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May 25, 2004 03-1413-427/4300

Cumberland Resources Ltd.
Suite 950, One Bentall Centre
505 Burrard Street
Vancouver, BC
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Attention: Mr. Brad Thiele

## RE: BLASTING REPORT ADDENDUM

Dear Mr. Thiele:

## 1.0 INTRODUCTION

This document is an Addendum to a more detailed report titled "Blast Design, Meadowbank Gold Project, Nunavut" issued February 10, 2004, and should be read in conjunction with that report.

A request was made by Cumberland Resources to consider the use of 3-m high benches and 76-mm (3") diameter for blasting both ore and waste at the Meadowbank Project. It is understood that issues related to grade control and blasting vibrations are the primary driving influences behind the use of smaller diameter blastholes with lower bench heights.

## 2.0 EXPLOSIVE TYPE

The explosive selected for blasting with the larger diameter holes would not be suitable for use with the smaller diameter blastholes due to sensitivity issues. Consequently, a more sensitive emulsion product will be required. The emulsion product would have to be sensitized (either with gas, micro-balloons or with small amounts of a molecular explosive) to ensure detonation in the smaller diameter blastholes. This will increase the cost of the explosive product. The product would be pumped directly to the bottom of the blastholes.

The following table summarizes typical properties of sensitized emulsion products.

**Table 1: Typical Properties of Sensitized ANFO/Emulsion Mixtures for Small Diameter Blastholes**

| ANFO (%) | Emulsion (%) | Density (g/cc) | Velocity of Detonation (m/s) | RWS/RBS | Minimum Diameter (mm) | Water Resistance | Loading |
|---|---|---|---|---|---|---|---|
| | 100 | 1.20 | 5700 | 77/113 | 75 | Excellent | Pump |
| 20 | 80 | 1.23 | 5400 | 82/123 | 90 | Excellent | Pump |
| 30 | 70 | 1.24 | 4800 | 84/127 | 100 | Excellent | Pump |
| 50 | 50 | 1.27 | 4700 | 93/130 | 125 | Good | Auger |

Reference: Dyno Nobel, Inc.

## 3.0 PRODUCTION BLAST DESIGN

The following tables summarize blast designs developed for the smaller blasthole diameter, lower bench height, and a straight emulsion product.

**Table 2: Blasthole Parameters**

| | Units | 76 mm Diameter Blasthole | |
|---|---|---|---|
| | | Waste | ORE |
| Working Bench Height | m | 3 | 3 |
| Blasthole Diameter | mm | 76 | 76 |
| Hole Inclination | deg | 90 | 90 |
| Subdrill | m | 0.6 | 0.6 |
| **TOTAL DRILLED DEPTH** | **m** | **3.6** | **3.6** |

**Table 3: Blast Patterns**

| | |
|---|---|
| Blasthole Pattern | Staggered |
| Blast Sequence | En Echelon |
| Spacing/Burden Ratio | 1:1.15 |
| Number of Rows | 5 |
| Number of Holes per Row | 10 |

**Table 4: Charge Table – (100% Emulsion)**

| Blasting Variables | Units | Ore | IV and Quartzite | Ultramafic |
|---|---|---|---|---|
| Bench Height | m | 3 | 3 | 3 |
| Subdrill | m | 0.3 | 0.3 | 0.3 |
| Stemming Length | m | 1.2 | 1.2 | 1.2 |
| Charge Length | m | 2.1 | 2.1 | 2.1 |
| Linear Charge Density | kg/m | 5.9 | 5.9 | 5.9 |
| Burden | m | 2.4 | 2.3 | 2.3 |
| Spacing | m | 2.7 | 2.6 | 2.6 |
| Burden Volume | $m^3$ | 19 | 18 | 18 |
| Explosives Mass per Hole, Q | kg | 12.4 | 12.4 | 12.4 |
| **Powder Factor, PF** | **$kg/m^3$** | **0.64** | **0.69** | **0.69** |

The general blast configurations are the same as those proposed for the larger diameter blastholes with the obvious changes to the burden and spacing dimensions. The shorter blastholes lengths are more amenable to following a gentle sloping footwall and should not require the "stab" holes proposed for the larger bench heights.

### 3.1 Drilling

The change in cubic meter of rock broken per drilled meter is dramatically decreased using the smaller blasthole diameter. The change is from approximately 23 $m^3$ for the 165 mm holes to 5.5 $m^3$ for the 76 mm diameter holes. This represents a 76% reduction in the rock fragmentation volume for each meter of blasthole drilled. The smaller holes are less expensive to drill but many more are required to break the same volume of rock.

### 3.2 Wall Control

The general concept for wall control blasting does not change with the smaller blasthole diameter. The smaller holes will produce less damage to the wall rocks and will result in smoother, sounder wall conditions. However, the use of 3 m bench heights will result in a reduction in the overall slope angle for the final pit walls. This is because there will be a "step-out" of at least 1 m for every 3-m high bench to allow access for the drill. For example, for a design bench configuration of a 65 degree bench face angle with two 12-m high working benches to reach the final bench height of 24 m, and a 49 degree design inter-ramp angle, the effective inter-ramp angle will be approximately 47 degrees allowing for a 1 m "step-out". If a 3 m working bench height is considered, this will require eight working benches to reach the final 24 m bench height, and will result in an effective inter-ramp angle of approximately 43 degrees, allowing a 1 m "step-out" on seven of the eight working benches for drill access.

### 3.3 Rock Fragmentation

The fragmentation was predicted using the Kuz-Ram model defined in the main text of the report. The following table summarizes the predicted rock fragmentation for the preceding design criteria, and for a five row blast pattern with ten holes per row. The fragmentation is predictably finer given improvement in energy distribution that results from the smaller burden and spacing dimensions. However, the tonnage per blast is lower than for the greater bench heights and larger blastholes proposed in the previous report. The predicted fragmentation curves are contained in Appendix I.

**Table 5: Predicted Fragmentation**

| Rock Type | Bench Height, m | Hole Size, mm | t/blast, t[1] | Powder Factor, kg/m$^3$ | 50% passing, m | 80% passing, m | Characteristic Size, m |
|---|---|---|---|---|---|---|---|
| Iron Formation | 3 m | 76 | 3,344 | 0.64 | 0.33 | 0.59 | 0.42 |
| Ultramafic | 3 m | 76 | 2,422 | 0.69 | 0.22 | 0.39 | 0.28 |
| Intermediate Volcanic | 3 m | 76 | 2,512 | 0.69 | 0.28 | 0.51 | 0.37 |

1. Assumes 5 rows and 10 holes per row.

The impact of the smaller hole diameters and bench heights on productivity should be assessed in greater detail. As an approximate assessment of this impact, consider a stripping ratio of about 7:1 for the Portage Pit area. Approximately 39,000 t/day of waste will need to be moved to feed the 5,500 t/day milling operation. Based on the smaller blast design, this would require about 16 blasts per day in waste assuming five rows and ten holes per row. By comparison, a 6-m bench with 86 kg charge weight would move about 30,000 t/day in waste per blast, and a 12-m bench with 250 kg charge weight would move about 46,000 t/day in waste per blast.

## 4.0 BLAST INDUCED VIBRATION

The following sections summarize the results of previous analyses, and include additional analyses based on the revised production blast designs for the proposed 3-m bench height.

### 4.1 Minimum Setback Distance for Canadian Fisheries Guidelines

For the Meadowbank Site, three blast designs were previously assessed: the first assumed a charge weight per delay of 420 kg for 229 mm (9") blastholes and an operating bench height of 12 m, the second assumed a maximum charge weight of 250 kg for 165 mm (6½") blastholes and a bench height of 12 m, and the third assumed a charge weight of 86 kg for 165-mm blasthole and bench height of 6 m (see Golder Report on Blast Design, February 2004). An Emulsion:ANFO ratio of 70:30 was assumed for the first three cases. An additional scenario is considered here for a charge weight of 12 kg for a 76 mm blasthole and 3-m bench height. The fourth case assumes a sensitized emulsion product.

The PPV's were evaluated for the Second Portage Lake East Dike, the Third Portage Peninsula east shoreline, the Bay Dike, and the Goose Island east shoreline. Based on the current mine layout, estimates of the minimum distance from the estimated final production blast near the pit crest, to the point of concern (either the shoreline or the dike face), and estimates of the distance from the pit centre to the point of concern (either the shoreline or the dike face) were made. The PPV were evaluated based on these estimated distances.

By reducing the working bench height to 3 m within the waste rock and the ore, the charge weight per blasthole is reduced. The following table summarizes the estimated PPV at points of concern either along the upstream face of the dike, or along the shoreline, whichever is closest, for a 12 kg charge weight, 76 mm blasthole, and 3 m bench height.

**Table 6: Preliminary Estimate of Peak Particle Velocities based on Production Blasting (12-kg charge weight per delay; 3-m bench height, 76-mm blasthole)**

| Location | Distance to Point of Concern (m) | | PPV (mm/sec) | | |
|---|---|---|---|---|---|
| | | | k=400 | k=800 | k=1500 |
| Second Portage Lake East Dike | Pit Crest to U/S Dike Face | 255 | <1 | 1 | 2 |
| | Pit Centre to U/S Dike Face | 375 | <1 | <1 | 1 |
| Third Portage Peninsula | Pit Crest to Shoreline | 101 | 2 | 4 | 7 |
| | Pit Centre to Shoreline | 295 | <1 | 1 | 1 |
| Bay Dike | Pit Crest to U/S Dike Face | 145 | 1 | 2 | 4 |
| | Pit Centre to U/S Dike Face | 355 | <1 | <1 | 1 |
| Goose Island | Pit Crest to U/S Dike Face* | 210* | 1 | 1 | 2 |
| | Pit Centre to U/S Dike Face* | 500* | <1 | <1 | 1 |

Distances are measured from approximate location of last production blast, not final trim blast.
Values of PPV in bold exceed 13 mm/sec.
*The Goose Island Dike alignment has been modified since the previous report. The new distance and results reflect the current concept for the dike alignment.

The following table summarizes the results of the analyses for the four charge weights that were considered, assuming a confinement value, k, of 800, which is considered to be appropriate for the Meadowbank Project based on experience at other northern mines.

**Table 7: Summary of Estimates of Peak Particle Velocities based on Production Blasting Charge Weights (k=800)**

| Location | Distance to Point of Concern (m) | | PPV (mm/sec) | | | |
|---|---|---|---|---|---|---|
| | | | 12kg/3m bench | 86kg/6m bench | 250kg/12m bench | 420kg/12m bench |
| Second Portage Lake East Dike | Pit Crest to U/S Dike Face | 255 | 1 | 4 | 9 | **14** |
| | Pit Centre to U/S Dike Face | 375 | <1 | 2 | 5 | 8 |
| Third Portage Peninsula | Pit Crest to Shoreline | 101 | 4 | **18** | **41** | **62** |
| | Pit Centre to Shoreline | 295 | 1 | 3 | 7 | 11 |
| Bay Dike | Pit Crest to U/S Dike Face | 145 | 2 | 10 | **23** | **35** |
| | Pit Centre to U/S Dike Face | 355 | <1 | 2 | 6 | 8 |
| Goose Island | Pit Crest to U/S Dike Face* | 210* | 1 | 5 | **13** | **36** |
| | Pit Centre to U/S Dike Face* | 500* | <1 | 1 | 3 | 9 |

Distances are measured from approximate location of last production blast, not final trim blast.
Values of PPV in bold exceed 13 mm/sec.
*The Goose Island Dike alignment has been modified since the previous report. The new distance and results reflect the current concept for the dike alignment.

The analysis indicates that, for the charge weight of 12 kg and bench height of 3 m, the peak particle velocity along the upstream (lake side) dike faces will not exceed 13 mm/s. With the exception of a short segment of the Third Portage Pit wall adjacent to the east shoreline of the Third Portage Peninsula, charge weights of 86 kg on 6 m benches will result in PPV less than the required 13 mm/s. Finally, with the exception of the segment of the Third Portage Pit wall just described, and short segments of the south end of the Goose Island Dike re-alignment, charge weights of 250 kg and 12 m bench heights can be used without exceeding the required 13 mm/s guideline.

For the portions of the dike or shoreline where the 13 mm/s guideline is exceeded, modified blast designs consisting of lower charge weights on lower bench heights have been shown to result in PPV that meet the guideline requirement. Alternatively, additional fill materials could be placed along the shoreline or dike upstream (lake side) face to increase the distance from the blasting area.

Figure 1 presents the relationship between charge weight and distance from blast for a constant Peak Particle Velocity of 13 mm/s for lower charge weights. The figure can be used as a guide to estimate the maximum allowable charge weight per blasthole that will not exceed a peak particle velocity of 13 mm/s at a specified distance from the blast.

The minimum setback distances to achieve a PPV of 13 mm/s have been estimated for the various values of ‘k’, and for the four potential charge weights per delay used in the above PPV estimates. The following table summarizes the estimates of minimum setback required to achieve a PPV value of 13 mm/s.

**Table 8: Minimum Setback Distance for 13 mm/s**
**Peak Particle Velocity Guideline**

| k | 12 kg charge weight per delay (3 m bench, 76 mm hole) | 86 kg charge weight per delay (6 m bench, 165 mm hole) | 250 kg charge weight per delay, (12 m bench, decked charge, 229 mm hole) | 420 kg charge weight per delay, (12 m bench, 229 mm hole) |
|---|---|---|---|---|
| | Minimum Setback Distance to Achieve PPV = 13 mm/s | | | |
| 400 | 30 m | 79 m | 135 m | 175 m |
| 800 | 46 m | 122 m | 208 m | 269 m |
| 1500 | 67 m | 180 m | 308 m | 399 m |

The relationships presented in the above table are shown on Figure 2 for a confinement value, k, of 800.

### 4.2 Minimum Setback Distance for Threshold Damage Levels

General guidelines for blasting nears dams indicate vibration damage thresholds on the order of 50 mm/s to be reasonable for dams having medium to dense sand or silts within the dam or foundation materials. The following table summarizes the estimates of minimum setback required to achieve a PPV value of 50 mm/s for the charge weights considered.

**Table 9: Comparison of Minimum Setback Distance for a Peak Particle Velocity of 50 mm/s for Various Blast Configurations**

| k | 12 kg charge weight per delay (3 m bench, 76 mm hole) | 86 kg charge weight per delay (6 m bench, 165 mm hole) | 250 kg charge weight per delay, (12 m bench, decked charge, 229 mm hole) | 420 kg charge weight per delay, (12 m bench, 229 mm hole) |
|---|---|---|---|---|
| | Minimum Setback Distance to Achieve PPV = 50 mm/s | | | |
| 400 | 13 m | 32 m | 58 m | 75 m |
| 800 | 20 m | 53 m | 89 m | 116 m |
| 1500 | 29 m | 78 m | 133 m | 172 m |

Figure 3 presents the relationship between charge weight and distance from blast for a constant Peak Particle Velocity of 50 mm/s. The relationships presented in the above table are shown on Figure 4 for a confinement value, k, of 800.

The analysis indicates that for the 80-m toe setback currently assumed for the dikes at the Meadowbank Project, a charge weight of up to 200 kg per delay could be used resulting in PPV less than 50 mm/s, based on the assumptions presented in this report. Additional blast monitoring during construction will be required to confirm the assumptions on which these results are based.

### 4.3 Instantaneous Pressure Change for Canadian Fisheries Guidelines

The required setback distance for confined explosives to achieve the 100 kPa instantaneous pressure change guideline can be estimated from relationships presented in “Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters” (Wright and Hopky, 1998).

The following properties were used to assess the minimum setback distance.

**Table 10: Properties Used to Assess Setback Distance for Instantaneous Pressure Change**

| Medium | Density, $g/cm^3$ | Compressional Wave Velocity, cm/s |
|---|---|---|
| Water | 1 | 146,300[1] |
| Rock (Intermediate Volcanic) | 2.8 | 457,200[1] |

1. Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters; Wright and Hopky, 1998

Based on the above properties, the range of potential charge weights, and the range in confinement value, k, the following minimum setback distances, below which the 100 kPa overpressure guideline will not be exceeded, are estimated.

**Table 11: Minimum Setback Distance for Instantaneous Pressure Change Guideline**

| Charge Weight per Delay | Minimum Setback Distance, m | | |
|---|---|---|---|
| kg | k=400 | k=800 | k=1500 |
| 12 | 10 m | 15 m | 22 m |
| 86 | 26 m | 40 m | 60 m |
| 250 | 45 m | 69 m | 102 m |
| 420 | 58 m | 89 m | 132 m |

The relationship between charge weight per delay and minimum setback distance to achieve the 100 kPa guideline for instantaneous pressure change is shown on Figure 5. The figure can be used as a guide to optimizing the blast designs. The relationships presented in the above table are shown on Figure 6 for a confinement value, k, of 800.

Based on the currently proposed de-watering dike configuration, the average distance from the pit crest to the outside (lake side) dike face will be on the order of 160 m. In order for the instantaneous pressure change measured on the outside (lake side) face of the dike to exceed 100 kPa, a charge weight in excess of 1300 kg would be required, based on the assumptions in this report. Consequently, for the range of charge weights considered in the analyses for the Meadowbank project, none will result in an instantaneous pressure change greater than 100 kPa.

## 5.0 CLOSING REMARKS

Cumberland is considering mining of both ore and waste at the Meadowbank Project using 3-m bench heights and small diameter (76 mm) blastholes. The reduced bench heights and small diameter blastholes will result in lighter charge weights, and hence lower vibration levels experienced on the outside (lake side) of the dikes. Based on the proposed 3-m bench configurations and 76 mm blasthole diameter, a 12 kg charge weight will be used.

An assessment of blast induced vibration and instantaneous pressure change was carried out to assess vibration levels resulting from the lower charge weights as these relate to Canadian fisheries guidelines. The maximum acceptable Peak Particle Velocity (PPV) resulting from the use of explosives in or near fisheries waters is 13 mm/s. The maximum acceptable instantaneous pressure change is 100 kPa.

The results of the assessment indicate that for the proposed 3-m bench configuration and 12 kg charge weight, PPV on the outside (lake side) of the dikes will not exceed 13 mm/s, and that with the exception of a short segment of the Third Portage Pit wall adjacent to the east shoreline of the Third Portage Peninsula, charge weights of 86 kg on 6 m benches will result in PPV less than the guideline 13 mm/s. Furthermore, with the exception of the segment of the Third Portage Pit wall just described, and short segments of the south end of the Goose Island Dike re-alignment, charge weights of 250 kg and 12 m bench heights can be used without exceeding the required 13 mm/s guideline. For the portions of the dike or shoreline where the 13 mm/s guideline is exceeded, modified blast designs can be used to meet the guideline requirements. Alternatively, additional fill materials could be placed along the shoreline or dike upstream (lake side) face to increase the distance from the blasting area.

The instantaneous pressure change along the upstream (lake side) face of the dikes is predicted to be less than the 100 kPa guideline for all charge weights that are currently being considered for the Meadowbank Project.

An assessment of blast induced vibration as it relates to threshold damage levels for structures was carried out. General guidelines for blasting near dams indicate vibration damage thresholds on the order of 50 mm/s to be acceptable for dams having medium to dense sand or silts within the dam or foundation materials. Based on the proposed toe setback of 80 m, a 3-m bench height and 12-kg charge weight, and assumed site conditions and confinement, the analyses indicate that the 50 mm/s guideline will not be exceeded at the toe of the proposed de-watering dikes and tailings dike. The analyses indicate that for the 80-m toe setback currently assumed for the dikes at the Meadowbank Project, a charge weight of up to 200 kg per delay could be used without exceeding PPV of 50 mm/s at the toe, based on the assumptions presented in this report, and the preceding report. Where blast induced vibration is predicted to exceed general guidelines, modified blast designs can be used to reduce vibration levels.

The Vault Dike has not been considered in the analyses. The Vault Dike lies some 750 m from the nearest crest of the Vault Pit. Consequently, the proposed bench configurations and charge weights currently being considered will not exceed the Canadian fisheries guidelines for blasting induced vibration or for instantaneous pressure change.

It is recommended that the modified blast designs consisting of smaller blasthole diameter and lower bench heights only be used in those areas of the final pit walls where PPV along the lake shoreline, or along the upstream (lake side) of the dikes, is predicted to exceed guidelines, or within the ore zone where grade control is essential. The larger blast configurations (either 6 m or 12 m benches) should be adopted elsewhere within the waste rock. The smaller charge weights and lower bench heights will require more blasts on a daily basis to move the required amount of waste rock to obtain the daily ore tonnage to feed the mill. The number of blasts required per day for the lower bench heights may be impractical from a longer term operational perspective.

During mine development, a vibration monitoring program will be required in order to measure the response of the de-watering dikes and tailings dike to pit blasting, and to measure peak particle velocities on the upstream (lake side) of the dikes to assess the blast designs.

Yours very truly,

**GOLDER ASSOCIATES LTD.**

Cameron J. Clayton, P.Geo.
Mining Group

W.W. Forsyth, P.Eng.
Principal

CJC/WWF/vee
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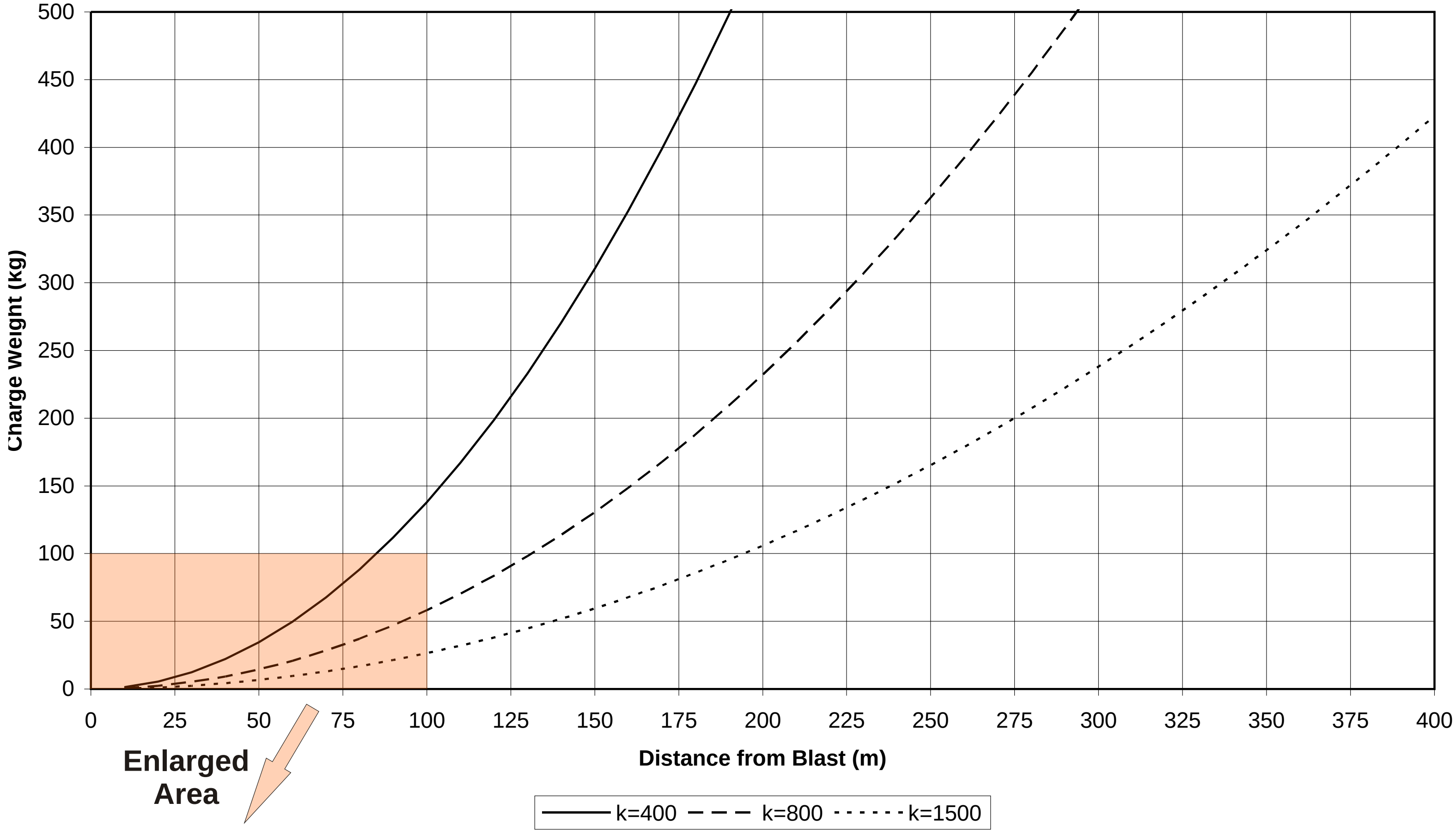
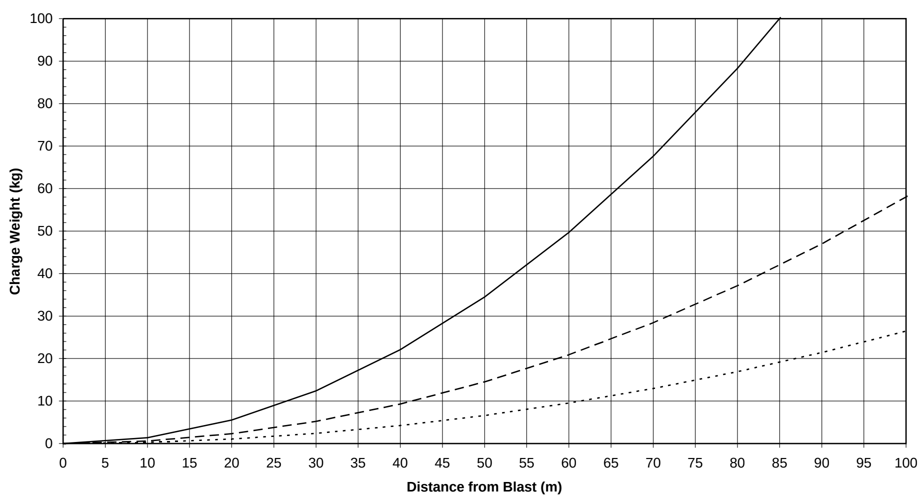



Site factor b=-1.6 for downhole blasting

**Enlarged Area**




PROJECT

**CUMBERLAND RESOURCES LTD.**

TITLE

**CHARGE WEIGHT vs DISTANCE FROM BLAST - PPV = 13mm/s**

Golder Associates

| | | | | |
|---|---|---|---|---|
| PROJECT No. | 03-1413-427 | | FILE No. FIGURE 4 | |
| DESIGN | CJC | 28JAN04 | SCALE NTS | REV. 0 |
| CADD | SS | 28JAN04 | **FIGURE 1** | |
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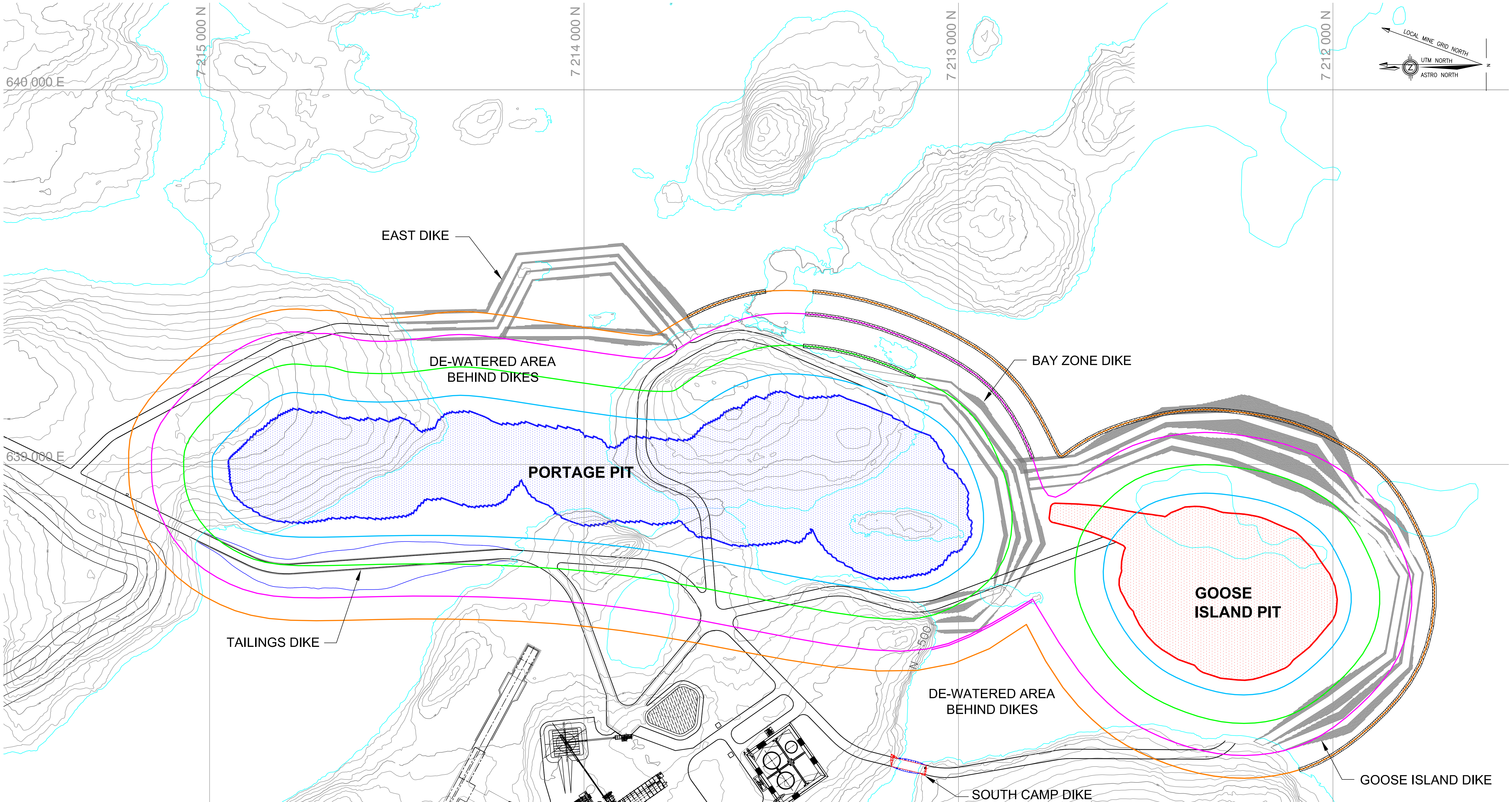
| REVIEW | | 10MAR04 | | |

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## LEGEND

12 kg Charge Weight, 46m Offset

Confinement, k = 800

86 kg Charge Weight, 122m Offset

250 kg Charge Weight, 208m Offset

420 kg Charge Weight, 269m Offset

Aquatic areas that may experience 13mm/s vibration levels for a specific charge weight.

## NOTES

1) Area behind dikes is de-watered during operations.

## REFERENCES

1) Drawing taken from AMEC, dated 28-01-04, Drawing # A1-131395-100-C-0001 Revision A - OVERALL SITE PLAN YEAR 1-5.

2) Golder Report on Blast Design, Feburary, 2004.

0 100 200 300 400 500

Scale in Meters

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REPORT ADDENDUM
PEAK PARTICLE VELOCITY
13 mm/s ISOPLETH

Golder Associates

| | | | | |
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| DESIGN | CJC | 08 MAR 04 | SCALE AS SHOWN | REV. 0 |
| CADD | SRR | 09 MAR 04 | | |
| CHECK | CJC | 10 MAR 04 | FIGURE 2 | |
| REVIEW | | 10 MAR 04 | | |

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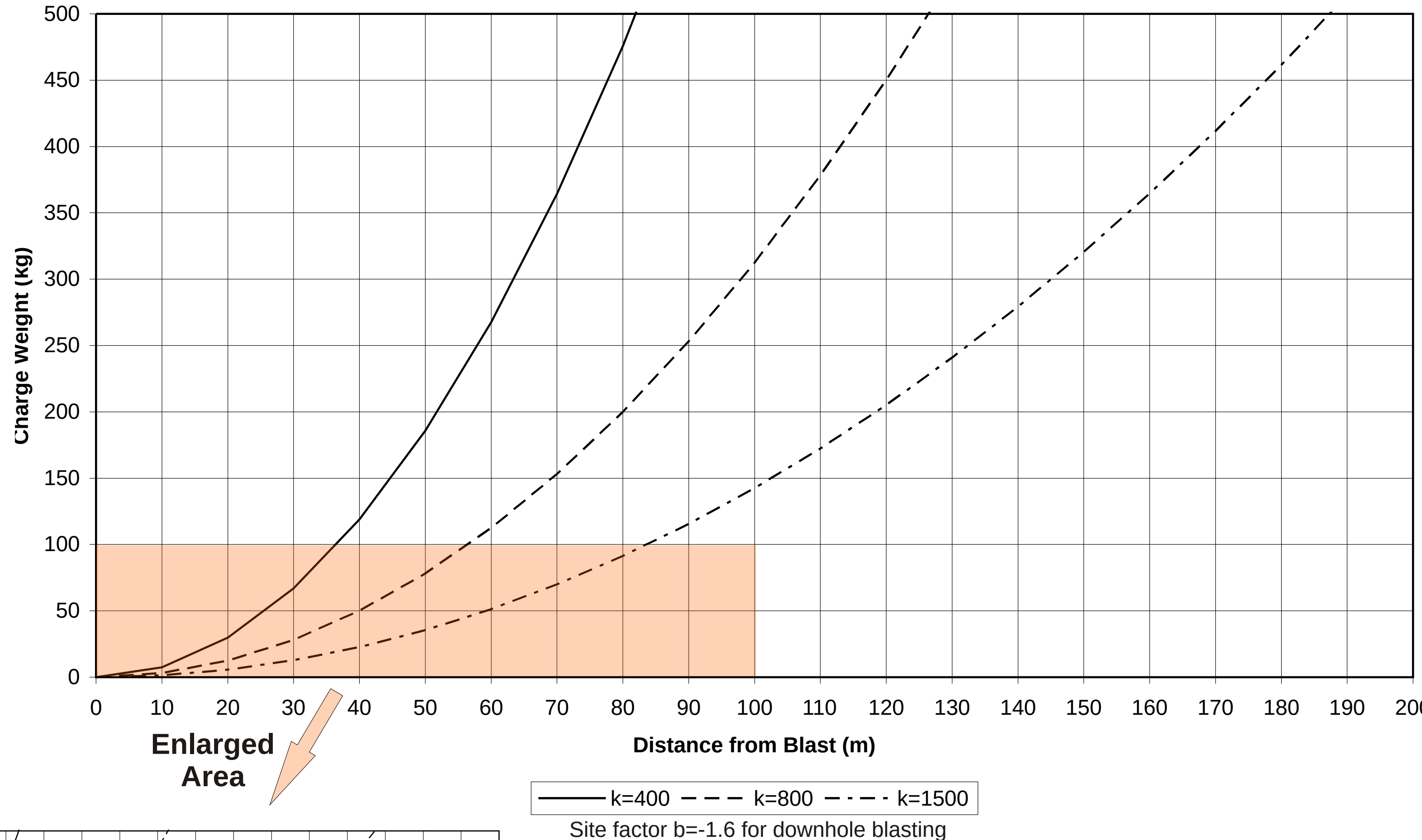


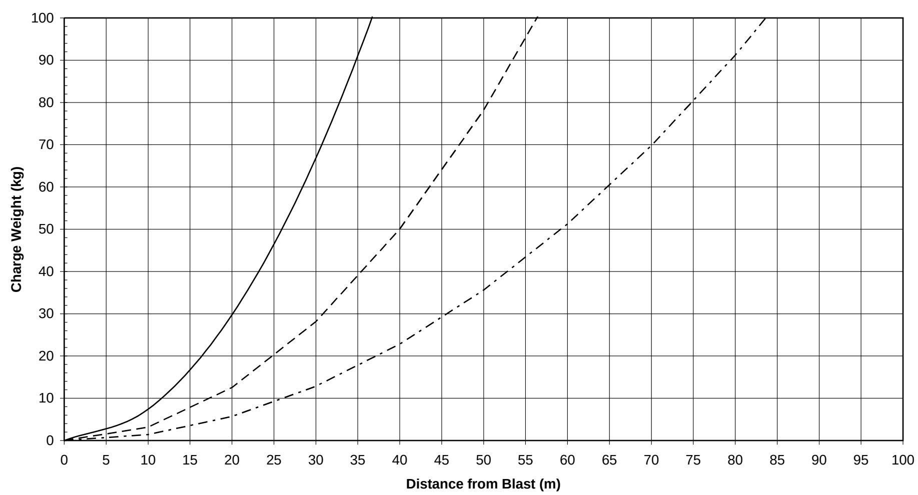


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PROJECT

CUMBERLAND
RESOURCES LTD.

TITLE

**CHARGE WEIGHT vs DISTANCE FROM BLAST - PPV = 50mm/s**

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| | | | | |
|---|---|---|---|---|
| PROJECT No. | 03-1413-427 | | FILE No. FIGURE 4 | |
| DESIGN | CJC | 28JAN04 | SCALE NTS | REV. 0 |
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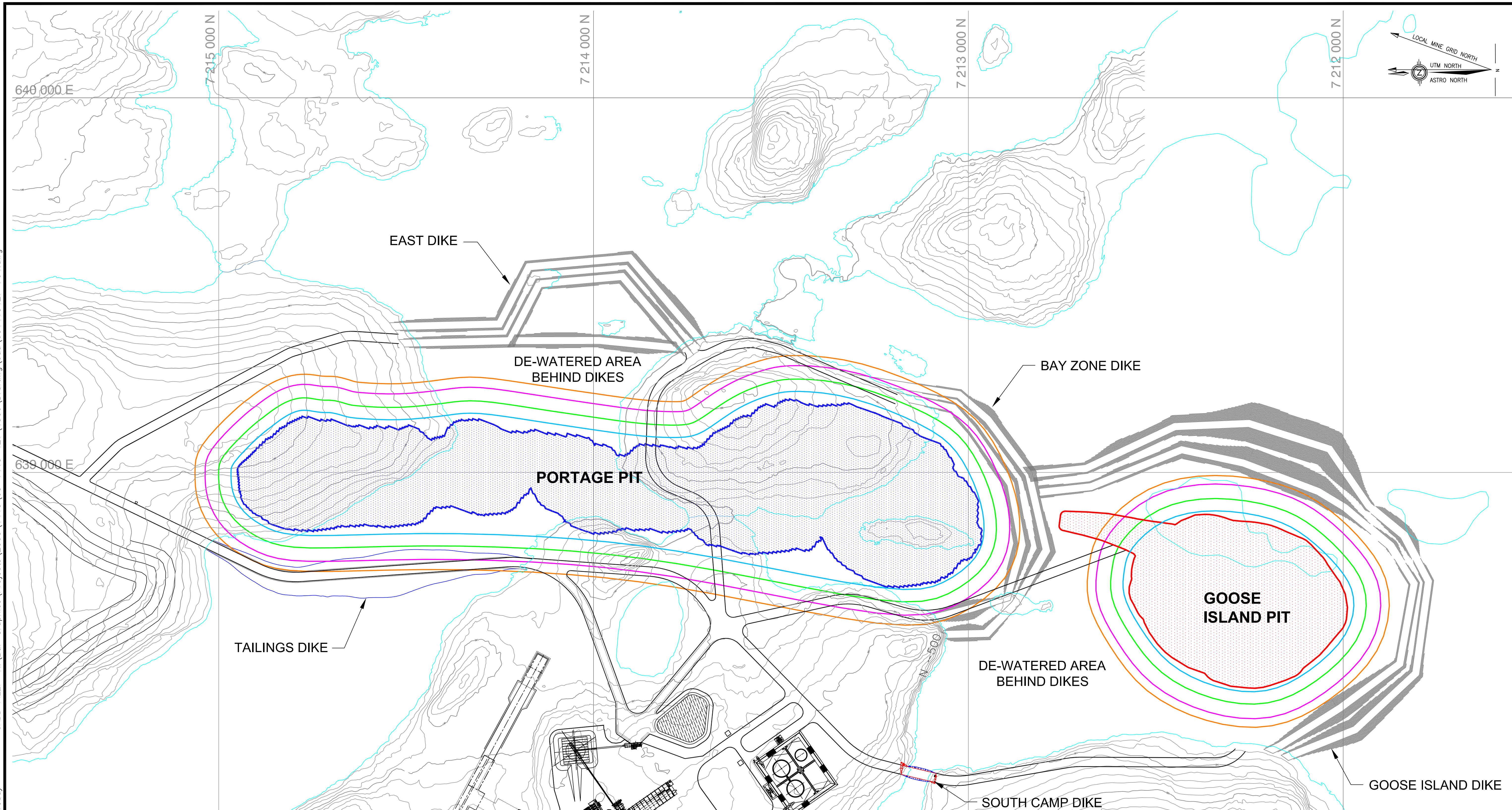
| REVIEW | | 10MAR04 | | |




## LEGEND

12 kg Charge Weight, 20m Offset

86 kg Charge Weight, 53m Offset

250 kg Charge Weight, 89m Offset

420 kg Charge Weight, 116m Offset

Confinement, k = 800

## NOTES

1) Area behind dikes is de-watered during operations.

0 100 200 300 400 500
Scale in Meters

## REFERENCES

1) Drawing taken from AMEC, dated 28-01-04, Drawing # A1-131395-100-C-0001 Revision A - OVERALL SITE PLAN YEAR 1-5.

2) Golder Report on Blast Design, Feburary, 2004.

PROJECT
CUMBERLAND
RESOURCES LTD.

TITLE
REPORT ADDENDUM
PEAK PARTICLE VELOCITY
50 mm/s ISOPLETH

Golder Associates

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| CADD | SRR | 09 MAR 04 | FIGURE 4 | |
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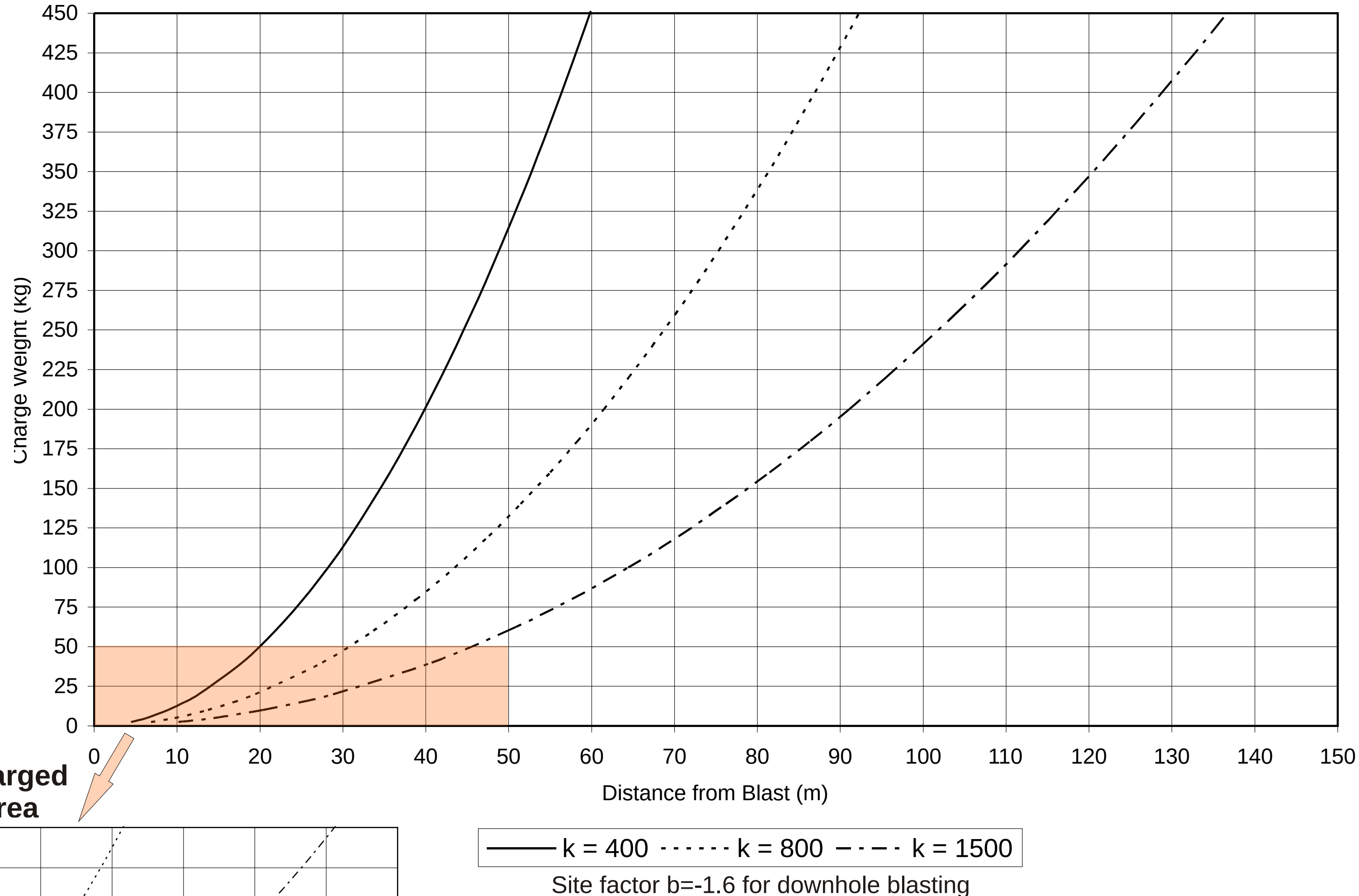
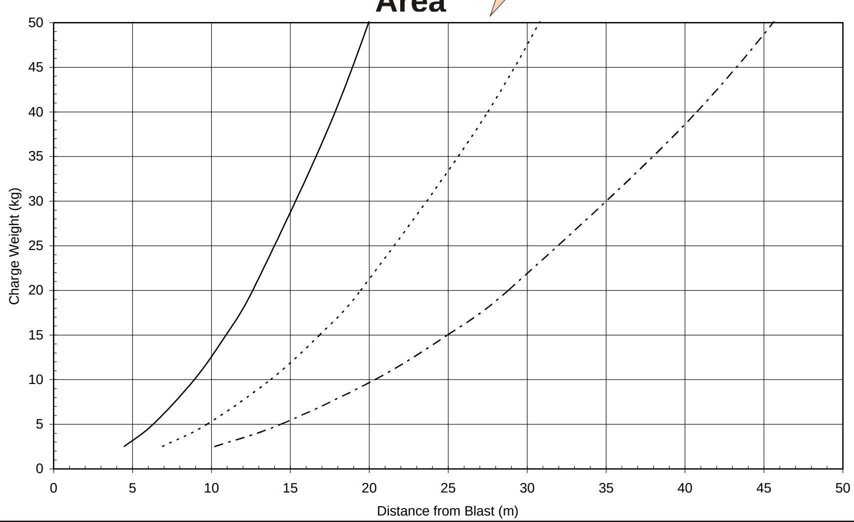



PROJECT

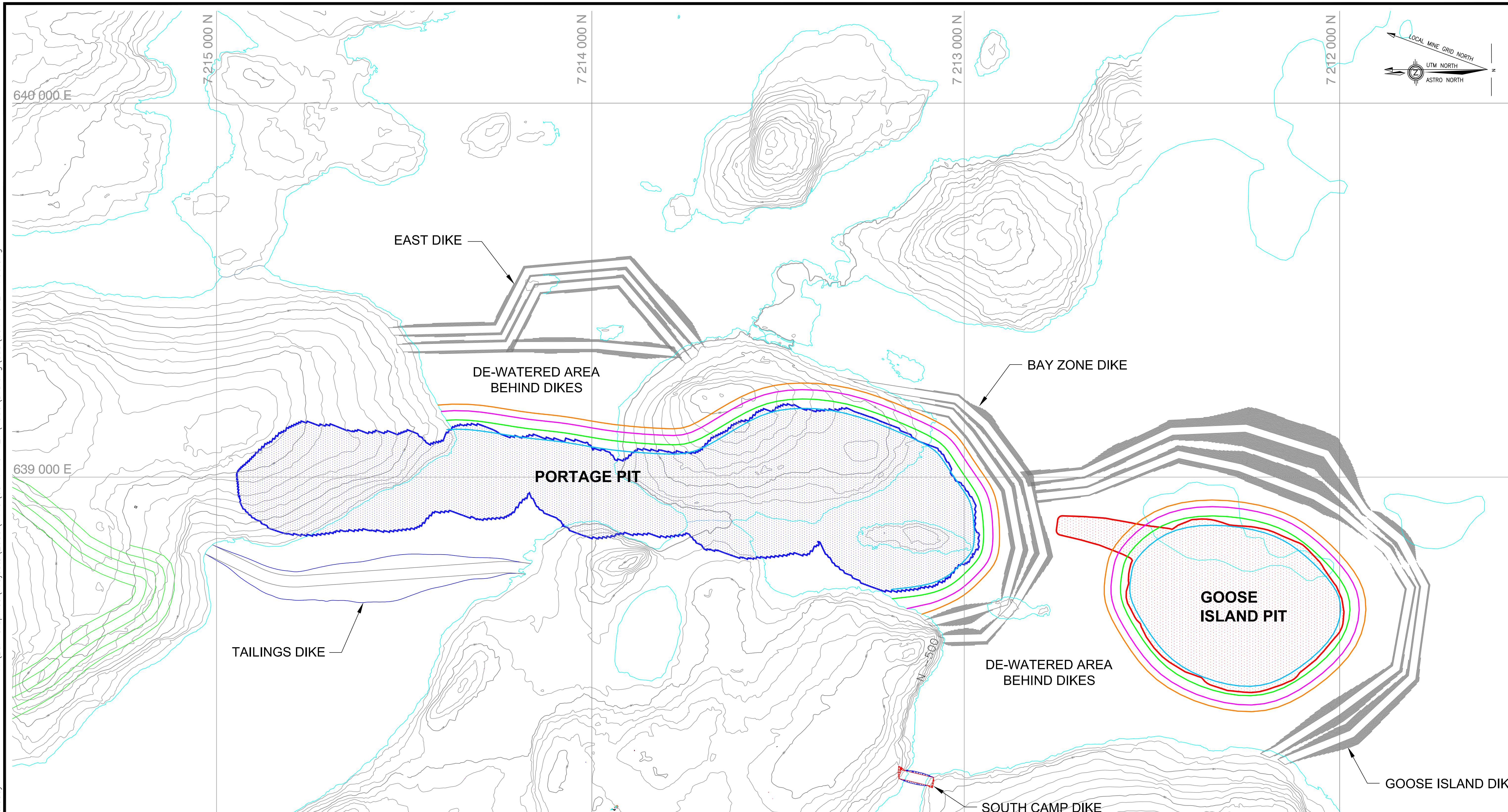
**CUMBERLAND RESOURCES LTD.**

TITLE

**CHARGE WEIGHT vs SETBACK DISTANCE FOR 100 kPA OVERPRESSURE**

Golder Associates

| | | | | |
|---|---|---|---|---|
| PROJECT No. | 03-1413-427 | | FILE No. FIGURE 4 | |
| DESIGN | CJC | 28JAN04 | SCALE NTS | REV. 0 |
| CADD | SS | 28JAN04 | **FIGURE 5** | |
| CHECK | CJC | 28JAN04 | | |
| REVIEW | | 10MAR04 | | |




## LEGEND

- 12 kg Charge Weight, 15m Offset
- 86 kg Charge Weight, 40m Offset
- 250 kg Charge Weight, 69m Offset
- 420 kg Charge Weight, 89m Offset

Confinement, k = 800

## NOTES

1) Area behind dikes is de-watered during operations.

0 100 200 300 400 500
Scale in Meters

## REFERENCES

1) Drawing taken from AMEC, dated 28-01-04, Drawing # A1-131395-100-C-0001 Revision A - OVERALL SITE PLAN YEAR 1-5.

2) Golder Report on Blast Design, Feburary, 2004

PROJECT
**CUMBERLAND RESOURCES LTD.**

TITLE
**REPORT ADDENDUM INSTANTANEOUS OVERPRESSURE 100kPa ISOPLETH**

Golder Associates

| | | | | |
|---|---|---|---|---|
| PROJECT No. | 03-1413-427 | | FILE No. | 031413427-F06 |
| DESIGN | CJC | 08 MAR 04 | SCALE AS SHOWN | REV. 0 |
| CADD | SRR | 09 MAR 04 | **FIGURE 6** | |
| CHECK | CJC | 10 MAR 04 | | |
| REVIEW | | 10 MAR 04 | | |

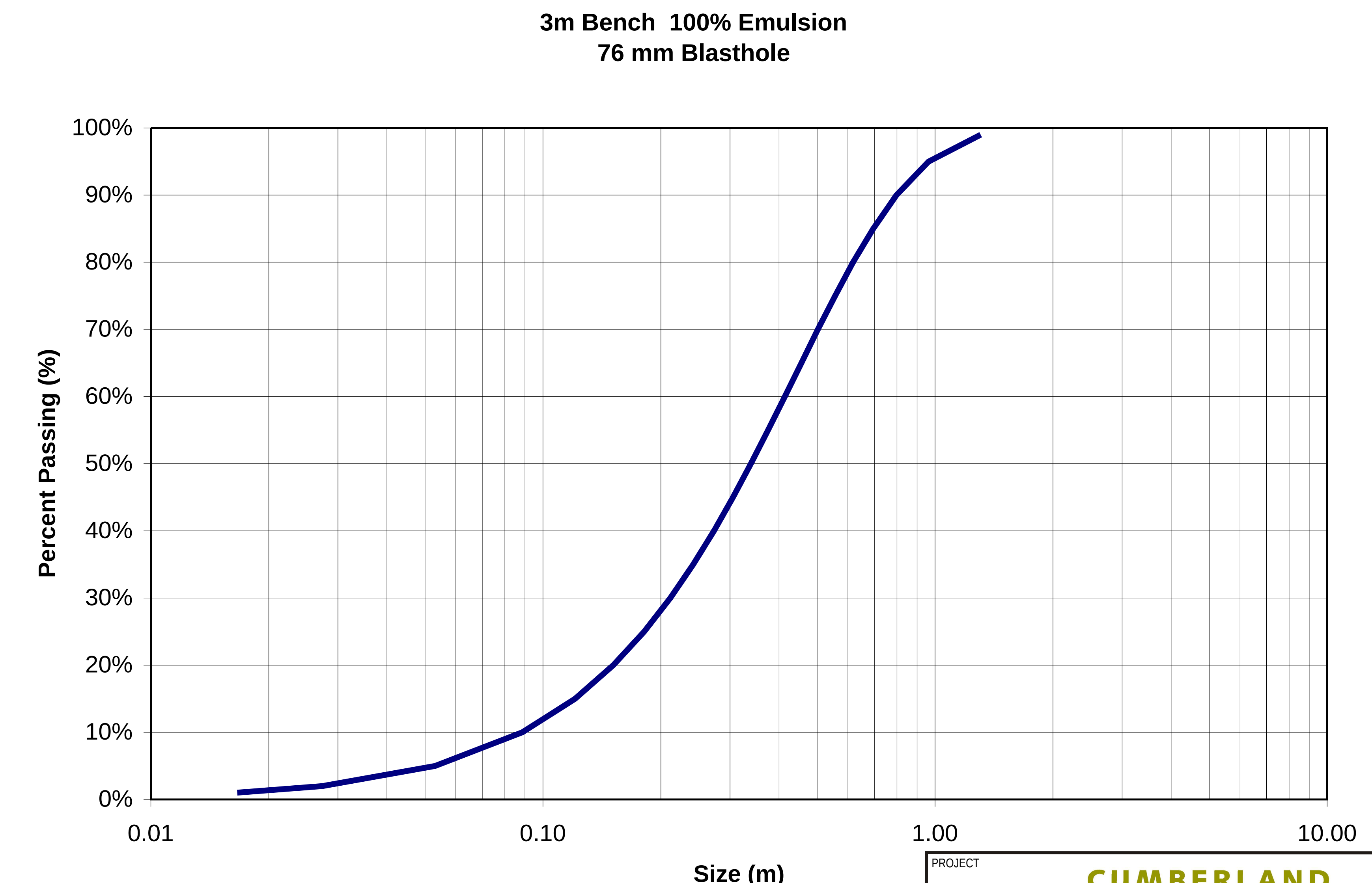
CADD FILE: N:\Bur-Graphics\Projects\2003\1413\03-1413-427\4300\Drafting\cad\031413427-F06.dwg

REVISION DATE: 04/03/9 11:18am By: sreddy

# APPENDIX I

# FRAGMENTATION PREDICTIONS

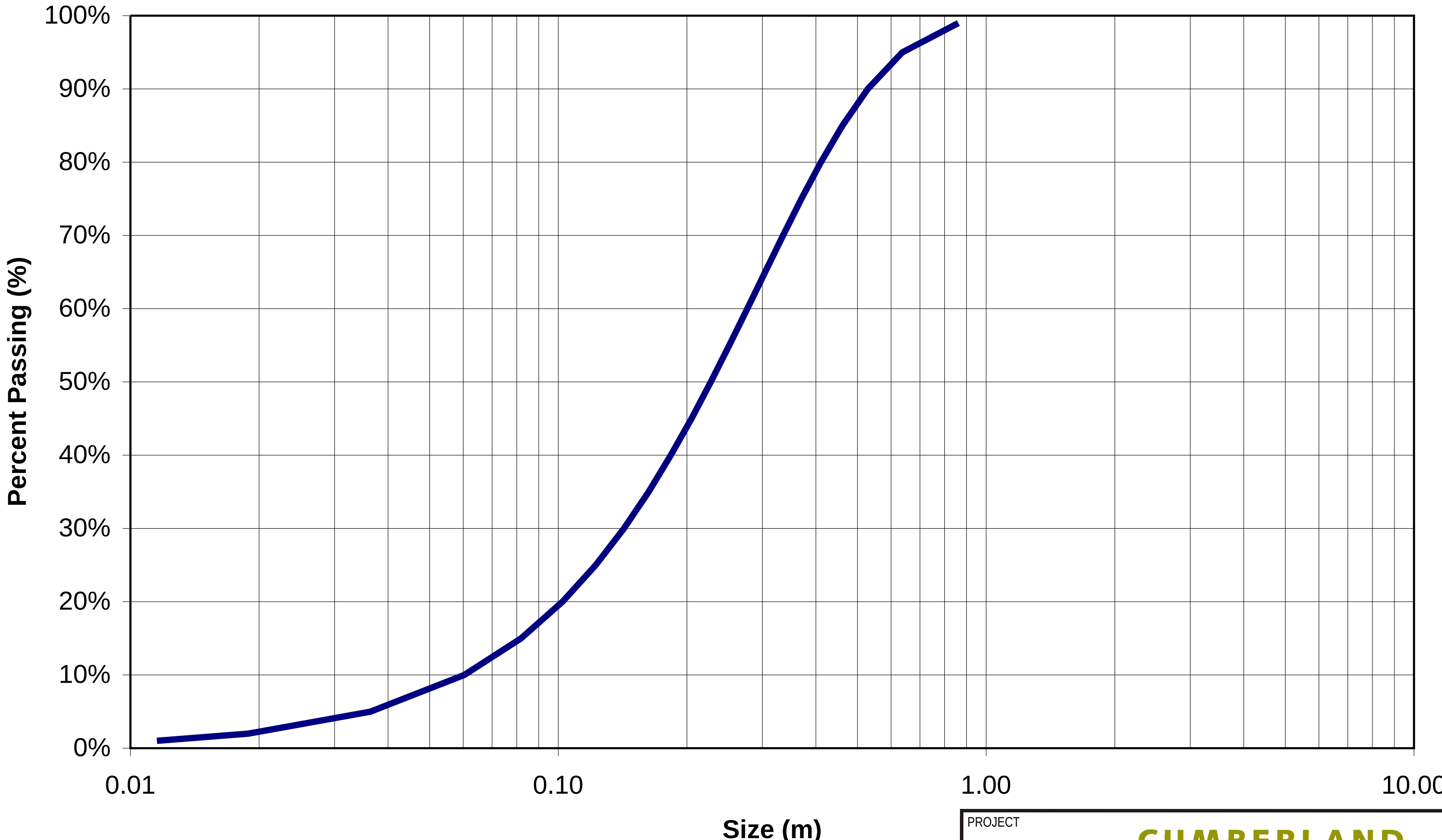
REVISION DATE:28-JAN-04 BY: SS COREL FILE:N:\Bur-Graphics\Projects\2003\1413\03-1413-427\Drafting\corel\Figures 4.cdr




| | | | | |
|---|---|---|---|---|
| PROJECT | CUMBERLAND RESOURCES LTD. | | | |
| TITLE | IRON FORMATION FRAGMENTATION PREDICTION 3m BENCH - 76mm BLASTHOLE | | | |
| Golder Associates | PROJECT No. | 03-1413-427 | FILE No. FIGURE 4 | |
| | DESIGN CJC | 28JAN04 | SCALE NTS | REV. 0 |
| | CADD SS | 28JAN04 | FIGURE I-1 | |
| | CHECK CJC | 28JAN04 | | |
| | REVIEW | 10MAR04 | | |

REVISION DATE:28-JAN-04 BY: SS COREL FILE:N:\Bur-Graphics\Projects\2003\1413\03-1413-427\Drafting\corel\Figures 4.cdr

**3m Bench 100% Emulsion**
**76 mm Blasthole**




PROJECT

CUMBERLAND
RESOURCES LTD.

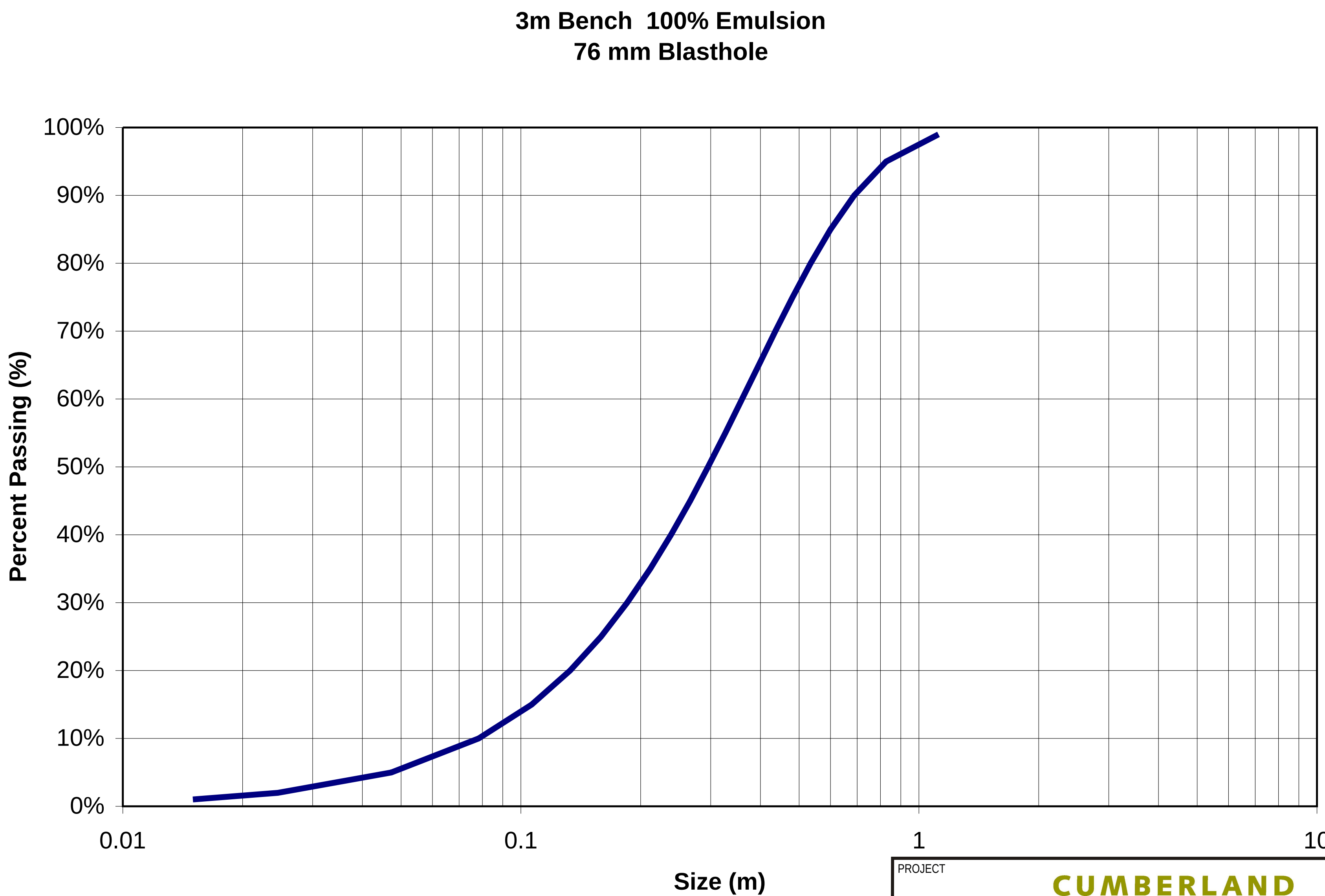
TITLE

**ULTRAMAFIC VOLCANIC**
**FRAGMENTATION PREDICTION**
**3m BENCH - 76mm BLASTHOLE**

Golder Associates

| | | | |
|---|---|---|---|
| PROJECT No. | 03-1413-427 | FILE No. FIGURE 4 | |
| DESIGN | CJC | 28JAN04 | SCALE NTS | REV. 0 |
| CADD | SS | 28JAN04 | **FIGURE I-2** |
| CHECK | CJC | 28JAN04 | |
| REVIEW | | 10MAR04 | |

REVISION DATE:28-JAN-04 BY: SS COREL FILE:N:\Bur-Graphics\Projects\2003\1413\03-1413-427\Drafting\corel\Figures 4.cdr




| | | | | | |
|---|---|---|---|---|---|
| PROJECT | CUMBERLAND RESOURCES LTD. | | | | |
| TITLE | INTERMEDIATE VOLCANIC FRAGMENTATION PREDICTION 3m BENCH - 76mm BLASTHOLE | | | | |
| Golder Associates | PROJECT No. | 03-1413-427 | | FILE No. FIGURE 4 | |
| | DESIGN | CJC | 28JAN04 | SCALE NTS | REV. 0 |
| | CADD | SS | 28JAN04 | FIGURE I-3 | |
| | CHECK | CJC | 28JAN04 | | |
| | REVIEW | | 10MAR04 | | |