOLE MYD 218
FRACTURE FREQUENCY
0
5
10
15
20
25
60
70
80
90
100
110
120
130
BOREHOLE DEPTH (m)

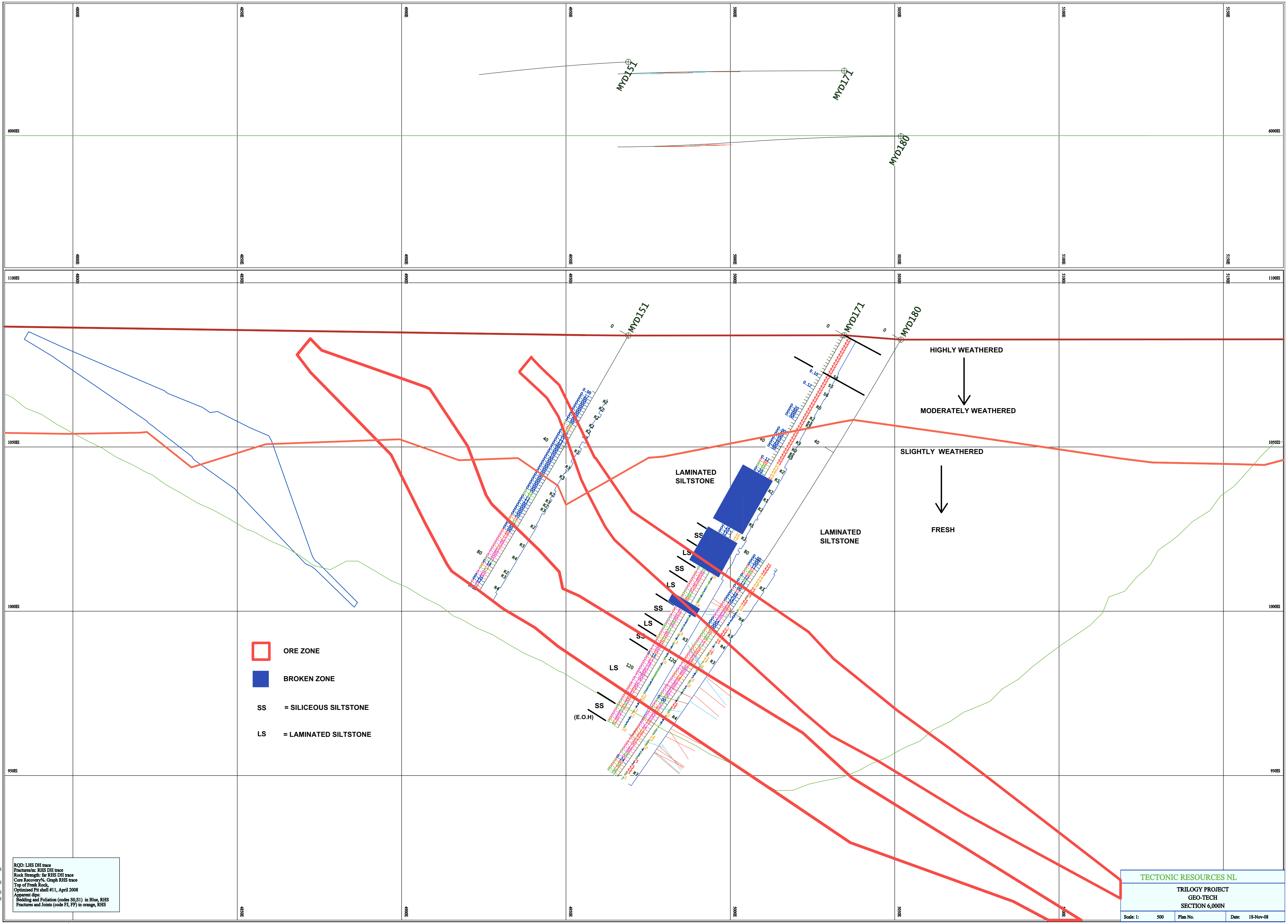
APPENDIX B

GEOLOGICAL CROSS SECTIONS

TRILOGY DEPOSITS

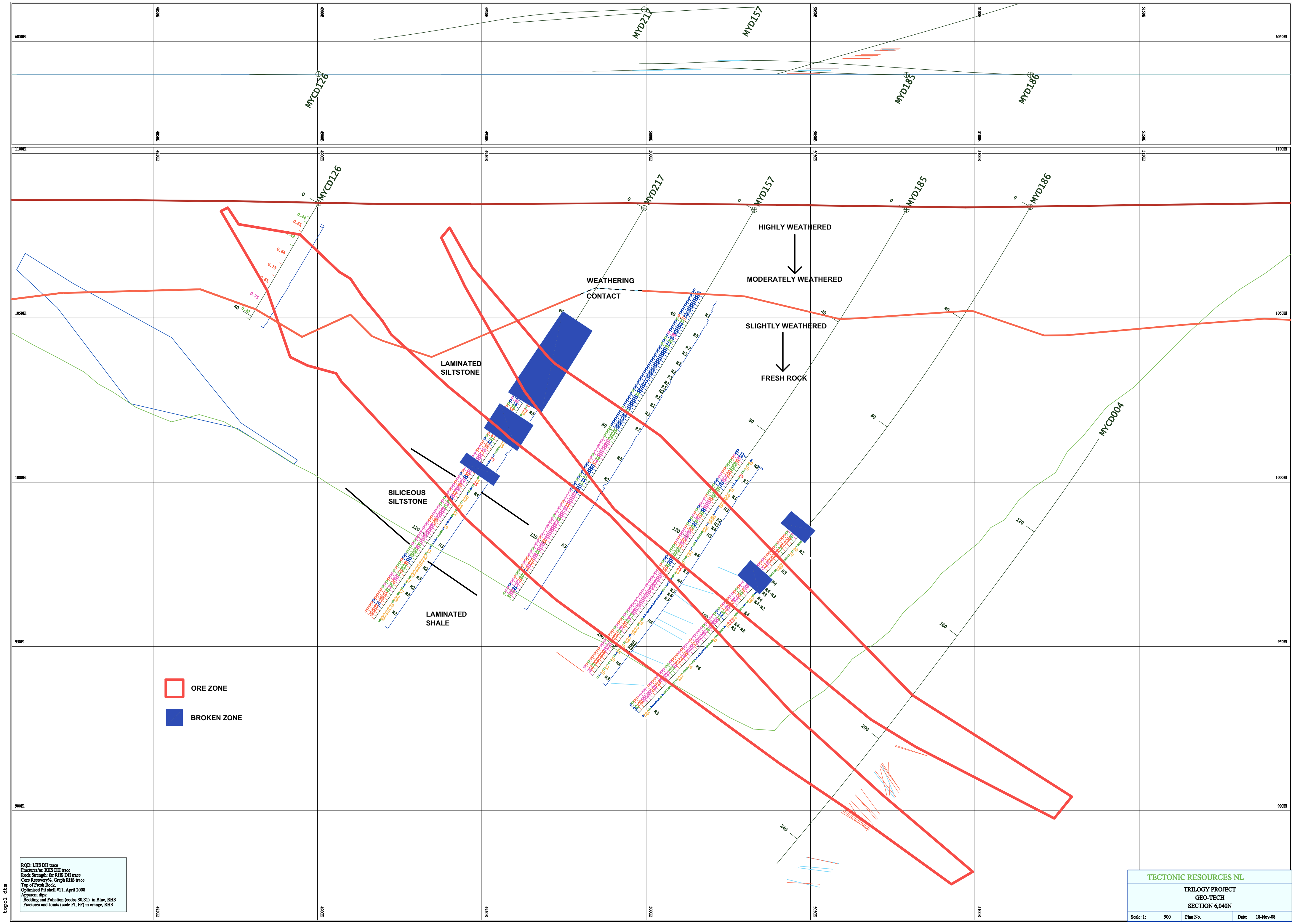


lode_c_v2_dtm_01
SURPAC - Surpac Minex Group

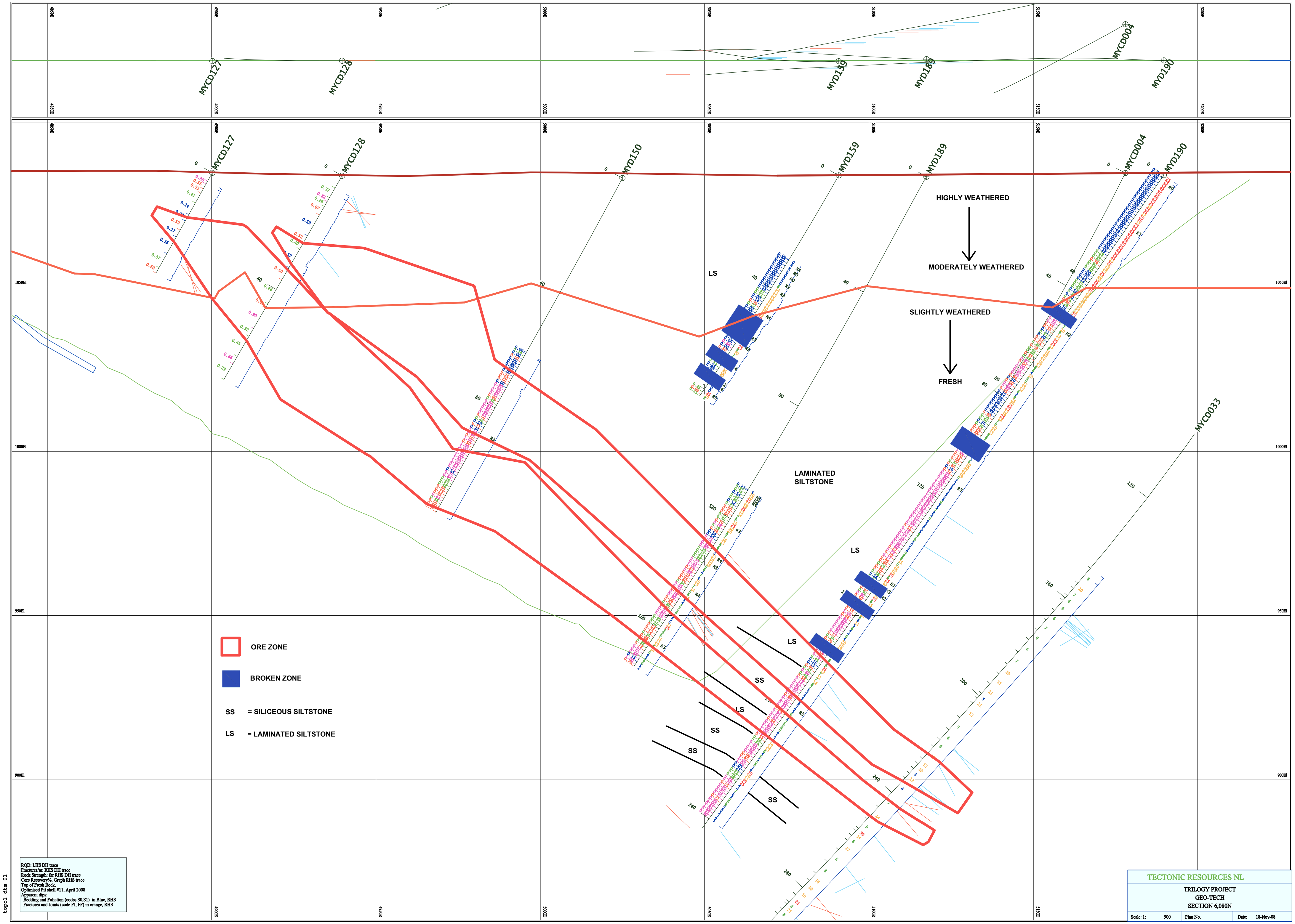


lode_c_v2_dtm_04

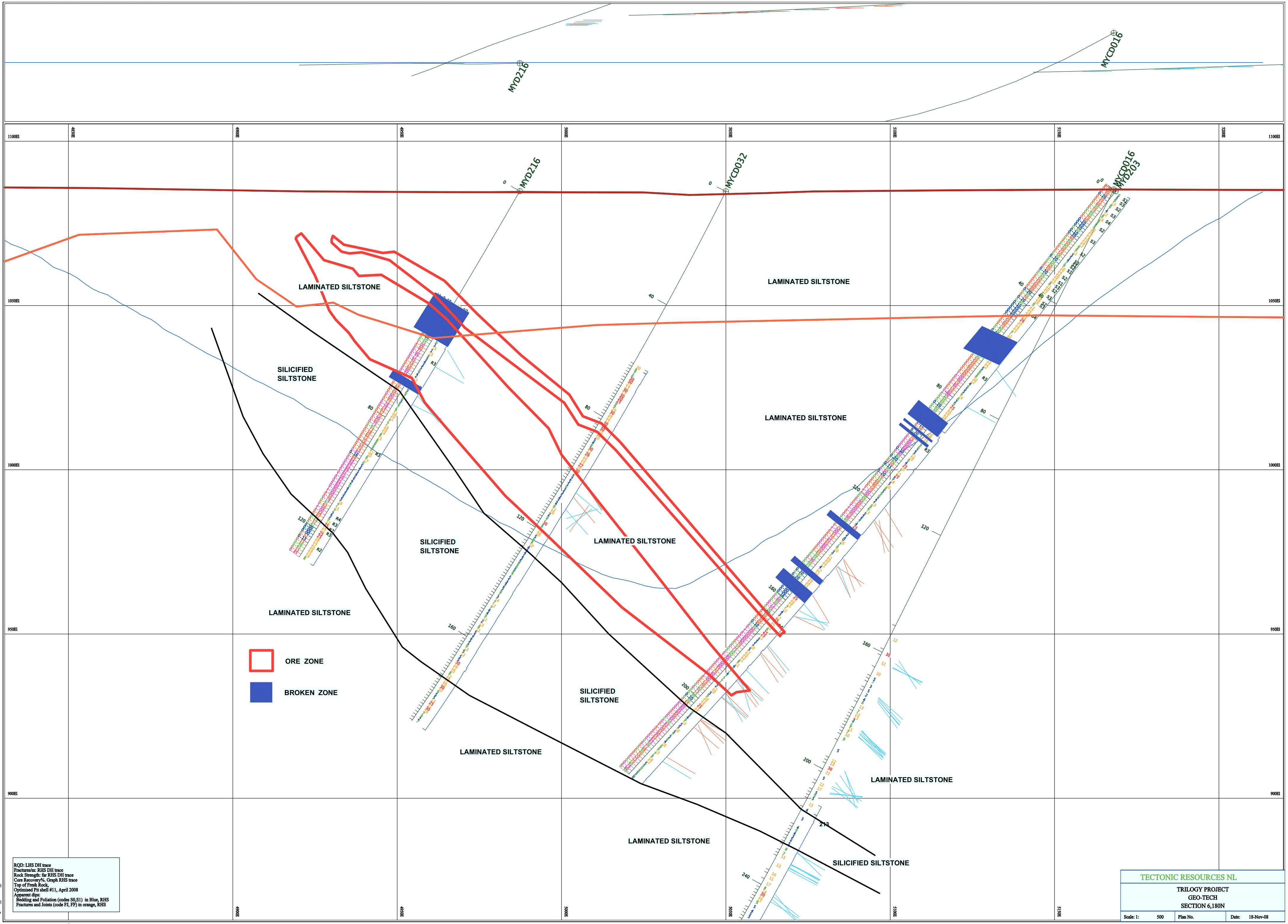
SURPAC - Surpac Minex Group



SURPAC - Surpac Minex Group



SURPAC - Surpac Minex Group

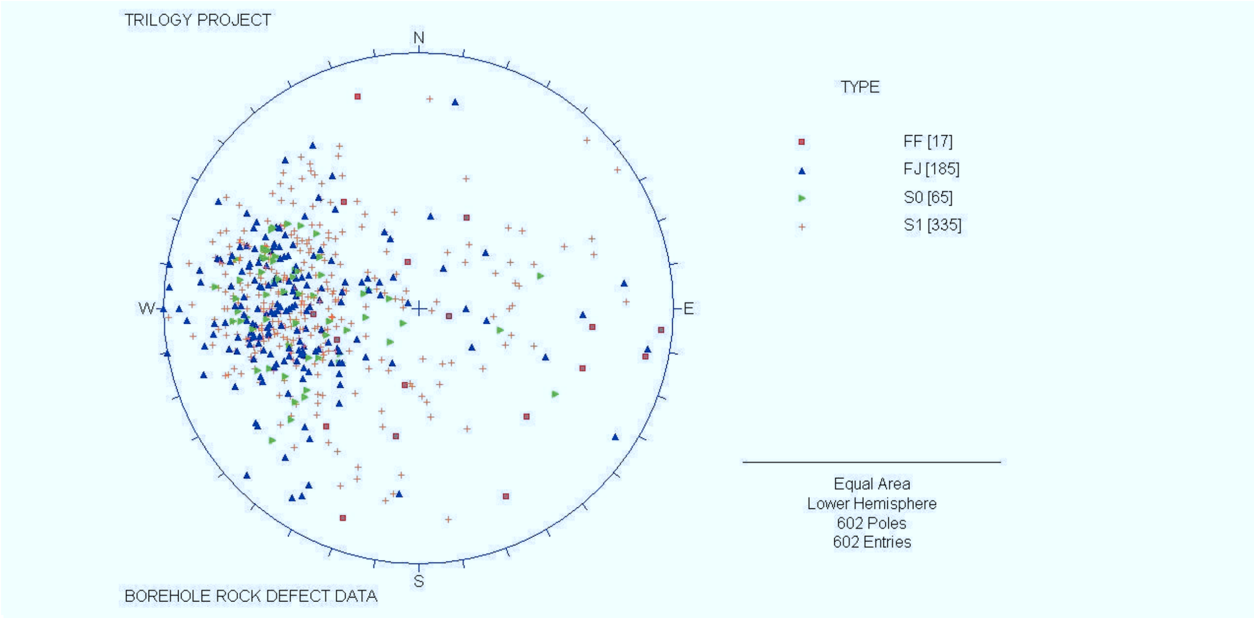


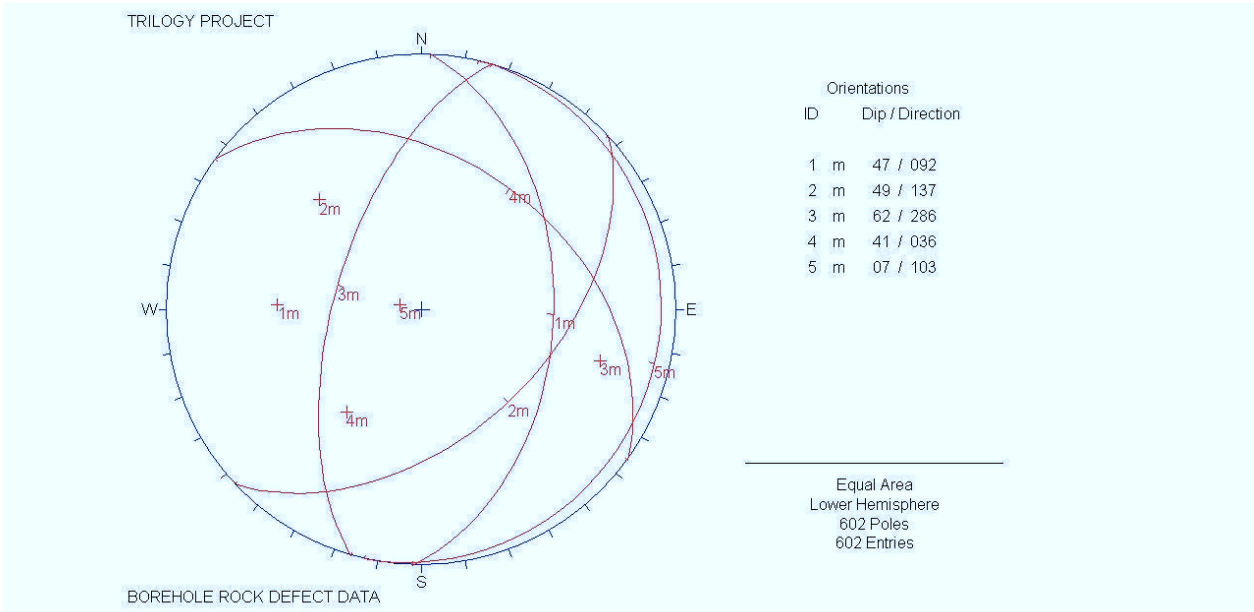
SURPAC - Surpac Minex Group

APPENDIX C

STEREOGRAPHIC PLOTS

TRILOGY DEPOSITS


TRILOGY PROJECT
N
W
E
S
TYPE
FF [17]
FJ [185]
S0 [65]
S1 [335]
Equal Area
Lower Hemisphere
602 Poles
602 Entries
BOREHOLE ROCK DEFECT DATA


TRILOGY PROJECT
N
W
E
S
1m
2m
3m
4m
5m
Orientations
ID Dip / Direction
1 m 47 / 092
2 m 49 / 137
3 m 62 / 286
4 m 41 / 036
5 m 07 / 103
Equal Area
Lower Hemisphere
602 Poles
602 Entries
BOREHOLE ROCK DEFECT DATA

APPENDIX D

MRMR AND SLOPE CALCULATIONS

TRILOGY DEPOSITS

Mining Rock Mass Rating (MRMR) parameters and calculations for ***moderately*** to ***strongly weathered*** siltstones:

Intact Rock Strength , IRS

UCS $_{Best}$ = 25 MPa from Table IRS $_{Best}$ rating
= 4.0

UCS $_{Worse}$ = 1MPa from Table IRS $_{Worse}$ rating
= 1.0

Spacing of Fractures and Joints, RQD+JS or FF

FF $_{Best}$ = 12 f/m 2 Joints present from Table FF $_{Best}$ rating
= 11.0

FF $_{Worse}$ = 25 f/m 3 Joints present from Table FF $_{Worse}$ rating
= 4.0

Joint Condition and Water, JRC

Accumulative % adjustment of possible rating of 40%.

Rock mass conditions described as damp.

JRC $_{Best}$

Large scale joint expression = 0.80 for curved.

Small scale joint expression = 0.75 for undulating rough.

Joint wall alteration = 1.00 wall rock not weaker than fill.

Joint filling = 0.20 gouge thickness > amplitude of irregularities.

Rating = 40 x (0.80 x 0.75 x 1.00 x 0.2) JRC $_{Best}$ rating
= 4.8

JRC $_{Worse}$

Large scale joint expression = 0.70 for planar.

Small scale joint expression = 0.55 for planar smooth.

Joint wall alteration = 1.00 wall rock not weaker than fill.

Joint filling = 0.20 gouge thickness > amplitude of irregularities.

Rating = 40 x (0.70 x 0.55 x 1.00 x 0.2) JRC $_{Worse}$ rating
= 3.1

Rock Mass Rating, RMR

RMR $_{Best}$= 4.0 +11.0 + 4.8 RMR $_{Best}$ rating
= 20

RMR $_{Worse}$ = 1.0 + 4.0 + 3.2 RMR $_{Worse}$ rating
= 8.

Mining Rock Mass Rating, MRMR

Adjustments to RMR.

Weathering = 0.88 moderate to high weathering, pit life 3 years.

Number of joints = 0.8, 3 joint forming blocks.

Stress = 1.00, negligible stresses expected at shallow depth.

Blasting = 0.94, good conventional blasting.

MRMR = RMR × Adjustments

$MRMR_{Best}$ = 20 x 0.88 x 0.8 x 1.0 x 0.94 = 13.0 — $MRMR_{Best}$ rating

$MRMR_{Worse}$ = 8 x 0.88 x 0.8 x 1.0 x 0.94 = 5 — $MRMR_{Worse}$ rating

Slope Angle.

$$\text{Slope angle} = \frac{MRMR}{2} + 30$$

$$\text{Slope angle}_{Best} = \frac{13.0}{2} + 30 = 36°$$

$$\text{Slope angle}_{Worse} = \frac{5.0}{2} + 30 = 33°.$$

Mining Rock Mass Rating (MRMR) parameters and calculations for ***slightly weathered to fresh siltstones***:

Intact Rock Strength , IRS

UCS $_{Best}$ = 160 MPa from Table IRS $_{Best}$ rating
= 16.0

UCS $_{Worse}$ = 50 MPa from Table IRS $_{Worse}$ rating
= 6.0

Spacing of Fractures and Joints, RQD+JS or FF

FF $_{Best}$ = 8 f/m 2 Joints present from Table FF $_{Best}$ rating
= 13.0

FF $_{Worse}$ = 25 f/m 3 Joints present from Table FF $_{Worse}$ rating
= 4.0

Joint Condition and Water, JRC

Accumulative % adjustment of possible rating of 40%.

Rock mass conditions described as damp.

JRC $_{Best}$

Large scale joint expression = 0.75 for slightly undulating.

Small scale joint expression = 0.65 for undulating slickensided.

Joint wall alteration = 1.00 wall rock not weaker than fill.

Joint filling = 0.45 for fine graphite coating.

Rating = 40 x (0.75 x 0.65 x 1.00 x 0.45) JRC $_{Best}$ rating
= 8.8

JRC $_{Worse}$

Large scale joint expression = 0.70 for straight.

Small scale joint expression = 0.55 for planar smooth.

Joint wall alteration = 1.00 wall rock not weaker than fill.

Joint filling = 0.20 gouge thickness > amplitude of irregularities.

Rating = 40 x (0.70 x 0.55 x 1.00 x 0.2) JRC $_{Worse}$ rating
= 3.2

Rock Mass Rating, RMR

RMR $_{Best}$= 16.0 +13.0 + 8.8 RMR $_{Best}$ rating
= 37.8

RMR $_{Worse}$ = 6.0 + 4.0 + 3.2 RMR $_{Worse}$ rating
= 13.2

Mining Rock Mass Rating, MRMR

Adjustments to RMR.

Weathering = 1.0 no weathering expected.

Number of joints = 0.8, 3 joint forming blocks.

Stress = 1.00, negligible stresses expected at shallow depth.

Blasting = 0.94, good conventional blasting.

MRMR = RMR × Adjustments

$MRMR_{Best}$ = 37.8 x.1.0 x 0.8 x 1.0 x 0.94 = 28.0 — $MRMR_{Best}$ rating

$MRMR_{Worse}$ = 13.2 x 1.0 x 0.8 x 1.0 x 0.94 = 10.0 — $MRMR_{Worse}$ rating

Slope Angle.

$$\text{Slope angle} = \frac{MRMR}{2} + 30$$

$$\text{Slope angle}_{\text{Best}} = \frac{28}{2} + 30 \qquad = 44.0°$$

$$\text{Slope angle}_{\text{Worse}} = \frac{10}{2} + 30 \qquad = 35.0°.$$

Mining Rock Mass Rating (MRMR) parameters and calculations for ***slightly weathered to fresh silicified siltstones***:

Intact Rock Strength , IRS

UCS_{Best} = 258 MPa from Table IRS_{Best} rating = 20.0

UCS_{Worse} = 200 MPa from Table IRS_{Worse} rating = 20.0

Spacing of Fractures and Joints, RQD+JS or FF

FF_{Best} = 4 f/m 2 Joints present from Table FF_{Best} rating = 20.0

FF_{Worse} = 25 f/m 3 Joints present from Table FF_{Worse} rating = 4.0

Joint Condition and Water, JRC

Accumulative % adjustment of possible rating of 40%.

Rock mass conditions described as damp.

JRC_{Best}

Large scale joint expression = 0.8 for curved.

Small scale joint expression = 0.75 for undulating rough.

Joint wall alteration = 1.00 wall rock not weaker than fill.

Joint filling = 0.65 for coarse graphite coating.

Rating = 40 x (0.80 x 0.75 x 1.00 x 0.65) JRC_{Best} rating = 15.6

JRC_{Worse}

Large scale joint expression = 0.70 for straight.

Small scale joint expression = 0.65 for undulating slickensided.

Joint wall alteration = 1.00 wall rock not weaker than fill.

Joint filling = 0.45 for fine graphite.

Rating = 40 x (0.70 x 0.65 x 1.00 x 0.45) JRC_{Worse} rating = 8.2

Rock Mass Rating, RMR

RMR_{Best}= 20.0 +20.0 + 15.6 RMR_{Best} rating = 55.6

RMR_{Worse} = 20.0 + 4.0 + 8.2 RMR_{Worse} rating = 32.4

Mining Rock Mass Rating, MRMR

Adjustments to RMR

Weathering = 1.0 no weathering expected.

Number of joints = 0.8, 3 joint forming blocks.

Stress = 1.00, negligible stresses expected at shallow depth.

Blasting = 0.94, good conventional blasting.

MRMR = RMR × Adjustments

MRMR $_{Best}$ = 55.6 x.1.0 x 0.8 x 1.0 x 0.94 = 42 — MRMR $_{Best}$ rating

MRMR $_{Worse}$ = 32.4 x 1.0 x 0.8 x 1.0 x 0.94 = 24 — MRMR $_{Worse}$ rating

Slope Angle.

Slope angle = $\frac{MRMR}{2}+30$

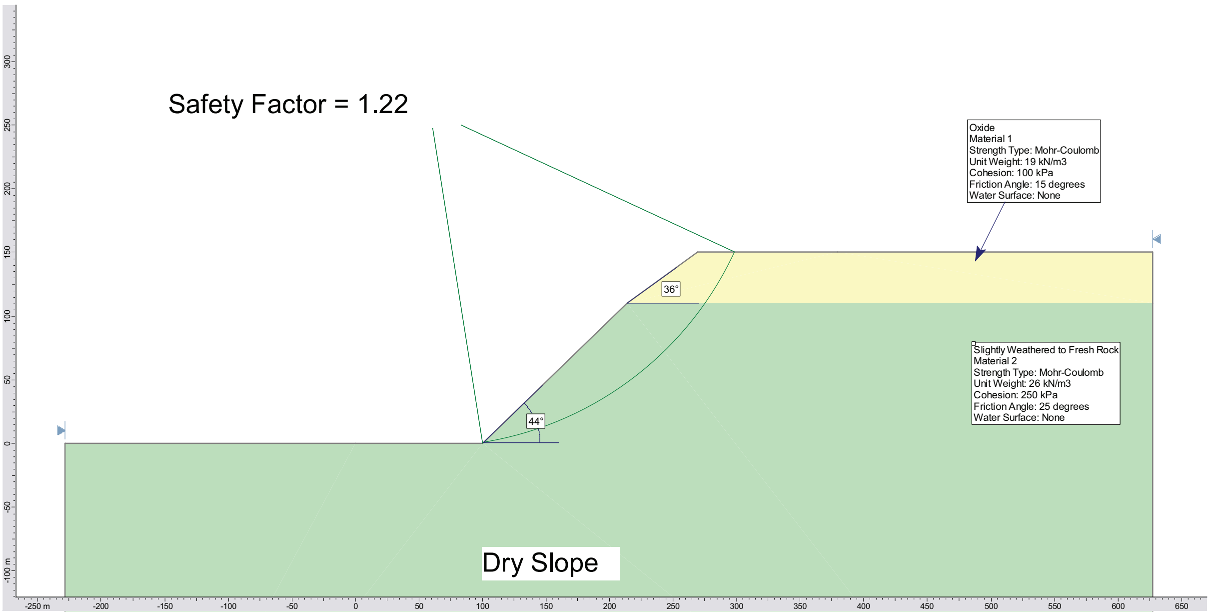
Slope angle $_{Best}$ = $\frac{43}{2}+30$ = 51°

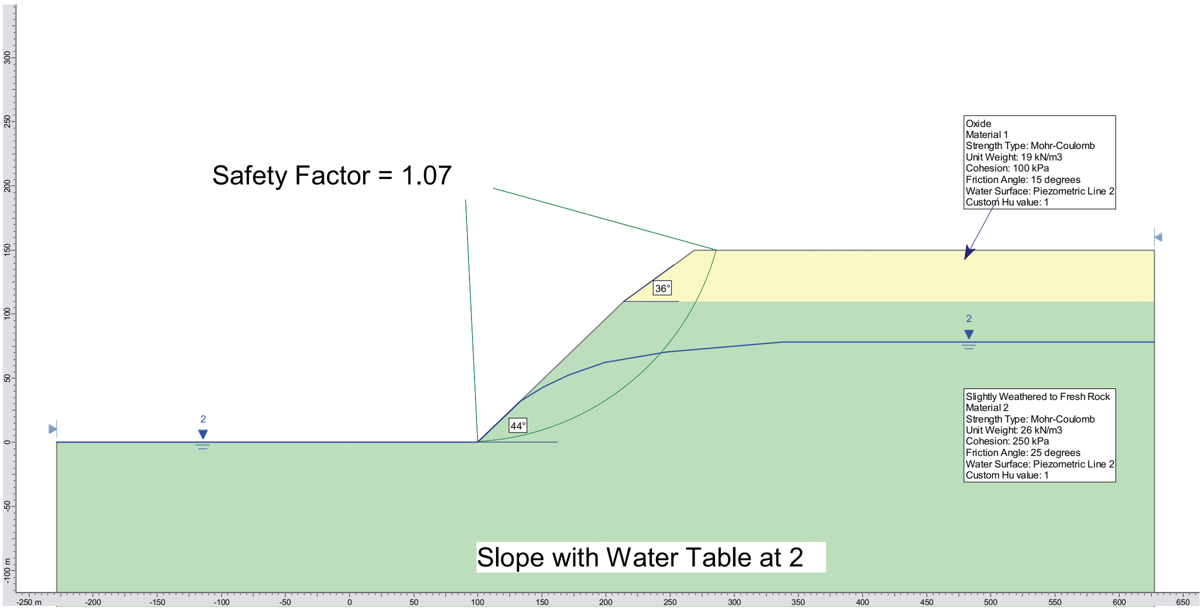
Slope angle $_{Worse}$ = $\frac{24}{2}+30$ = 42°.

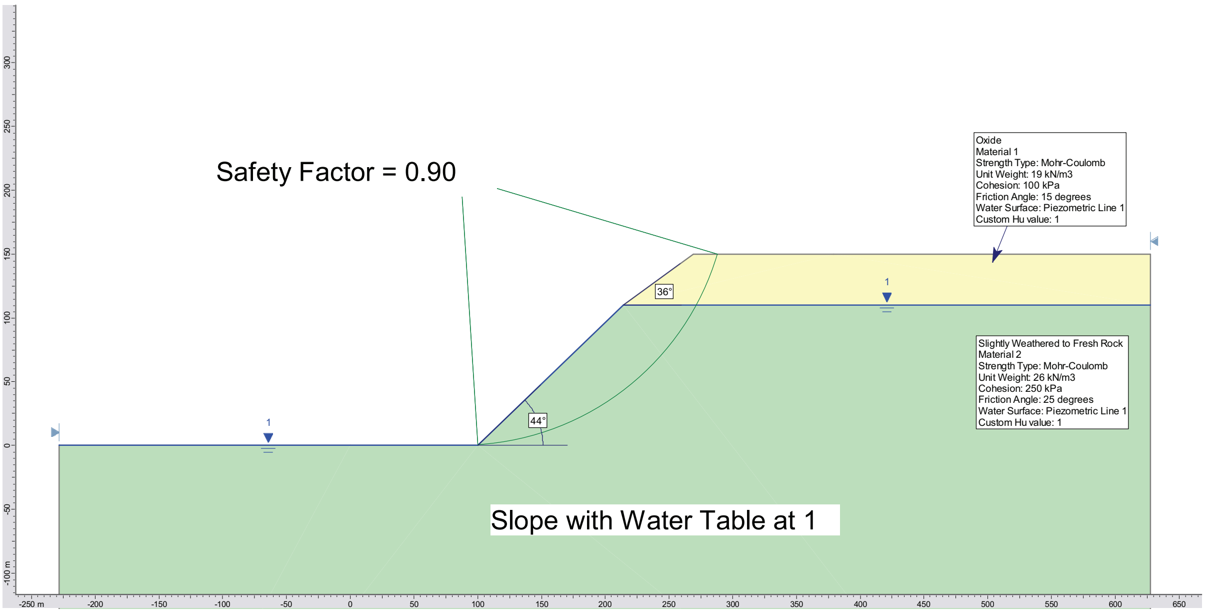
APPENDIX E

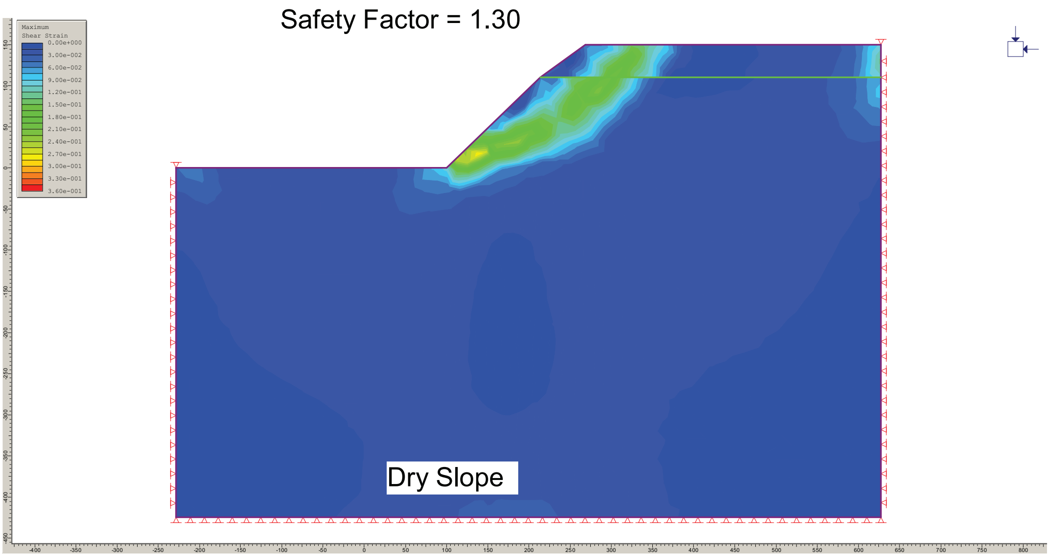
LIMIT EQUILIBRIUM AND FINITE ELEMENT ANALYSIS OUTPUT

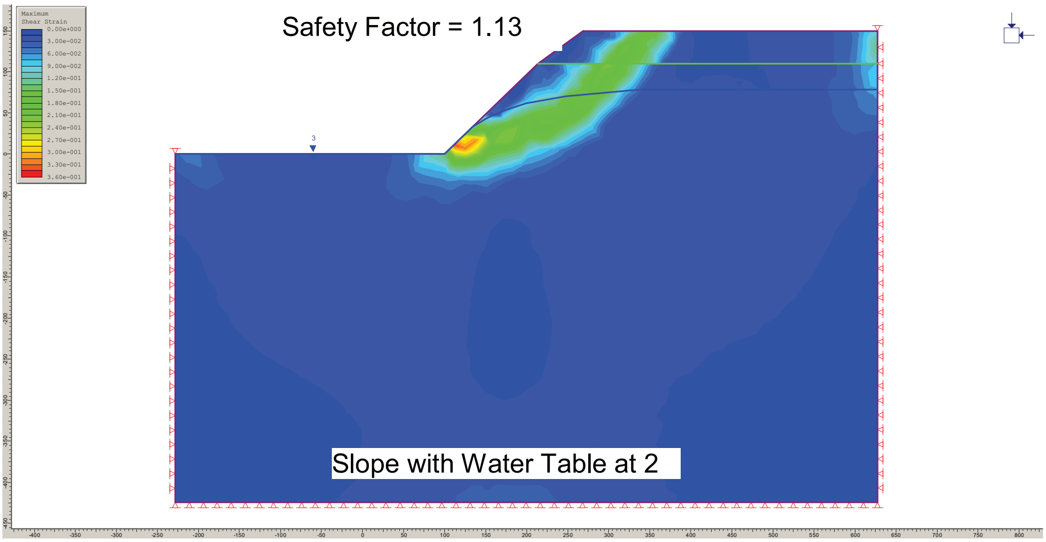
TRILOGY DEPOSITS

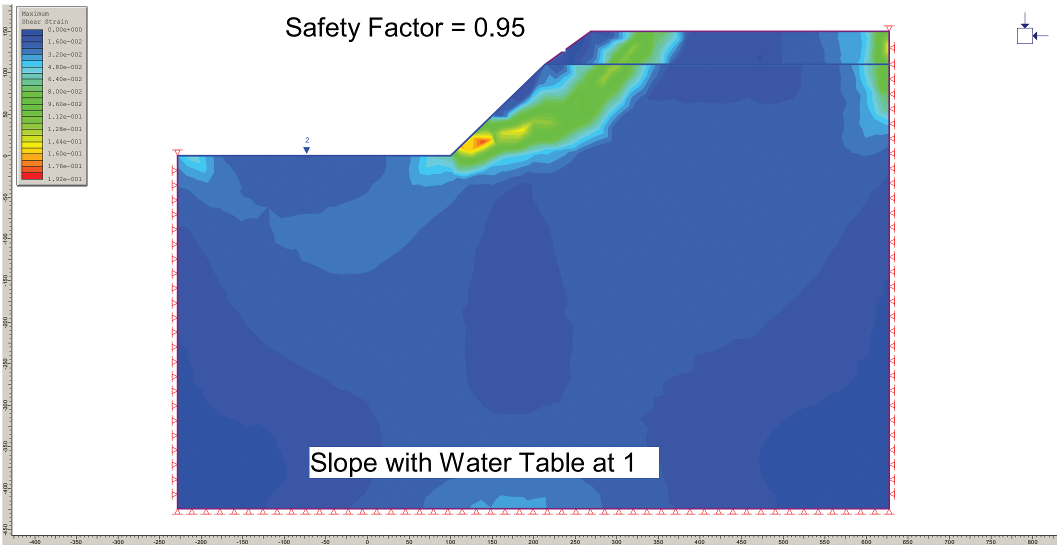

Safety Factor = 1.22
Oxide
Material 1
Strength Type: Mohr-Coulomb
Unit Weight: 19 kN/m3
Cohesion: 100 kPa
Friction Angle: 15 degrees
Water Surface: None
36°
Slightly Weathered to Fresh Rock
Material 2
Strength Type: Mohr-Coulomb
Unit Weight: 26 kN/m3
Cohesion: 250 kPa
Friction Angle: 25 degrees
Water Surface: None
44°
Dry Slope


Safety Factor = 1.07
Oxide
Material 1
Strength Type: Mohr-Coulomb
Unit Weight: 19 kN/m3
Cohesion: 100 kPa
Friction Angle: 15 degrees
Water Surface: Piezometric Line 2
Custom Hu value: 1
36°
Slightly Weathered to Fresh Rock
Material 2
Strength Type: Mohr-Coulomb
Unit Weight: 26 kN/m3
Cohesion: 250 kPa
Friction Angle: 25 degrees
Water Surface: Piezometric Line 2
Custom Hu value: 1
44°
Slope with Water Table at 2


Safety Factor = 0.90
Oxide
Material 1
Strength Type: Mohr-Coulomb
Unit Weight: 19 kN/m3
Cohesion: 100 kPa
Friction Angle: 15 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1
36°
Slightly Weathered to Fresh Rock
Material 2
Strength Type: Mohr-Coulomb
Unit Weight: 26 kN/m3
Cohesion: 250 kPa
Friction Angle: 25 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1
44°
Slope with Water Table at 1


Safety Factor = 1.30
Dry Slope


Safety Factor = 1.13
Slope with Water Table at 2


Safety Factor = 0.95
Slope with Water Table at 1